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TECHNICAL FACULTY "MIHAJLO PUPIN"
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Zrenjanin
October 23, 2015

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INTRODUCTION

Information Technologies and Internet as a part of Computer science creates new approaches and perspectives, new models and numerous services, which opens up and makes use of the world of information and symbolized knowledge. Advances in Information technology, including the Internet, have dramatically changed the way we collect and use public, business and personal information.

The 4th **International Conference on Applied Internet and Information Technologies** is an international refereed conference dedicated to the advancement of the theory and practical implementation of both knowledge of Information Technologies and Internet and knowledge of the special area of their application.

The objectives of the **International conference on Applied Internet and Information Technologies** are aligned with the goal of regional economic development. The conference focus is to facilitate implementation of Internet and Information Technologies in all areas of human activities. The conference provides forum for discussion and exchange of experiences between people from government, state agencies, universities and research institutions, and practitioners from industry.

The key Conference topic covers a broad range of different related issues from a technical and methodological point of view, and deals with the analysis, the design and realization of information systems as well as their adjustment to the respective operating conditions. This includes software, its creation and applications, organizational structures and hardware, different system security aspects to protocol and application specific problems. The Conference Topics are:

1. Information systems
2. Communications and computer networks
3. Data and system security
4. Embedded systems and robotics
5. Reliability and maintenance
6. Process assessment and improvement
7. Software engineering and applications
8. Computer graphics
9. ICT Support for decision-making
10. Management in IT
11. E-commerce
12. Internet marketing
13. Customer Relationship Management
14. Business intelligence
15. ICT practice and experience

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Special thanks to the authors of papers, reviewers and participants in the Conference who have contributed to its successful realization.

President of the Organizing Committee
Ph.D Biljana Radulović

Zrenjanin, October 2015

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CONTENT:

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Information and communication technology and principal official civil records in the Republic of Serbia

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ABSTRACT - The establishment of a Central system for electronic data processing and storing and keeping of the second copy of birth, marriage and death registries, and/or transfer of all birth, marriage and death registries to electronic form and building of a network infrastructure for linking all towns and municipalities into a single information system started at the close of 2009. This system, as the first manufacturing centralized registry containing data about the Republic of Serbia citizens meets all technical, informatics and security standards in this area, and as the most important service with respect to citizens represents the key element in the public administration reform, particularly in the segment of e-administration. Central system for electronic maintenance of birth, marriage and death registries is the largest network of the government authorities in Serbia and potentially an information system intended to include in the future – as sub-systems – the databases from the remaining official records maintained about the citizens by other government authorities. In that regard, this system represents a concrete contribution to a radical change of the traditional performance of administrative procedures which will, coupled with a clear and precise further regulation of the concept of birth, marriage and death e-registers, establish a "good practice" for the development of this particular and related areas.

I. INTRODUCTION

Information and communication technology is in many ways a unique technology. It has the characteristics of a 'threshold' technology, with a potential to rapidly change the entire structure of a society and to transform the entire structure of a state. In a single human generation this technology has revolutionised the way we live, learn, work and have fun and it continues to profoundly transform the way people, companies and public institutions interact.

Both citizens and businesses have shown particular interest in the development of e-government that will provide faster, simpler and cheaper services at various levels of governance. All over the world the concept of e-government means electronic services adjusted to the needs of the people and economy, integrated at all levels of public sector. This is why special attention is paid to its development in Serbia. E-government aims to bring benefits to all citizens, reduce the administrative burden on businesses and citizens, increase the efficiency of state authorities and holders of office, enhance citizens' participation in democratic decision-making processes and protect privacy and security.

Bearing this in mind, the ongoing development of e-government in Serbia increasingly aims, both strategically and operationally, to ensure extensive use of information and communication technologies by public authorities or holders of office and to introduce e-document, e-signature and e-identity in public services.

One of the key steps towards the establishment of e-government in Serbia, which should enable the modernisation of public administration and faster and easier exercising of citizens' rights without cumbersome procedures and unnecessary costs, is certainly the establishment of electronic civil registration, the principal official record of vital events.

II. THE CONCEPT AND CHARACTERISTICS OF ELECTRONIC CIVIL REGISTRATION

Electronic civil register, or e-civil register, is a record of vital events of citizens prescribed under the E-Registration Law kept by state authorities by means of electronic data processing [1]. The data kept under this law make up the content of e-civil register.

According to the regulations governing civil registration in Serbia, e-civil register is a transcript of the first copy (original civil register), kept by means of electronic data processing and storing. The backup copy of the civil register, the e-civil register, has the same legal effect as the first copy (original civil register), and the law allows for civil registration certificates to be issued on the basis of the data from the electronic backup copy of the civil register [2].

At the moment, according to positive regulations, an e-civil register contains the births, marriages and deaths data entered in the backup copies of civil registers kept for all registration districts of all municipalities, cities and towns on the territory of the Republic of Serbia, regardless of the date of entry.

Considering that this database is comprised of official civil records, it represents an information system that in the future should include other related databases as information subsystems of the Central Electronic Data Processing and Storing and Civil Register Backup System [3].

E-civil records are kept in a way that ensures coherence, compatibility, exchange and use of information, with obligatory protection of personal data entered in these records.

The authorities performing the delegated tasks of civil registration are connected via information and communication networks within the information system of the Ministry of Public Administration and Local Self-Government. They ensure that the data are entered at their place of origin as well as data accuracy, quality and protection during their processing and transmission, access to the data for authorised users under equal conditions, application of

uniform standards for data and document exchange (certificates of vital events).

The prescribed data entered in civil registers and changes thereof, the information on municipalities, cities and towns and their registration districts as well as necessary codebooks and classifications, comprise a common civil registration database [4].

III. CIVIL REGISTRATION SYSTEMS

Until the adoption of the current Law on Civil Registers backup copies of civil registers were kept as transcripts or certified copies of the first copies (originals) of civil registers or by means of automatic data processing (that current e-civil register is partly based on).

Register offices decided on whether to keep hard-copies or electronic backups of civil registers.

As a result, backups of civil registers were mostly kept in hard copy, whilst electronic backups could only be kept in registration districts located in the administrative seats of municipalities or towns or cities rather than in all registration districts of a municipality or town or city.

Although the previous Instruction on Civil Registration and Civil Registration Forms envisaged that competent government authorities should prescribe a uniform methodology for keeping electronic backup copies of civil registers, it never happened in practice, so register offices started developing applications for electronic civil registration independently [5]. As a result, there were a myriad of applications by as many developers, from those created by leading software companies and educational institutions to those that were product of individual efforts. Image 1 shows the number/percentage of municipalities/towns/cities, registration districts and registrars using applications by various developers, as well as the number/percentage of entries made in civil records.
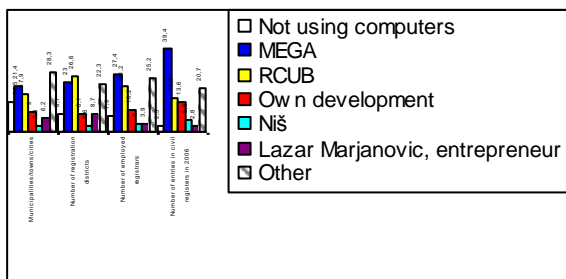
Image 1: Applications/developers usage – in % by reference indicator

Various operating systems, i.e. computer platforms (Dos, Linux, Microsoft, and even unknown operating systems), were used in these applications, as shown in Image 2.
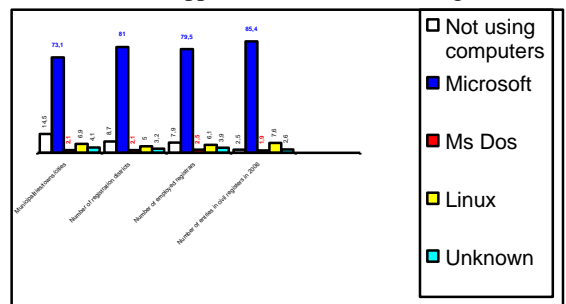
Image 2: Operating systems/platforms usage – in % by reference indicator

In addition, various databases were used in the applications listed above (MS SQL Server, Oracle, Access, MySQL, Progres & MySQL, Progres, etc.). Image 3 shows the databases used in applications by reference indicator.
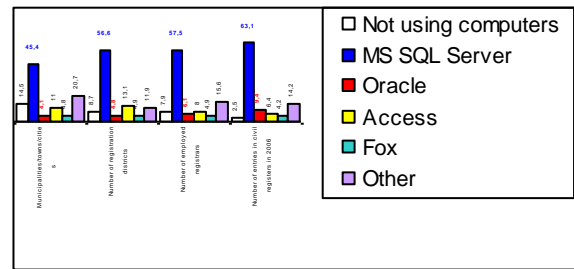
Image 3: Database usage – in % by reference indicator

While it was drafting the current Law on Civil Registers, the ministry responsible for public administration did a research with a view to establishing to what extent computers and information technologies were used in civil registration in Serbia and proposing measures to improve the system of ICT to address users' requirements and expectations.

The research covered all register offices in Serbia and written and field surveys were used to collect the data. The results of the survey were analysed and a report entitled Using Information Technologies in Civil Registration was compiled.

The study first establishes the number of registration districts in Serbia, the number of registrars and their deputies in charge of civil registration, the number of entries of births, marriages and deaths in civil registers in a calendar year and the number of certificates issued in a calendar year.

The next segment focuses on the use of computers in civil registration. Asked whether they used computers in civil registration, 117 register offices answered 'yes', 21 answered 'no', whilst 7 said that the introduction of computers in civil registration was in progress (Chart 4).

DO YOU USE COMPUTERS IN CIVIL REGISTRATION?	NUMBER OF TOWNS/CITIES/ MUNICIPALITIES	%
Yes	117	80.7
No	21	14.5
In progress	7	4.8
TOTAL	145	100
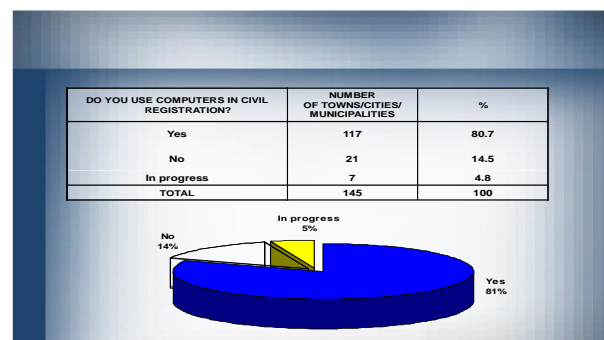
Chart 4: Use of computers in civil registration

This segment of research presented the data that on their own give a distorted image of computer use in civil registration as apparently as many as 81 % of register offices provide this service in electronic form. However, considering that most register offices provide electronic civil registration exclusively for registration districts located either in municipal or town administration centres, but not for other registration districts, much fewer civil registers were available in the electronic form. So, when it comes to

the number of register offices that have made e-civil registers available, out of 145 register offices in total, e-civil registers are available in 20 register offices for the period ending in 1945, in 24 register offices for the period 1946-1970, in 19 register offices for the period 1971-2000, in 17 register offices for the period 2001-2007, whilst 37 register offices do not have a record of the years for which e-records are available (Chart 5).

YEARS FOR WHICH E-CIVIL REGISTERS ARE AVAILABLE	NUMBER OF TOWNS/CITIES/ MUNICIPALITIES	%
Not using computers	21	14.5
Introduction of computers is in progress	7	4.8
- 1945	20	14
1946 – 1970	24	16.7
1971 – 2000	19	13.2
2001 – 2007	17	11.8
Not knonw, did not answer	37	25.5
TOTAL	145	100
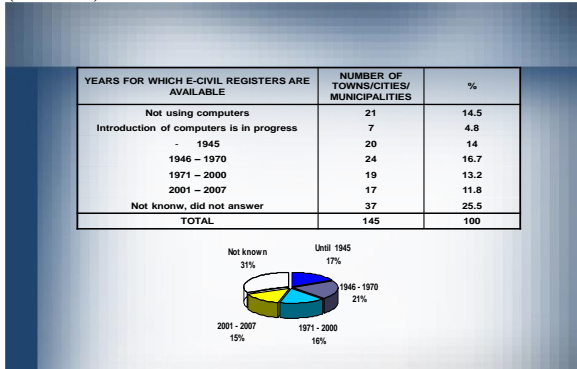
Chart 5: Years for which electronic civil registers are available

That significantly fewer civil registers are available in the electronic form is supported by the finding of the survey that most register offices (46 or 31.7 %) started using computers in civil registration in 2003-2005, whilst 35 register offices (24.1 %) started using computers in 2006-2008 (Chart 6).

WHEN DID YOU START USING COMPUTERS IN CIVIL REGISTRATION	NUMBER OF TOWNS/CITIES/ MUNICIPALITIES	%
Not using computers	21	14.5
Introduction of computers is in progress	7	4.8
- 1999	17	11.9
2000 – 2002	16	10.9
2003 - 2005	46	31.7
2006 - 2008	35	24.1
Not known, did not answer	3	2.1
TOTAL	145	100
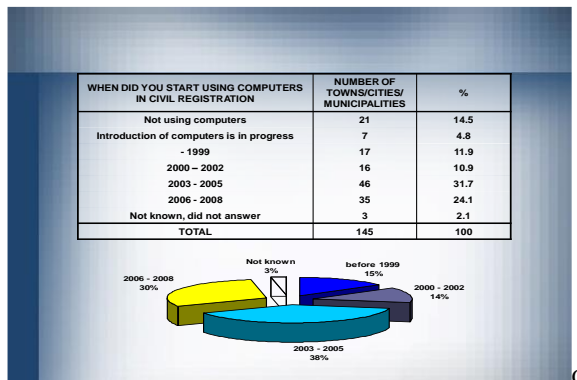
hart 6: Years when electronic civil registration started

The results of this segment of the research show that a standardised solution for civil registration in the electronic form does not exist, that the quality of electronic civil registration solutions varies and that it is sometimes inadequate, that the electronic civil registration solutions are neither interconnected nor compatible and that the integration of such non-standardised electronic civil registration solutions is challenging and time-consuming.

Aware of the issues in the area of electronic civil registration, employees in register offices provided numerous suggestions on how to improve the system, such as: adopt a modern, new law governing civil registration, integrate existing solutions in a comprehensive information system, provide funding for the offices that are not able to finance such a big project on their own (procurement of computers and software) and provide appropriate training for registrars and their deputies during the preparations for a new information system.

The findings of the research helped considerably to formulate the provisions of the current Law on Civil Registers governing the civil registration system that is now in place.

IV. CENTRAL ELECTRONIC DATA PROCESSING AND STORING AND CIVIL REGISTER BACKUP SYSTEM

Current legal framework regulates keeping backup copies of civil registers on a completely different basis. It prescribes that this has to be done using solely electronic data processing and storing, whilst the ministry responsible for public administration has to provide conditions for the establishment of the Central Electronic Data Processing and Storing and Civil Register Backup System, i.e. electronic civil registration, no later than two years from the date of entry into force of the new law, and that register offices have to create electronic copies of all registers no later than 28 December 2016.

The Central System, which was established within the set deadline, is the first productive centralised civil register in Serbia and it meets all national technical, IT and safety standards as well as the EU standards in this field. The system is based on data redundancy and housed in specialised data centres equipped with various forms of technical and physical protection. Additional redundancy is provided by a co-location where the data from the primary location is copied in real time.

Users wishing to access the Central System need an Internet wired connection. The type and quality of the connection may vary, from direct access to optical fibres or leased lines, to cable networks and ADSL. However, for security reasons, any wireless connection is disabled. To connect towns, cities and municipalities with the Central System, a state-of-the-art IP/MPLS network is used, enabling good bandwidth and safety of network traffic. IP/MPLS network is used for the Central System, e.g. for reserving specific streaming with Quality of Service, Point-to-Point Tunnelling Protocol and virtual private networks (VPN). Such a network is secure and safe because it is logically separate from other VPNs that use the same physical resources and the data transmitted via such a network are protected.
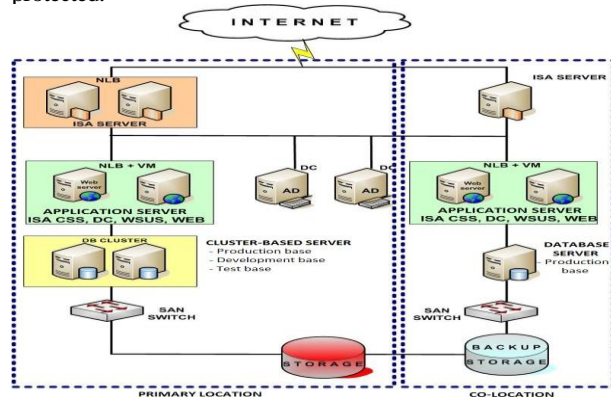
Chart 7: System architecture

As regards using the Central System, special attention was paid to the system safety, from communication and access rights to data protection. The data are protected from unauthorised users in every segment of the Central System. Physical protection of the Central System is provided on both

locations the primary location and the co-location whilst the data centre facilities and the hall housing the equipment are physically secured with video surveillance 24/7 and who enters the facility is under strict supervision. As regards applications, the protection of the Central System is provided via MS ISA servers functioning as firewalls and VPN concentrators with the SSL Protocol that enables safe, encrypted web connection. Authentication is done at the Internet Information Server (IIS) level where the identity of the user is checked, whilst the authorisation is done at the Active Directory level. Using qualified electronic certificates of one of three Serbian authorised certification bodies (e.g. PE Post of Serbia) is compulsory.

An authorised user's right to work in the Central System is defined by the type of work they do and are under strict control. In other words, registrars read the data and print certificates, IT administrators in town or municipal administrations only transfer daily data entries from local systems to the Central System, and the ministry's employees supervise the work of the Central System.

Furthermore, a module for entering the data from the first copy (original civil register) in the Central Electronic Data Processing and Storing and Civil Register Backup System by end users of the central application (registrars and their deputies) was put in place, i.e. a standardised quality solution appropriate both in terms of application of civil registration regulations and in terms of technical components they contain, solving the problem of incompatible software applications used by local self-government units. By entering the data in the backup copy of a civil register (e-register), directly in the Central System rather than in a local application and later (at the end of the working day) in the Central System, all procedures pertaining to civil registration have become legal, accurate, uniform and up-to-date, and the supervisory body is able to establish, at any given moment, which local self-government unit is fulfilling its legal obligations and the extent thereof.

To establish such a complex system, which is not only the most important citizen service in Serbia but also the biggest network of government agencies in the country, great organisational, personnel and financial efforts were and are still required.

In fact, the ministry responsible for public administration has based the entire establishment of the Central System on the Central Electronic Civil Register Backup System project [6], envisaging phased-out development. In the first phase, a prototype of central application for downloading the data from civil registers was created, the initial downloading of data from civil registers in five cities and towns was done, the development and building of network infrastructure started and registration districts of these cities and towns were networked to enable the downloading of data from civil registers, and the application and system uses were tested before they were put in production. In the second stage, the development of network infrastructure continued so that registration districts of local self-government units could be networked and the data from original civil registers downloaded to the Central System and Civil Register Backup System was built based on its prototype and installed, tested and put in operation, licences (qualified electronic certificates) were issued to the end users of the Central System and housing of hardware equipment was provided. All technical and other conditions were created for issuing certificates from civil registers in local government seats based on the data

from the Central System, making it possible for all citizens to get their certificates in any local government office in the country, rather than just in the register office where the entry was originally made, provided that the data had been sent to the Ministry to be stored in the Central System In the third stage, the main activities were building a network infrastructure to connect registration districts and downloading the data from civil registers to the Central System. These activities continued in the forth stage of the central system development. The training of registrars, their deputies and IT administrators working in the Central System was organised in all stages of the project.

The Central System currently contains the data on births, marriages and deaths for all towns, cities and municipalities in Serbia, and has nearly 20 million entries.

V. DEVELOPING NEW USES FOR THE CENTRAL ELECTRONIC DATA PROCESSING AND STORING AND CIVIL REGISTER BACKUP SYSTEM

Considering the technical components and characteristics of the Central System, in addition to converting all civil registers into electronic forms, it enables simultaneous development of new uses that can significantly improve the procedures and unify practices of register offices, with the aim to make it easier and faster for citizens to exercise their rights in this field without unnecessary costs and cumbersome procedures.

Therefore, a project is under way aimed at improving the Central System by developing new uses for electronic administrative procedures in relation to the following: determining and entering the data in registers, the exchange of data and electronic documents within the Central System and other IT systems, and to the module for testing the registrars' knowledge gained in professional training [7]. The implementation of these uses and their full application in practice is expected by the end of the next year.

Electronic administrative procedures

In theory, there is half-a-century long debate about the use of ICT when adopting new laws, i.e. whether, and under what conditions, new technologies are capable of performing such complex mental activity such as making legal decisions [8]. However, if we bear in mind that making decisions proved to be much simpler in some legal matters than in others, and that the main objective of using IT in law is to improve the work in some areas of law, there is no doubt that standard cases may be automated without fearing that it might affect the legality and correctness of decisions of competent authorities and the degree of exercising citizens' rights and legal interests.

Therefore, the main objective of the project dedicated to the development and implementation of new uses of the Central Electronic Data Processing and Storing and Civil Register Backup System is to create administrative relations in the civil register system whose main characteristic will be creating specific processing conditions for the implementation of the automated preliminary hearing and making decisions on subjective rights for an unlimited number of standard or 'typical' cases and persons on equal bases.

The Central System application is designed as a multi-layered internet application accessed via Web Client, whilst new modules (components) will collaborate with those already existing in the Central System. The general architecture of software solutions is shown in the diagram below.
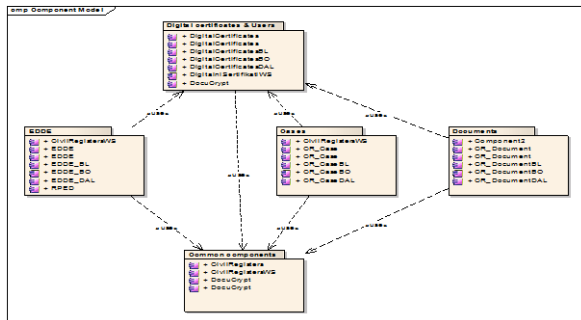
Diagram 1: General architecture of software solutions

Full automation of all segments of administrative procedures pertaining to entering births, marriages and deaths data in civil registers will be established in full compliance with the regulations governing electronic document and electronic signature and strict personal data protection standards. The diagram below shows how births are entered in civil registers, clearly demonstrating that those participating in the automation of this procedure are not just register offices but other authorities and public services as well such as medical institutions, the Ministry of the Interior, social care centres, the Statistical Office of the Republic of Serbia, etc.
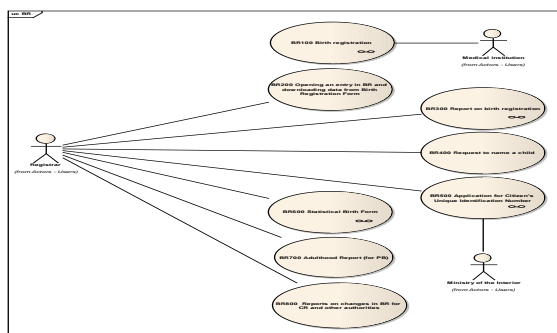
Diagram 2: Civil register – new uses

The project focuses particularly on the development of the electronic data and document exchange (EDDE) system both within the system itself and with other systems. This means: developing, within the Central System, a module for the transmission of all types of notes and messages exchanged by registrars in an xml e-document signed with a qualified digital certificate; downloading messages and entering the data in the e-civil register in the prescribed note format; monitoring of and reporting on the messages and electronic documents exchanged and building a web service for electronic data exchange with other authorities in accordance with the described principle. In the development of this segment of uses cooperation has so far been established with the Ministry of Health, Ministry of the Interior, Ministry of Labour, Employment, Veteran and Social Affairs and Statistical Office of the Republic of Serbia, and the plan is to establish connections and relations with other relevant state authorities and public services.
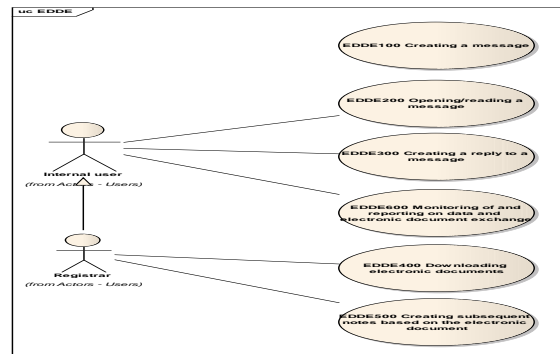
Diagram 3: System use cases for electronic data and document exchange (EDDE)

Registrar e-training

In addition to the hardware and software and the established network infrastructure made up of local government registration districts, human resources (registrars and their deputies), are also included the Central System.

The Central System has great potential and to fully exploit its information and communication capacity its building up and extending has started as well as professional development of registrars including testing what they have learned in the training, which will significantly help establish the first eLearning system in public administration but improve the planning, organisation and implementation of registrar professional training and testing. The Central System itself provides the necessary information and communication infrastructure that can support the implementation of modern software based on using the Internet and digital certificates both in training and in testing, simultaneously providing quality at all stages of organisation and realisation of registrar training and testing as well as monitoring and keeping records of organised and realised registrar training.
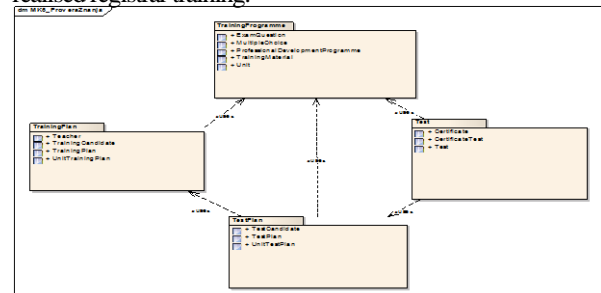
Diagram 4: Data Modelling – New Schemes in a CivilRegister Database
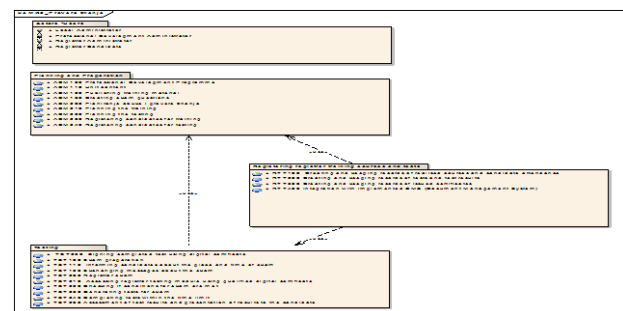
Diagram 5: New use-case diagrams of registrar testing application module

VI.   CONCLUSION

Civil registers, as records of all vital events from birth and acquisition of legal capacity to death and loss of legal capacity of every person, provide indispensable evidence in any legal situation in which identity or personal data needs to be proven. They provide authenticity of all other official records on citizens or public documents issued to citizens, which is why they rightfully take a central place in the Serbian system of official records on citizens.

Also, considering that faster and easier exercising of citizens' rights and more efficient and cost-effective functioning of public authorities is linked to automated processes and electronic data exchange, there is no doubt that electronic civil registers are a precondition for radical changes in traditional administrative procedures in the Serbian state administration and local self-government system, both from citizens to government and within the government itself.
These are the reasons why the Central Electronic Data Processing and Storing and Register Backup System is the most important citizen service in Serbia and the entire project of its establishment and development is the key element in the reform of e-government.

The development of the Central System and of the network infrastructure that will connect all registration districts in Serbia with the Central System already has a number of advantages. However, the ultimate goal is to stop the old practice where, to exercise their rights, citizens had to go from one window to another to get documents from the registers and for the state authorities to get electronic records ex officio instead, as well as to provide full automatisation of all stages of administrative procedures for entering data in civil registers, regardless of whether these refer to procedures carried out before authorities and public services responsible for issuing acts for initiating the procedure or before authorities responsible for entering data in civil registers.

At the same time, electronic records enable further development of information systems in a string of state administration authorities and introduction of new IT solutions in all other official citizen records. This may also sere as a basis for developing an information system that, with the electronic data exchange between various government authorities, would store all the basic information on every Serbian citizen in one place (general civil register).

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The Big Data and the relationship of the Hungarian National Digital Infrastructure

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Abstract - The amount of information and the need for information is fast increasing today, and it will further multiply in the coming years. The critical infrastructure ensures the welfare of the state and its citizens. Everyday decision-making requires a large amount of information of various types. The present publication will show the relationship between the Hungarian National Digital Infrastructure and Big Data. The emergence and use of Big Data have been greatly emphasized in recent years. The present publication will present the conceptual and practical manifestations of the Big Data phenomenon. It will also present the Digital National Development Program, funded by the Government of Hungary and the European Union to increase the welfare of the Hungarian society and to make Big Data a digital service that is easier to access for everyone. The history of Big Data will also be discussed, as well as the conditions and possibilities of its applications, which will serve for the next period of economic growth. Furthermore, it will examine the security and risk factors of Big Data, which is essential to ensure the effective protection of the Hungarian National Digital Infrastructure and personal data.

I. INFRASTRUCTURE DEVELOPMENT

A. The development of hardware and software

The data or databases have a life-cycle of different stages, from their creation to their repeated uses, each of them requires the appropriate technical background and support. Everyday desktop PCs are becoming less and less suitable for this task. A growing part of data processing is taking place in shared systems, in data centers consisting of a huge number of special interlocking computers (computer grids), gigantic in size, called "computing clouds". The emergence and spread of open-source software and web services are lowering the barriers of entry and making its use cheaper. For these internet services and the transfer of gigantic databases, reliable broadband connections are needed.

The hardware itself is not enough: the appropriate software is also needed, which does not only refer to the programs. The phenomenon of "Big Data" provides an opportunity to find the answers to the questions of various disciplines with the help of mathematical, statistical, data mining tools looking for patterns in the data, and finding very complicated, many-variable correlations with applications that are also able to learn. To process, combine and query the data of various sources, created in various ways, it is necessary to use standards and standard metadata. [1]

Regarding "Big Data" investments in enterprise IT are obviously inevitable, and they have grown to the size of several trillion dollars a year, which means a significant increase in recent years.

Meanwhile, the cost of information origination, management and storage has been reduced to its sixth in the last five years. [2]

B. Digital National Development Program

The Digital National Development Program has been launched in Hungary as well as in other countries in the European Union. This program embraces the superfast Web, the development of the digital community and economy, the E-government services and the digital competencies. The Government aims to build a super-fast internet coverage throughout the country by 2018, which means that it will ensure a minimum of 30 Mb/s bandwidth internet access for every household and institution. This is called National Digital Utility (NDU) in the framework of the program. The program aims at a more sophisticated accessibility, a better quality of life by ensuring full coverage. The aim, therefore, is not just to build the final infrastructure, but to improve the quality of life and the standard of living of the Hungarian population through this added value. [3]

1) The aims of development in the Administration

In human societies information has a significant effect on social connections. The central element is information and its attachment is the internet. E-shopping is becoming increasingly popular within the population, because it is fast and convenient. The office administration is becoming more popular, too, although the development and expansion of the existing infrastructure and the available services are essential and necessary. The aim is to go online with a wider range of services, reaching a growing number of users. In the 2010s, besides providing interactive possibilities, the E-Government must also be consumer-friendly.

The development of infrastructure in Hungary is proceeding well, and serious progress has been made in both fixed-line and mobile broadband coverage. However, there are some areas of the country, where no development has taken place. The digital home, the smart city and the E-Government are considered as priority investments. The "success criteria" include the goals, frameworks, participants and responsibilities. The goals: infrastructure, services and competence development. The participants: the state, the market and the EU. The frameworks: the taxes, the EU sources and controls. The

responsibilities: education, coordination and cooperation. The development of an appropriate regulatory environment has already begun in Hungary. The program is complex because it covers the network, competence and service enhancements. It will be realized within the frameworks of the programs and projects called the "European Digital Agenda", the "National Information and Communication Strategy", and the "Digital Partnership for Hungary". The Next Generation Access (NGA) coverage was 75.7% in Hungary in 2013. The long-term benefits are more significant than one might think. The preparation of the project, the planning, the tendering phase is followed by the development of networks, including local area networks, and construction of missing facilities. This has been the biggest telecommunication development project of recent times. The EU Directive 64/2014, which is in the process of naturalization, will be governing in the development of the nation-wide access and network coverage ensured by the state. The project of the Digital Agenda for Europe COM (2010) 245; the 2014/61/EU directive of the European Parliament and of the Council on reducing the development costs of high speed electronic communications networks, the National Infocommunication Strategy, the 1162/2014. (III. 25.) Govt. decision on the Digital Nation Development Program and the 1631/2014. (XI. 6) Govt. decision of the "Digital Nation Development Program" provide the legal background for the development of ICT by 2020 and it will contribute to the functioning of the European economy. The elimination of administrative obstacles is essential for the implementation of the Super-fast Internet Project (SIP), and further investments are needed in order to achieve the strategic objectives. [3]

2) The Hungarian "smart city"

The next question in the Digital Agenda is what makes a city digital? Information technology, networks or mobile penetration can also be mentioned here. The service providers, that is the state, the municipalities and the market can also be listed here, as well as the consumers: the citizens and the corporations. The "smart city" program was started in Hungary to improve public safety, to increase the use of city cards, and to provide the necessary devices and training in several rural cities, e.g. in Nyíregyháza, Miskolc and Salgótarján.

The digital city – "the future that is already here" – also means the provision of Wi-Fi service for the population. In addition, the "smart city" project also produces revenue for the administrative units. The online bookings of accommodations have increased by 60%. This has resulted in the increase of employment, too.

The sales revenue for operators can also increase, if the digital skills amongst users are growing. Social barriers between material issues and digital devices need to be broken down. As long as these barriers separate people from each other and from the benefits of the digital world, the envisioned future will remain a dream, which only very few people will be able to use for their well-being. These barriers can be broken down by achieving cost-effectiveness. [3]

For example Tokody et al. (2015), however, have shown that "there are cities where traffic that comes to a standstill is an everyday problem. It is unquestionable that change is necessary. Green mobility and smart city are parts of this change." "In Hungary SMART technologies have long been present in building automation, energy and telecommunication, as well as in other fields. This tendency has been greatly facilitated in certain disciplines, and, as a result, it has been applied to railway developments, too. … By using SMART elements, these modern solutions can ensure the cost-effective development and maintenance of the created network, they contribute to a higher level of passenger service increasing the quality of such service, and provide strategy for the protection of critical infrastructure… ." [4]

3) The development of digital literacy

In order to reduce digital illiteracy in the society, various programs have been initiated by the State. For example, the TÁMOP[1] 2.1.2-1/1, which aims to develop foreign language and information technology competences, as well as the digital textbook program, the grants for research and development, and the promotion of teaching programming. Digital illiteracy can also be reduced by the use of widespread mobile applications for educational purposes, for example, by developing various teaching and learning support applications that can run on mobile platforms.

Unfortunately, 40.2 % of the population above the age of 15, approximately 3 million people are digitally incompetent in Hungary. Moreover, this does not mean that the remaining 7 million people are digitally competent, because they do not use the contents that would be required for digital literacy. The reason for this may be that people are afraid to discover the digital world, they do not feel that it is made for them, which is a great problem, because they will not reach that knowledge or develop those digital skills that are necessary to take full advantage of the benefits of the digital world. The low level of use of digital content in the society may also be explained by the security issues that have always been on the agenda. This is an important matter to be solved as it accounts for a significant part in the development of digital competence, including the issues of safe storage and safe operation. [3]

II. WHAT IS BIG DATA?

By the end of the 20th century the industrial society was replaced by the information-knowledge-based society. This change transformed everyday life considerably. The increased use of digital devices from the '90s resulted in the generation and accumulation of a continuously growing amount of digital data. The concepts of petabyte and terabyte are slowly becoming commonplace in today's world. For those who deal with information technology, the concepts of exabyte and zettabyte are also familiar. These are such big volumes of data that their process and storage require serious infrastructure and resources. These volumes of data and the activities related to them are now together called "Big

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[1] European Union in the framework of the Social Renewal Operational Program

Data", a term that is becoming increasingly fashionable nowadays.

A. The data and their dimensions

In order to make these enormous data volumes more presentable, the amounts of data will be illustrated through a few examples below.

A typewritten page constitutes approximately 30 Kb of data. An MP3[2] track is about 5 megabytes. A movie can reach 5 gigabytes. 1 terabyte data can ensure the storage of approximately 6 million books. If 1 Petabyte of data had to be written on DVDs[3], the tower of DVDs would be around 55 floors high. About 5 Exabyte of data was generated in the world in 2003. This figure rose already to 1.8 zettabyte in relation to the production of worldwide data in 2011.

A further example can be thought-provoking and frightening for the future. The NSA[4] set up a new data center in Utah at the end of 2013, which is capable to store 1 yottabyte of data.

According to the survey made by Intel in 2013, 640 terabytes of data are forwarded on the Internet every minute, which means 204 million e-mails, over 3 million searches on Google[5], 6 million Facebook entries and 30 hours of video upload and video viewing on YouTube[6]. In addition, 50 gigabytes of data are produced every minute by the Large Hadron Collider [7]. [5]

It is easy to understand, therefore, why such a vast amount of data must be seriously dealt with.

III.   THE BIG DATA PHENOMENON

It is a fact of life that there will always be new things to invent, or existing ideas to revise. The IT market also likes to introduce new phrases that are easy to remember and can be associated with a trend, a product or a service. One such a buzzword of today is 'Big Data', a field which, as experts claim, will be the oil of the 21st century. It means that a wider scale of collection, structuring and analysis of data will determine and drive the world's economy.

Although the definition of Big Data has not been fully clarified, it has been accepted as a reference to the systematic collection and analysis of the increasing amount and more complex forms of data in the world. The conclusions reached at the end of the analysis process help decision makers produce greater business value than without using the big data methods. [6]

"Big" refers to a database or data set that contains a large amount of data. Such a large amount, in fact, that it would be difficult to manipulate it with the commonly

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[2] MP3 is an audio coding format for digital audio which uses a form of lossy data compression.
[3] DVD - Digital Versatile Disc
[4] NSA - National Security Agency
[5] Google is an American multinational technology company specializing in Internet-related services and products
[6] YouTube is a video-sharing website.
[7] The Large Hadron Collider (LHC) is the world's largest and most powerful particle collider, the largest and most complex experimental facility ever built, and the largest single machine in the world.

available database management applications. The management (creation, transmission, storage, processing, query, etc.) of this huge data volume really pushes technical possibilities to their limits.

The Big Data phenomenon can be described as follows: a high degree of complexity and diversity characterized by fast-growing volumes of generated data, for the use of which there is little time available. [1]

A. The 4V model

There are much more data existing today than a few years ago, and the aggregation and synthetization of these data sets of different sources has become a major goal to support the making of more successful business decisions.

• "Volume" - the amount of information. The volume of data has grown to truly shocking proportions.

• "Variety" - the diversity of data, the data in a variety of forms. Social media is just one part of the Big Data needs, although admittedly a significant part. Behavioral (consumer behavior-related) data, transaction data, videos, photos, and GPS data, sound recordings, etc. can also be mentioned here.

• "Velocity" - the speed of data spreading. The speed of accessing and analyzing data has increased considerably, making the streaming data analysis possible.

• "Veracity" - the validity of data. The above features, however, can only be useful, if the data can be integrated and synthesized in a way that helps companies make better business decisions. [7]

IV.   THE CONDITIONS OF EXPLOITING BIG DATA

• Data collection: An institution collects data from different data sources, which are then massively parallelized using systems - often using the grid technology - to distribute them; each node processes a subset of the data.

• Processing: The system uses the same high-performance parallelism in order to carry out quick calculations on the data for each node, reducing the results into more usable data sets.

• Data management: The large amounts of data to process are often heterogeneous, given that they originate from different systems. In almost every case, the data need to be interpreted, defined, purified, enriched and audited for security purposes.

• Measurement: The applying organizations must continuously assess and monitor the quality of their data to ensure data connectivity. User requirements determine exactly what should be measured and what goals should be set in relation to the quality of the data.

• Uses: The use of data must be in accordance with the original requirements of the processing.

• Storage: With the emergence of the data-cloud (data-as-a-service) trend more and more data can be found in a particular location, while the locations of the programs accessing them are not fixed. Either in case of a short term batch processing or for long term storage, the organization

must manage the data storage solutions in a conscious way.

• Data asset management: Embraces the user guidelines for data assessment and supervision that refers to each of the six previous steps. [8]

V. THE APPLICATION OF BIG DATA

A. Analytics in the public sector

The employees of the public sector also face the challenge of the potential use of large amounts of data in their work, including the decision making process of the government, which can also be effectively supported by analytical solutions. The Hungarian Central Statistical Office (CSO) used the SAS [8] Device for the central procession of the 2011 census data. [9]

The extent of the data explosion can be well illustrated, considering that the Hungarian tax authority collected as many data between 1988 and 2000, as in the first four months of 2013. The processing is a largely online process, only 1.5 million of the annual 80 million cases are paper based.

Besides the purchase of a petabyte storage space, complex mathematical models and analytical capabilities are also required. [10]

1) Big Data to help the census
During the Hungarian census, 11.4 million questionnaires were processed at the Central Statistical Office. The possibility of further use lies in the connection of data bases. For example, the system monitoring the careers of higher education graduates, the graduate course-tracking system, is only connected to the data bases of the National Tax and Customs Board and of the National Health Fund. If it were connected to the long term employment agency database, the system would not only be able to register this data, but also offer job opportunities. [10]

B. Big Data in the Hungarian agriculture

In an environment such as agricultural production, particularly high results can be achieved through an effective information system, where the utilization of available knowledge is difficult. The creation of an agricultural knowledge center has been launched by Hewlett-Packard's Informatics Ltd., István Széchenyi University, the Hungarian Academy of Sciences Computer and Automation Research Institute (CARI) and the eNET Research and Consulting Ltd. The Consortium received over 2 billion forints for the project in the framework of the New Széchenyi Plan – the participants communicated to the Hungarian News Agency.

The project aims to create a broad knowledge base by implementing the "Big Data" analytical system into the field of agriculture. During the research, thousands of sensors will be scattered in the territory of the country, and a complex analytical, forecasting and decision supporting solution will be developed from the data and

databases, with the help of another open international knowledge base. [11]

C. The application of Big Data abroad

1) The Dutch water application
The Netherlands has started the Digital Delta program, a more effective analysis of Big Data that contributes to the improvement of flood protection and the optimization of the water management system of the Netherlands. The initiative aims to prevent disasters and environmental degradation, but the system can also reduce the cost of water management by 15 percent. Through the analysis of Big Data, the new monitoring system introduced during the program addresses such issues as the deterioration in the quality of drinking water, extreme weather, or the threat of floods and drought. [12]

2) Big Data use in the US crime-prevention
In the BBC's [9] documentary, "The Age of Big Data"[13], the first series presents the work of the police in the Los Angeles area. The police database stores the various crimes of many decades. The database was examined by a research team with an algorithm that prepares a forecast every day based on the pattern of crimes committed, highlighting the events of previous days and the locations of high risk on the basis of past experience. Police patrols received maps indicating the risky zones and they returned to those areas much more frequently during their scheduled patrol time. The result is startling: in the examined Los Angeles area the number of robberies fell by 26%, and the amount of crimes against property dropped by 12 %. Encouraged by this success, the program has been extended to the entire city, and it has also been adopted by other communities.

3) Big Data in the service of medicine
The combination of medicine and "big data" is an entirely natural and inevitable process. In human DNA, for example, which encodes our design and instruction manual in the form of nearly 3 billion characters. Few things are developing as fast as genome sequencing[10]. The sequencing speed is at least as important a parameter as its cost. While a decade ago sequencing accounted for 80% of the costs of DNA[11] analysis, today it is only a tiny fraction of the expenditure. 60% of the costs are now used for the processing of the data. The challenge is not the production of raw data, but their processing. Now it is possible to read the patient's DNA from a simple blood sample, and deduce which proteins differ in function or production from what is expected. This change can be particularly fruitful in the fight against cancer. [14]

4) Big Data in "smart cities"
In Rio de Janeiro, the accurate weather forecast guarantees the transport safety of the "megapolis", in Birmingham, a mobile application help to find a parking space, while in Singapore city developers aim to eliminate traffic jams by the real time tracking of traffic. [15]

5) The British model to combine databases

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[9] BBC – British Broadcasting Corporation,
[10] The genome sequencing is a laboratory process that determines the complete DNA sequence of an organism's genome at a single time.
[11] Deoxyribonucleic acid

[8] SAS - Statistical Analysis System, an integrated software suite produced by SAS Institute Inc.

One of the biggest problems the British Government face today is that each of its Divisions are working on a different database and it is difficult to share data between them. The Government is now considering the unification of all existing databases. This would mean, of course, that all data of the citizens would be at one place. With the elimination of errors, however, 46 billion euros of savings could be expected. [16]

D. Big Data and Future Challenges

1) The "big data scientist"

The new research tools that use the Big Data methods are constantly changing, creating opportunities for predictive analysis. This process has generated a significant and urgent need for the data scientist. [17]

The process of change will affect all areas of the organization, first of all the IT department. A qualitative change will take place with the creation of new jobs (scientific data analysts), and overall, the IT department will offer more jobs. Although the data will be managed by IT professionals, other departments (finance, marketing, etc.) will add their advanced technical knowledge to them, and then they will be combined by the IT. This will only be efficient if the data is processed by smart devices on the place where they are created, or else a huge network and storage capacity will be needed. The same changes are happening at the data centers now that were taking place at the PCs some decades ago. [17]

2) Big Data diploma

In the next two years 4.4 million positions will have to be filled worldwide by Big Data analyst experts. Their knowledge will be essential in the 2500 metropolises, too. Companies have started training programs involving more than 1,000 institutions of higher education, while in Ireland it is already possible to get an MSc degree in Big Data analytics. [18]

VI. RISKS AND SECURITY ISSUES

The State ensures the protection of the critical infrastructure at the regulatory level by the 2080/2008 (30.) Gov. decision on Critical National Infrastructure Protection, by the Law No. CLXVI of 2012 on the identification and protection of critical systems and facilities, and by the Gov. Regulation 65/2013 (II.8.) on the implementation of the above law. The areas of critical infrastructure in Hungary, including the critical information infrastructure, such as the IT utilities and their protection, are covered by these regulations. [19]

A. Risk reduction

Based on the above-written criteria, the Big Data phenomenon may give the impression that this "data-boom" has only positive effects for everyone. Unfortunately, as everything else, it also has its disadvantages.

The "digital shadow" is the mass of data generated continuously about a person. Some of these digital footprints are consciously created by the users, while the other part is unknown to the owner. This is why the protection of personal data is becoming increasingly important nowadays. In Hungary the law No. CXII was passed in 2011 on the right of informational self-determination and the freedom of information.

This law is based on Article VI of the Constitution, to protect the right of informational self-determination and to ensure the freedom of information, the protection of personal data, and the right to access and re-use the data of public interest. The above law ensures the protection of personal data and the freedom of information in Hungary by the established National Data Protection and Informational Freedom Authority. [1][20]

B. Security conditions

The "BalaBit " syslog-ng solution collects and processes the log messages generated by the information systems. The main motivation for users is to ensure regulatory compliance, information security control and operational support. However, at present the software products available on the market focus on the log messages of operating systems and basic system applications. The information collection from applications requires a very different approach. It is enough to consider the user activities in an ERP system, an online bank or a social networking portal. [21]

VII. SUMMARY

The Big Data, the "oil" or "goldmine" of the future, will be worthless, unless its safe access and storage can be ensured. It is evident that the crucial information utilities, as part of the critical infrastructure ensure people's welfare, which, in the second decade of the 21st century also includes digital welfare.

Digital welfare means the unconditional reach of necessary and sufficient public information by electronic access. A series of decisions need to be made every day. In order to make these decisions quickly, a great deal of accurate, up-to-date and various information is needed. Therefore, in this case, the 4V model can be applied for the use of Big Data. The Big Data will make a significant part of everyday life in the following years. Economic growth should be considered here, which appears in many forms like the increase of employment, the appearance of new professions, and the transformation of the structure of education. The use of Big Data also supports the modernization of the health care system, by ensuring faster and more accurate diagnosis and cure. The fast and secure transmission of data will be implemented by the State within the framework of the Digital National Development Plan. This project refers to the development of the Hungarian National Digital Infrastructure. In order to achieve digital welfare, access must be ensured to different services and their appropriate contents. It is absolutely necessary to increase digital literacy, which should not lack functionality. This can only be effective if all data and the media where the data and information are stored and transferred are adequately protected. [22]

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GI aspects of continuous monitoring of hazard indicators

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Abstract - **Using Geoinformatic systems to analyze data, capture necessary information, and to evaluate thematic scenarios, is becoming essential within natural hazard research and for the production of different hazard maps. GI approach can lead to improving hazard mapping which is one of the best preventive measures. For better understanding of the GI approach and need for development of visualization services and accessibility of data, snow avalanche in Kopaonik mountain area was mapped. For that purpose GIS techniques has been used, mostly the Quantum GIS 1.8.0-Lisboa program. Different geographical factors were considered that affect avalanche trigger the most. Contribution of this paper is creation of idea for reducing the risk of natural disasters and resolving the problem regarding the lack of information required for risk analysis of events with catastrophic consequences.**

Key words: Geographic Information Systems; hazard; risk; spatial-temporal distribution

I. INTRODUCTION

In the previous period, many different types of natural hazards appeared in the region, which caused significant property damage and turned attention to the vulnerability of the environment. Chronic negative water balance and perennial droughts which cause damage to agriculture are recognizable. Dozens of wild fires, landslides and snow avalanches are threat to a growing number of people. Agriculture, like the population, is also violated by flooding unregulated rivers.

Geoinformatic aspects of spatial-temporal distribution of hazards, the latest techniques of the informatics, and satellite based technologies in an early warning systems and minimization of the consequences of their occurrence, are required.

II. MODEL OF GI SYSTEM

Using GI system for risk analysis of the events with catastrophic consequences is a demanding job and has to be done continually [1] [2] [3]. However, due to the nature of the existing system, model of GI system is often reduced to a written application. The problem is that if it is connected to a different system, a new application has to be made. Furthermore, a lot of efforts and funds are spent on creating isolated applications. With this kind of approach the connection between individual nodes is often sensitive and hinders interoperability. Changes in one system have unpredictable impacts on other systems and for connectors that causes problems and extra attention. This problem propagates exponentially with the number of connected systems, while solving this problem technically is very expensive for given institutions. Availability of the pieces of information that are required for risk analysis of events with catastrophic consequences, are often limited. To resolve the problem regarding the lack of information, the use of a model system based on three premises is necessary:

1. Institutions which are considered to be the creators and users of data (The Republic Hydro meteorological Institute, Public water management companies, Military Geographical Institute) need to develop a local infrastructure data and specify exact areas in which they are located.

2. Development of National 3D SDI repository with a large base of expensive, frequently needed and rarely variable data. This 3D SDI must consist a terrain model of the national territory, high quality sensory images from various satellite systems, time series of satellite images and aerial images of high resolution, with the main focus on zones that are at high risk.

3. Availability of 3D visualization services and information in spatial relationship with extra attention on accessibility of 3D format which could be downloaded directly from the point of concentration, respectively from the creator or supplier of the data.

III. ONE POSSIBLE IMPLEMENTATION

Implementation follows the model of service, while the only constraint is the implementation of standards which are available for public usage. Point of service concentration is realized as a Web portal [4] [5]. Portal is an application based on "Openlayers" API and it is implemented with combination of Java applets, PHP pages and JavaScript code. For the purpose of risk assessment of the events with catastrophic consequences, GI system with specified architecture components needed for classic 2D and 3D space perception was developed. The system architecture is shown in fig. 1.
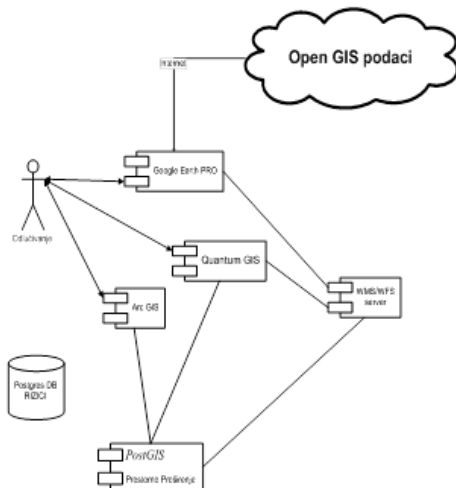
Figure 1. GIS system architecture developed for monitoring of hazard indicators

In both cases (2D and 3D perception) the main purpose is improvement of the quality of decisions that are related with spatial data. Different types of presentation of data which were formed for prototype implementation are:

• Presentation of different types of geographic data;

• Presentation of map that contains the elements, and explains their relations with geographic position;

• Presentation of model which is obtained from applying certain analytical functions to known data.

IV. EXAMPLE OF APPLICATION OF GI APPROACH: AVALANCHE MAPPING IN SERBIA

Snow avalanche is a rapid flow of snow down a slope or mountainside. It is known that avalanches can occur on any slope given the right conditions, certain times of the year and certain locations are naturally more dangerous than others [6]. For an avalanche to occur, it is necessary that a snowpack have a weak layer (or instability) below a slab of cohesive snow. Observation and experience has shown that newly fallen snow requires time to bond with the snow layers beneath it, especially if the new snow falls during very cold and dry conditions [7].

There are several ways to prevent avalanches and lessen their power and destruction. The first ones are active preventative measures that reduce the likelihood and size of avalanches by disrupting the structure of the snowpack. The second ones are passive measures which reinforce and stabilize the snowpack insitu. Explosives are used extensively to prevent avalanches, by triggering smaller avalanches that break down instabilities in the snowpack, and removing over burden that can result in larger avalanches. Passive preventive systems such as snow fences and light walls can be used to direct the placement of snow [7].

Avalanche risk cannot be eliminated entirely, but it can be prevented, while avalanche mapping is one of the most effective preventive measures. In addition to that, it can reduce the catastrophic consequences of avalanches, because with the avalanches maps, risk can be minimized, especially in the populated mountain areas. Serbia is a

country with a large number of peaks higher than 2000 meters above the sea level, and where winter tourism is on the rise, thus the development of the hazard mapping is necessary.

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Avalanche zoning includes identification of hazardous areas for land use and applying restrictions to construction. Three basic steps are involved in the avalanche zoning, they are [8]:

• Identifying avalanche paths;

• Subdividing avalanche paths, principally the runout zones;

• Applying restrictions to construction in the various zones.

Using a printed map with large-scale topographic terrain information as a base combined with specific thematic information – such as avalanche paths, potential hazard areas, event chronology etc is a common form of presenting avalanche relevant information. Terrain information in maps consists mainly of isolines, hydrography, land cover - in some cases rock depiction and hillshading – and infrastructure. The detail as well as accuracy within these cartographic products is primarily dependent on the scale. The most commonly used map scales for such base maps range from 1:1.000-1:5.000 (land register maps) over 1:25.000-1:50.000 (classical topographic maps) all the way to 1:100.000 or smaller (regional overviews). Orthophotos or satellite images that

show a high amount of detail however lack a generalized depiction are other base maps that are in frequent use [9].

It is known that some variables and geographical factors more affect avalanche trigger. One of them is height. It goes without saying that avalanches occur over the snow level, and that is directly related to the freezing level which is around 1700 meters, which means that the height above 1700 is very risky for avalanche to occur. The second variable is the slope, in all the existent bibliography concerning this matter it is accepted that the critical slope for the avalanche triggering range from 25 to 45 degrees. The third variable is the aspect, actually the performance of two different factors interacting: the prevailing wind direction and the Sun's path along the day. The forth is the curvature. It is accepted that convex surfaces cause an unstable situation in the snow mantle, allowing the appearance of fractures due to stress, while concave surfaces favour the snow accumulation and its stabilization. Needless to say, the type of green cover existing on the ground (its height and density) has an effect that can favour or prevent the avalanches triggering [10].

The study area chosen for this analysis, Kopaonik mountain area in Serbia, is displayed in Fig. 2. Kopaonik is one of the largest mountain ranges in Serbia and is located in the central part of the country. Kopaonik's highest point is Pančić's Peak, which is 2,017 m (6,617 ft) above sea level [11]. Kopaonik became national park in 1981, and now covers an area of 11,810 hectares and based on the number of endemic species, it is one of Serbia's most important biodiversity hotspots for endemic flora [11]. According to latest data, Kopaonik is one of the most visited ski center in Serbia. Ski area stretches at altitudes from 1100 up to 2017m and has 24 installations, which can transport 30 000 skiers per hour [12].

Figure 2.   Application location - Kopaonik

For avalanche mapping in Serbia, precisely for the mapping of Kopaonik mountain area, the GI approach was used. Firstly, the multiple layers were merged and the 2D scene that indicated the possible occurrence of avalanches was shown. When everything is set on the project, raster layer of the examined location is inserted, which is, in this case, the area of Kopaonik, Fig. 3.
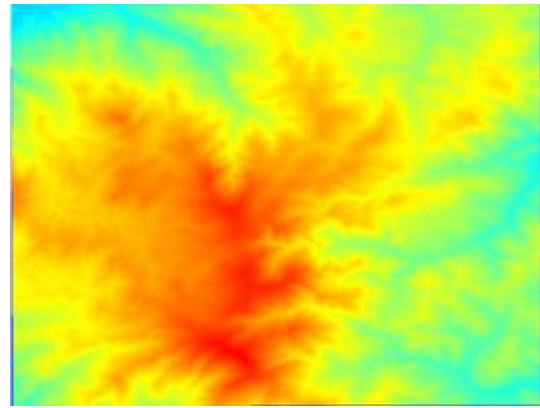
Figure 3.   Raster layer of location of interested

The insertion of a satellite representation of the location and overlapping the two existing layers were the next steps, Fig. 4.
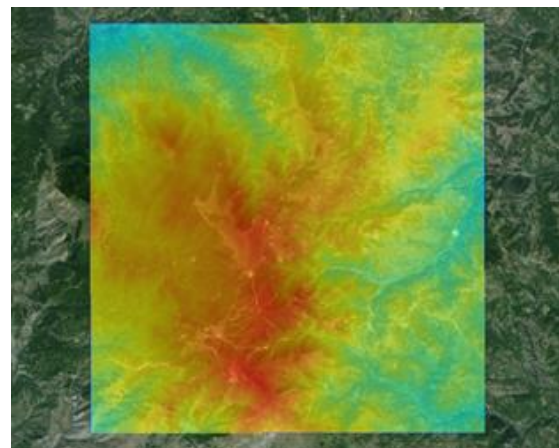
Figure 4.   Raster layer with satellite representation

Analysis of the slope is one of the most important of all the geomorphological factors which influence the occurrence of snow avalanches. For this reason, all inclinations were generalized. For the purpose of the distinctness of the picture, a layer that shows the precise values of the slope was inserted, so it is easier to decide on which slope it is more likely that avalanches will occur Fig. 5

Figure 5.   Layer with slopes

It is widely known that avalanches most commonly occur on slopes with a gradient between 30 and 60 degrees [13]. Due to the accuracy of the results, we took a slope with a gradient of 70 degrees as the final range. For this reason, all the other values of the slope which are not in this range were ignored by using the raster calculator. On the map are shown only the necessary gradients, Fig. 6.

Figure 6.   Layer with slopes between 30 and 70 degrees

To identify the values of the slope which were required, that are suitable for the formation of avalanche, green color was used. For a better understanding of the need for avalanche mapping and for the marking of the avalanche-prone areas, the ski slope where an avalanche was recorded in the year of 2012 was inserted. After overlapping the previous layers with the known trajectory of the ski slopes, the results indicated that the path of the ski slope is stretched just between the vegetation surrounding the ski slope, and the gradient which is previously determined to be suitable for the occurrence of avalanches. Furthermore, the safety of visitors of the ski resort is endangered. The ski slope is marked with red squares and is approximately equal with the track, which is also shown on the official ski maps of Kopaonik ski resort. The map scale 1:100.000 is overlapped with the previous layers, fig 7.

Figure 7.   Layer with slopes

With further work and research it is possible to insert all the required layers such as the soil layer, clear satellite imagery, the whole layer of vegetation as well as the others, for more precise insight of the terrain which is suitable for avalanches to form. Mapping avalanches is a demanding job and requires cutting edge technology and the necessary resources to create a zone where the possibility of the occurrence of avalanches is visible.

V.   CONCLUSION

As a result, based on a recommended architecture, we can get an interactive, service-based 3D hazard map, for avalanche like it is shown for landslides in Vojvodina, on Fig. 8.
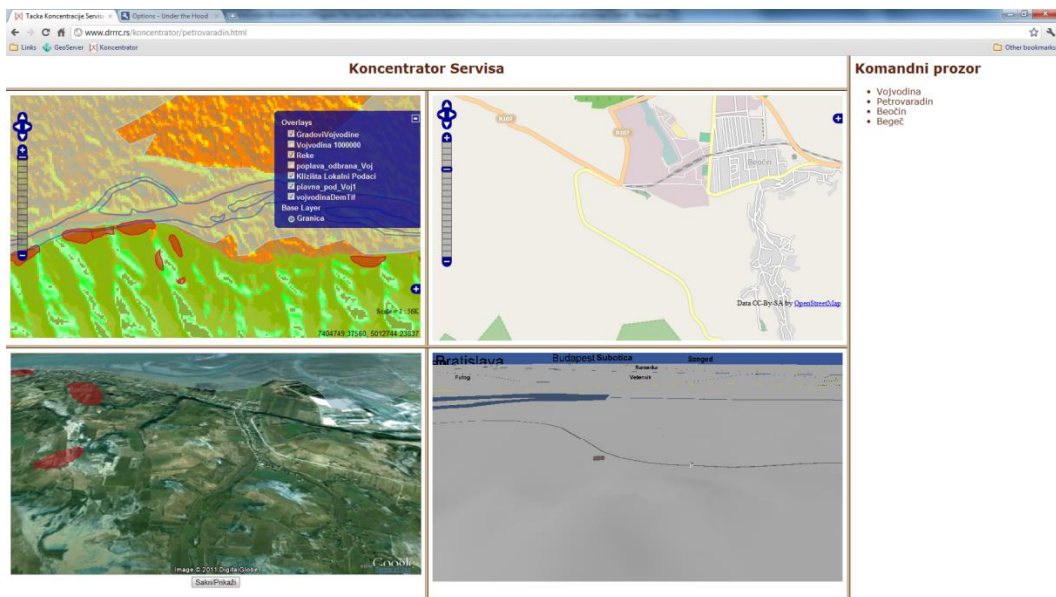
Figure 8.   service-based 3D hazard map

However, further development of a model of services and interoperability of data and 3D scenes, is necessary. On the given system architecture, an efficient system of presentation of the level of vulnerability of each object individually, or set of objects has to be created. Different situations and scenarios in which vulnerability should be specified and special analysis of social vulnerability has to be taken in consideration and presented in the temporal spatial domain. The integration of inherited systems data should be increased, while special attention should be focused on the development of the contemporary generation of sensor networks (Sensor Web).

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Exploring the Influence of ICT on Pupils' Attitude toward Mathematics in a Serbian Primary School

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Abstract – **Generally, pupils consider mathematics in Serbian primary schools dull and unconnected to real life. The attitude of the pupils' in the primary school one of the authors works for is no different than the norm. Prevailing opinion in the literature is that ICT (Information and Communication Technologies) could improve pupils' attitude towards mathematics. In this paper we explored whether the attitude of the fourth and seventh grade pupils could change using ICT in mathematical classes. We compared their results when lessons are based on ICT and when they are not based on ICT. In the end we surveyed pupils' opinion on the subject of using ICT in mathematics. The somehow surprising results are reported in the paper.**

I. INTRODUCTION

Mathematical education plays a big part in the Serbian educational system. Pupils are educated in mathematics for a minimum of nine years. However, the prevailing opinion among the pupils is that—although important—mathematics taught in primary school is boring and with no connection to real life [1].

Surveys of the Serbian educational system and its pupils' [1] concluded that by changing the pupils' attitude towards mathematics, one could change how they perceive mathematics and—as a result—how they use it in their day to day activities. The same conclusion was reached in other countries, as well [2].

A considerable number of results published in the literature—such as [3, 4, 5, 6, 7, 8]—suggest that Information and Communication Technologies (ICT)—if adequately employed in the educational process—could significantly improve the way pupils perceive and learn mathematics.

We wanted to survey whether ICT could actually influence the pupils' attitude towards mathematics. We decided to do this in the "Heroj Janko Cmelik" primary school in Stara Pazova [9] which was appropriate since mathematics is one of the least popular subjects there. In this the school fits the general trend in the country. This is the oldest primary school where classes are conducted in Slovak. It is one of the many primary schools in Serbia that supports learning in the languages of national minorities [10]. Pupils are taught for eight grades with, usually, two classes for each grade. The school has one interactive whiteboard and a classroom with twenty five computers. The computer classroom is shared among all the classes.

The initial survey of whether ICT could influence the pupils' attitude towards mathematics—and hopefully improve it—was conducted in the fourth and the seventh grade. The survey included actual work and demonstrations using computers and the interactive whiteboard, as well as one questionnaire. In general it showed very promising results which are reported in this paper.

The organization of the paper is as follows. The mathematical educational system in Serbia and pupils' attitude towards mathematics is described in Section 2. ICTs that are / or could be used in mathematical education are described in Section 3. The survey conducted to explore ICTs influence on pupils' attitude towards mathematics is outlined in Section 4. Results of the survey are presented and discussed in Section 5. Section 6 concludes the paper.

II. MATHEMATICAL EDUCATION AND PUPILS' ATTITUDE IN SERBIA

As stated in [1], Serbian children first encounter compulsory mathematical education at the age of six in kindergarten. It is part of the pre-school program and is taught for one year. Compulsory education of mathematics continues for the next eight years in primary school. First stage of basic mathematical education is organized as classes and is taught for four years. All the subjects in the four year basic education are taught by one teacher. This teacher is teaching mathematics as well. Lower secondary mathematical education (second stage of basic education) lasts for four years. Mathematics is organized as a subject and is taught by dedicated mathematics teacher. In primary schools mathematics is taught four times a week. Optional—upper secondary mathematical education—continues for three to four years in secondary school. Like lower secondary education it is organized as a subject and taught by one dedicated teacher.

The further continuation of mathematical education is possible as a part of non-tertiary and tertiary education in higher education [1]. It is taught through several courses

in bachelor studies that last three to four years and in master studies that has one or two years duration. There are also PhD studies in mathematics that last three years [1].

In primary and secondary school pupils are graded using five grade scale: 5 (excellent), 4 (very good), 3 (good), 2 (sufficient) and 1 (insufficient) [1]. Also, mathematics is one of the obligatory subjects that form the final exam at the end of the primary school—"mala matura". The results of these exams are used as precondition for pupils to continue their education in various secondary schools.

At the end of the secondary school pupils have final exams [1]—"velika matura". Mathematics is not an obligatory subject. However, results of the final exam are not considered for university entrance. As entrance for university, pupils have to pass exams in subjects that are from the adequate field of study. Mathematics is part of the exams at technical and natural sciences faculties and it is taught in several courses at almost all the universities in Serbia [1]. At universities and higher schools pupils are graded using six grade scale: 10 (excellent– outstanding) for 95-100 points, 9 (excellent) for 85-94 points, 8 (very good) for 75-84 points, 7 (good) for 65-74 points, 6 (sufficient, pass) for 55-64 points, and 5 (not sufficient, fail).

Although mathematics represents a big part of the pupils' education, it is still taught in a conventional way which emphasizes quantity of content over its essence and application in various contexts [1]. In 2012 Serbian pupils' performance in mathematics was significantly below the OECD (Organisation for Economic Cooperation and Development) average, although it is steadily improving since 2003 [1]. According to PISA's definition of mathematical literacy, Serbian students fall behind the OECD average in their capacity to formulate, employ, and interpret mathematics in various contexts, and also have difficulty recognizing the role that mathematics plays in the world [1]. Of the four comprehensive categories from the PISA assessment framework for mathematical literacy, only in quantity catagory the Serbian pupils achieved higher results than the overall mathematics proficiency scale [1].

Thus it is natural that the Serbian government is trying to improve its pupils' mathematical literacy by improving and updating the entire educational system [1]. The ultimate goal is reaching European educational standards. However, this is a very slow process often not adequately supported, executed, and often met with resistance from various stakeholders included in the process.

Most of the government efforts are guided toward introduction of state-of-the art technology-based methods for mathematical teaching. This means that computers and rest of ICT are more and more applied in everyday mathematical teaching [4, 11]. In addition, Serbian teachers are getting trained in using these technologies [12]. Much of this training is compulsory [1], but often met with resistance. Although significant effort is made [13], the results are—as PISA (Programme for International Student Assessment) tests show [1]—still poor. However, number of teachers applying ICTs and technology-based teaching methodologies is increasing every year [4, 11].

Beside the backlog in applying technology-based teaching methodologies, additional drawback in improving Serbian pupils' mathematical literacy is pupils' generally negative attitude towards mathematics. As the results of the survey published in [1] showed, the popular opinion among the Serbian pupils on mathematics has two main characteristics:

- It is important and valuable, but dry and boring.

- It has no connection to real life or to different domains of culture like the arts.

However, as a positive result the survey [1] reports that if the pupils' attitude towards mathematics could change, then their experience of the subject could also change. At the end of the survey, authors concluded that the core of the mathematical content in education should not be changed, but rather the educational methodology and the technologies used [1].

Main suggestions [1] aimed at improving pupils' attitude towards mathematics include broadening mathematics teaching techniques by including ITCs, mathematics support software, and including game-like activities [14].

III.   ICT IN MATHEMATICAL EDUCATION

Usability of ICT in education has been a substantially explored topic [15]. The modern day meaning of ICT use in education is expanded and includes not only desktop computers but includes mobile technologies as well [16]. Its potential in mathematical education has been also explored [17]. Some examples [17] of ICT use in mathematics include:

- Use of mobile devices—such as smart phones, pads, or tablets—as tools for studying mathematics outside of the classrooms and to use it in everyday life. Use of mobile devices not only increases the mobility of the pupils, but also increases their collaboration, Fig. 1. They could work physically close, sharing the same device, or on several devices working on the same task in the same room or over distance.
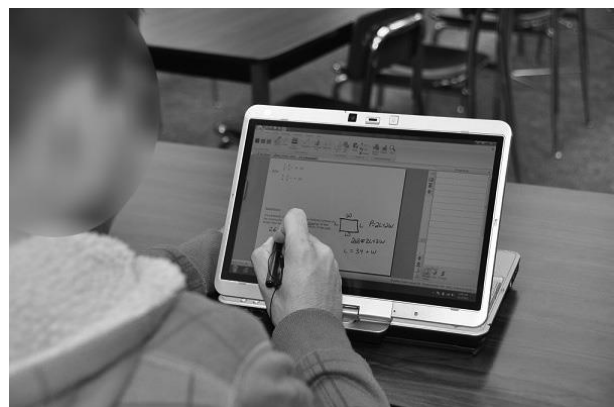
Figure 1.   Example of using mobile devices in mathematics classes to incresa pupils mobility and collaboration
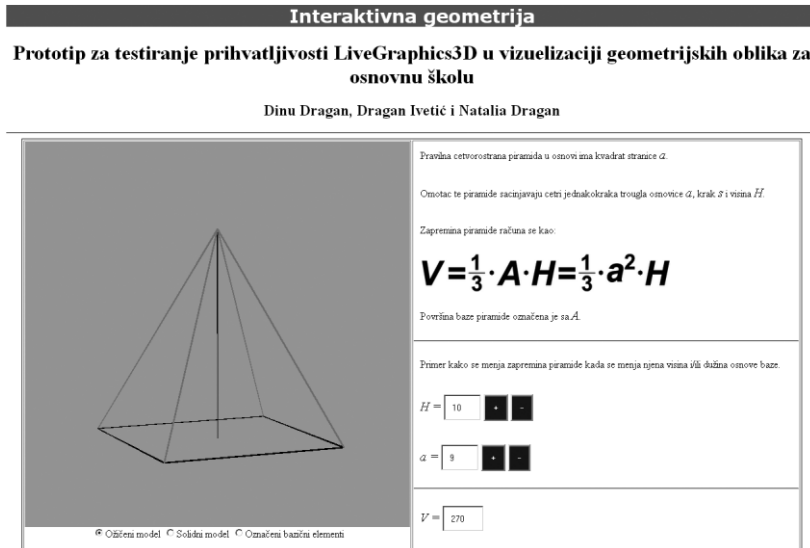
Figure 2.   An example of interactive geometry software [18]

- Graphic calculators and computerized graphics such as GeoGebra [18] which help pupils' improve their understanding and skills in algebra. Understanding and comprehending geometric problems represents a challenge to primary school pupils. Only a small number of them find it easy to comprehend and solve geometric problems, while the rest struggle with geometry [18]. ICT and different visualization techniques—such as the one presented in Fig. 2—could help pupils understand geometry and algebra better and faster [18].

- Specialized software such as Mathematica and MatLab [18] which support different mathematical calculus and simulation. The specialized software is used not only for complex mathematical operations, but also for simulating complex results and to demonstrate a connection between mathematics and everyday problems and use. For example, in Fig. 3 software is used to simulate and visualize an airplane and how the changes in mathematical formula influence the position of the airplane.

- Programmable toys or floor robots—such as the one presented in Fig. 4—which help pupils to develop problem-solving skills and higher level mathematical thinking. Although meant for younger children as a starting point for teaching control, directional language, and programming, it could be also used for elder children as entertaining example of mathematics. For example, pupils could use mathematical formulas to program floor robots trajectory.

- Multimedia (audio and visual) support for teachers in presenting new mathematical concepts and topics. These tools are especially useful when there is a need to present visually challenging topics such as algebra and geometry, but also to demonstrate connection between the mathematics and its everyday use. As an example, it is possible to take the video tutorial on sphere volume calculations [19], Fig 5.

- 3D hardware/software for interactive work with geometrical content such as Microsoft Kinect which can additionally help pupils in understanding concepts in 3D space [20]. For
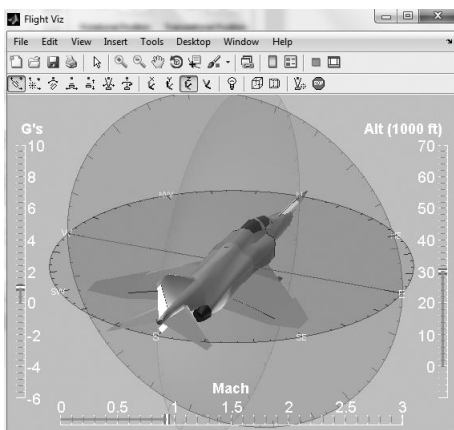
Figure 3.   Example of sofware simulating changes in position of an airplane based on changes in mathematical formulas

Figure 4.   Example of floor robot—Bee-Bot—that could be used for teching how to solve practical problems using mathematics

Figure 5. An example of multimedia presentation used for teaching Volume of a sphere [19]

example they could plot xy coordinate plane, where x represents the input factor (height, for example) and y represents the output (total distance traveled). Separate graphs will have to be made for each input factor assessed [21].

Considering software use in mathematical education, it is possible to distinguish two main ways [11] in which they are used:

- As presentational tools, supporting teachers' lecturing with limited interactivity. Unfortunately, in Serbian primary schools this is the predominant way of using ICT. Mostly lectures are accompanied with Power Point slides—or something similar—that has small interactivity [11].

- As interactive tools used by pupils and teachers. These tools could be used online or offline. The tools are used by pupils to explore different mathematical concepts through interactive examples, such as the ones in Fig. 2 and Fig. 3. Often many of them support game-like learning. Examples of such tools could be found on Internet as part of Web sites for interactive teaching resources, such as Visnos [22] and Virtualna Kniznica [23]. Teachers are using these tools to interactively demonstrate new mathematical subjects and concepts.

A visible trend in using ICT in Serbian primary schools is the addition of interactive whiteboards into the teaching process [24]. A whiteboard in combination with a computer and a projector, Fig. 6, could improve interactivity of pupils and teacher in a classroom [24]. They are usually used for presenting learning material accompanying teacher's lessons, and for displaying interactive software tools used by teachers and pupils. In addition, it is possible to combine whiteboard with mobile devices, Fig. 7, which would increase interactivity and collaboration. Also, if the teacher is combining whiteboard with tablet, he/she would actually interact with

the tablet, but turned to face the pupils, and not turning them his/hers back. Namely, one big issue in general when working with any kind of board is that teacher is spending most of the time interacting with the board, than he/she is interacting with pupils. Also, tablet allows the teacher to access their computer from anywhere in the room.

If a multi-touch whiteboard is used in class then teacher and a pupil—or two and more pupils—could work at the same time solving problems together. However, for mathematical classes, it is even better if several tablets are at disposal—ideally a tablet for each of the pupils. In that case pupils and teacher could interact with the whiteboard and collaborate from their desks. Teachers would also be able to send individual interactive activities to individual tablets for small group instruction. Class time will not be lost because pupils have to go to and back from the whiteboard. This technology would enable pupils in wheelchair to get more engaged in classes and even to solve tasks on board—something that is not possible in the conventional classroom settings.

One of the biggest issues for primary schools in Serbia is limited funds [4]. Although the number of primary schools which have computers is increasing year after year, the situation is still far from wanted—for every

Figure 6. Interactive whiteboard based on projector

Figure 7. Example of interactive mathematical class based on whiteboard and tablet

school to have at least one classroom fully equipped with computers. However, even if every primary school would have at least one classroom equipped with computers, the use of the classroom would be limited only to a small number of classes. Other—more advanced—types of ITC devices are even harder to obtain by primary and secondary Serbian schools due to fund limitations.

Another big sidetrack is a lack of interest among older teachers [12]. However, year after year this is improving as the teachers' population gets younger. Younger teachers are versed in using computers and technology-based teaching methods. Also more and more old-school teachers get trained in technology-based education methodologies as well [12].

IV. THE SCHOOL AND METHODS USED IN THE SURVEY

As stated in the introduction, the survey was conducted in the "Heroj Janko Cmelik" primary school from Stara Pazova. All the classes are taught in Slovak. Although the school is well equipped for a Serbian primary school—it has one classroom equipped with computers and an interactive whiteboard, the computer classroom is not used to its full potential. Only the computer literacy subject is using it regularly—on a weekly basis. The computer literacy subject is taught from the fifth through the eighth grade (second stage of basic education). The subject is not compulsory and 90% of the pupils from the school attend it. Pupils are obtaining basic skills in:

- working with text processors such as MS Word [25],

- working with data processors and spreadsheets such as MS Excel [25],

- working with Web browsers such as Mozilla Firefox [26], MS Internet Explorer [27],

- handling email such as Mozilla Thunderbird [28], MS Outlook [29],

- in HTML programming and using HTML editors such as Dreamweaver [30] and MS Expression Web [31],

- creating vector graphics and working with vector graphics authoring tools such as Inkscape [32],

- photo and image editing using tools such as GIMP [33],

- sound editing using tools such as Free Sound Recorder [34],

- video editing using tool such as MS Movie Maker [35],

- algorithmic thinking and programming using tools such as MIT Scratch [36].

Beside the computer literacy class, the classroom with computers is additionally used on irregular basis by the technical education subject. In this course pupils learn to work with different CAD (Computer Aided Design) software and different simulation software.

Therefore, we can conclude that the pupils of the senior grades are relatively versed in using computers. However, they have no experience in using them for anything else other than technology-based subjects.

Mathematics is one of the least popular subjects in the school. Further the results of the pupils' final exams at the end of primary school were below district average in 2015. Usually, the pupils have to be compelled to do their homework. That is why we wanted to survey how the pupils will react to the use of ICT in the mathematical classes and if ICT would help improve their attitude toward mathematics.

The survey was conducted during May of 2015. We decided to survey two categories of pupils:

- Pupils that had some classes that used computers in the teaching process. For this we chose the seventh grade classes as they are more mature and have substantial experience in using computers. There are two seventh grade classes in the school containing 18 and 20 pupils. We did not survey the eighth grade classes as they have been preoccupied with the final exams and not too keen to participate in the survey.

- Pupils that had no subjects that used computers in the teaching process. We have chosen the fourth grade for this part of the survey as they are the eldest pupils that have not used computers in subjects. They were available, and they were very keen to participate in the survey. There are two fourth grade classes in the school containing 15 and 18 pupils.

Computer experienced pupils were surveyed on two occasions. The first occasion included one lesson based on interactive whiteboard and interactive software presentation based on the Wolfram Research Computable Document Format (CDF) [37]. The lesson was about the binomial square theorem. The presentation was interactive and it tried to explain binomial square using visual examples similar to the one presented in Fig. 8. Pupils actively participated in the lesson.

At this part of the survey we compared:

- pupils' results at a binomial square exam with the results they achieved last year,

TABLE I.   QUESTIONNARIE PRESENTED TO THE PUPILS OF THE SEVENTH GRADE REGARDING THEIR OPINION ON USING ICT IN
MATHEMATICAL CLASSES ON A LARGER SCALE (TRANSLATED)

In your opinion, what will the use of computers in mathematical class do:		
	I agree	I do not agree
It will make mathematics more intresting.		
It will make learning mathematics easier.		

- how many tasks pupils solved in the class in comparison with how many they usually solve.

At the second occasion computer experienced pupils completed a questionnaire regarding the use of ITC in their mathematics lessons. The questions asked are shown in Table I. We wanted to survey their opinion on using ICT in mathematics lessons on a larger scale.

In Serbian primary education, pupils' advancement from the fourth to the fifth grade marks the transition from the first stage of primary education to the second stage of primary education. Every year fourth grade pupils are introduced to their future mathematics teachers. Usually, the mathematics teacher teaches them one lesson from the senior grades. This year we chose to teach them two lessons:

- The first lesson was in a conventional classroom and conventional teaching methodology—that is not based on ICT—was used.

- The second lesson was in the classroom equipped with computers and a technology-based teaching methodology was used. We chose several interactive software tools from [23] and pupils used them to learn and solve different fraction problems. Fig. 9 shows an example of one of the interactive software tools used to test pupils' grasp of the concept of fractions. Pupils have to drag and drop the correct fraction onto its representation.

With the fourth grade pupils:

- We compared pupils' attitude toward the mathematics lessons when ICT was used and

when it was not used. We took notes of their comments.

- We compared how many tasks pupils completed when ICT was used and when it was not used.

- We compared how many homework tasks pupils solved with and without ICT used in lesson.

It should be noted that the majority of the pupils from the fourth grade have computers at their homes and that they have some rudimentary experience in using them. However, pupils from the fourth grade use computers mostly for fun—playing games and videos.

V.   RESULTS AND DISCUSSION

A.   The Binomial Square and Computer Experienced Pupils

With the survey of the computer experienced pupils learning the binominal square we achieved mixed results. During the lecture the pupils showed some enthusiasm, answered the question more vigorously, and even the pupils with lower grades participated and answered the questions. The pupils solved the tasks given to them during the lecture with ease and it seemed as if they understood the concept of binomial square well. So, we observed that the pupils' attitude towards mathematics improved during the lecturing in which teacher used interactive whiteboard and interactive software tools. It should be noted that pupils' behavior improved significantly in comparison to the way they usually behave during lecturing. They paid more attention to the subject and their willingness to participate was clearly visible.

However, we did not perceive any significant changes in the results they achieved at the binomial square exam.

$(a+b)^2 = a^2 + 2ab + b^2$
if a = 10 and b = 4
$10^2 + 2(10)(4) + 4^2$
100 + 80 + 16
$(10+4)^2 = 196$
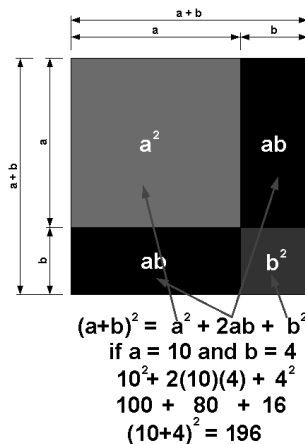
Figure 8.   Interactive whiteboard based on projector
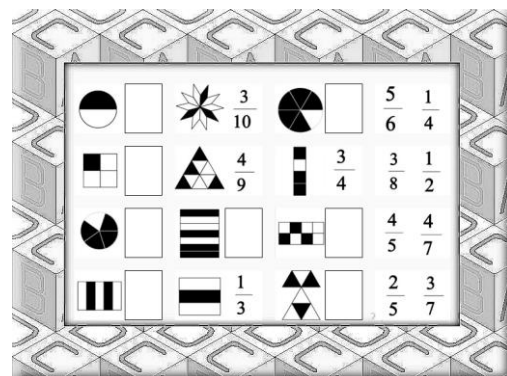
Figure 9.   Interactive software tool for learning concepts in fractions
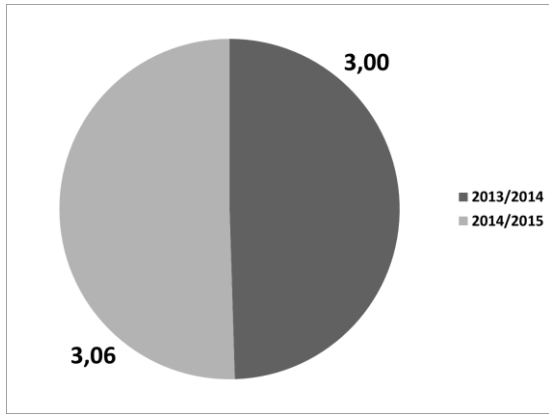
Figure 10. Difference in pupils' binomial square exam avarage grade when ICT was not used (2013/2014) and when ITC was used (2014/2015)

Grades	Generation	
	2013/2014 (% of the entire grade)	2014/2015 (% of the entire grade)
5 (excellent)	6	6
4 (very good)	44	28
3 (good)	6	39
2 (sufficient)	39	17
1 (insufficient)	6	11

Distribution of the grades was statistically similar to the results achieved by the previous generation of pupils, and the average grade was only slightly better, 3.06 vs. 3.00. Difference is almost unperceivable, Fig. 10. The grad distribution comparison is presented in Table II. Difference comes from one grade of a single pupil. Only thing of notice is that when technology-based teaching method was applied in class, there were less insufficient grades. The results obtained definitively require further and more thorough statistical analysis and comparison.

The reason for the results observed could be found in the fact that the previous generation of pupils in general achieved better results than the current generation at the exams. The results would be more informative if we could compare the pupils' results on the binomial square exam when ICT is used or not in the lessons.

The surveyed improvement in the pupils' attitude towards mathematics should be taken with a grain of salt. There could be several explanations of the surveyed results. As of the pupils' attitude improving, we could not conclude with absolute certainty that it is a result of using ICT and technology-based teaching methodology. It is possible that the pupils' attitude changed because the lesson was different than the pupils were used to and that this resulted in the increase of their interest. However, knowing our pupils, we are convinced that the observed improvement in pupils' attitude is more the result of ICT use than of the novelty.

B. Computer Experienced Pupils Questionnarie

This part of the survey was conducted several weeks after the lecture including interactive whiteboard and after the binomial square exam, as we wanted to allow our pupils' impressions time to settle after the lecture. We must admit that the results of the questionnaire somehow surprised us. We expected that pupils will be in general more receptive to use of ICT in mathematics. However, as it is shown in Fig. 11 and 12, the pupils were divided in their attitude towards using ICT in mathematics. The number of pupils that took part in the survey was 35. Three pupils were not at school that day and they did not take part in the survey. Some s Majority of the pupils—24 of them—thought that using ICT will make mathematics more interesting. But they were divided almost in half in their opinion whether ICT would make learning mathematics easier. Interestingly nine of the pupils thought that using ICT will make mathematics more interesting, but that it will not make learning mathematics easier. After we observed the results we asked the pupils to explain to us why they gave these answers. In their opinion mathematics is too important to be fun as they perceive computers as tools for having fun, not as tools for education.

C. Fractals and Pupils not Experienced in Computers

The pupils of the fourth grade showed much more enthusiasm towards the use of ICT in mathematics. This
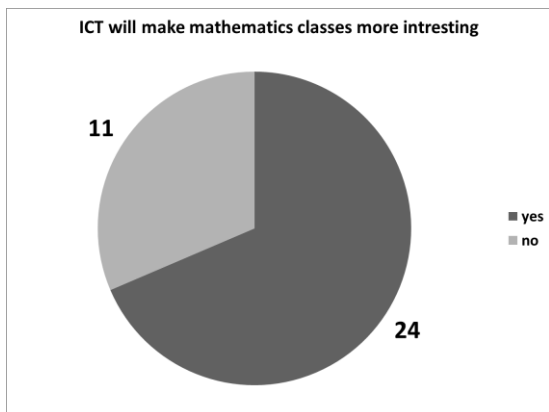
Figure 11. Pupils' answers regarding the first question in the survey questionnaire
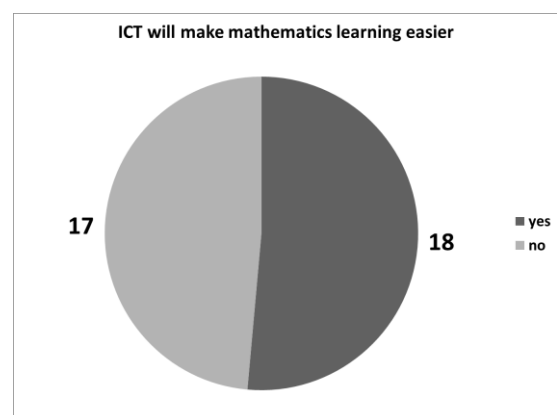
Figure 12. Pupils' answers regarding the second question in the survey questionnaire

could be observed from their comments, such as "This is great!" and their evident enjoyment. They fully participated in tasks solving, answered the questions with vigor, and they even had questions of their own. In comparison to the lesson in a conventional classroom, they completed all the tasks and almost all of them did their homework. 91% of the pupils did their homework after the lesson based on ICT and only 61% of them did the homework when ICT were not involved.

As with the seventh grade pupils, there could be several explanations of the surveyed improvement in the fourth grade pupils' attitude towards mathematics. It is hard to ignore the fact that this was the first time that the fourth grade pupils visited the classroom equipped with computers. This fact alone was perceived by the pupils as something extra and a prize in itself. Many of the pupils showed eagerness and willingness to learn mathematics using computers. They requested more of it and even asked whether all the mathematical lessons in the higher grades are based on computers.

VI. CONCLUSION

The survey of the seventh grade pupils that have some experience in using computers in lessons and of the fourth grade pupils that do not have experience in using computers in lessons gave us some insight into how ICT could improve the pupils' attitude towards mathematics.

In general the pupils' attitude towards mathematics and concepts taught substantially improved during the lessons that were based on ICT. So an optimistic conclusion would be that ICT can improve pupils' attitude towards mathematics in primary school. However, further—more detailed and comprehensive—surveys are necessary to investigate how much influence the change in the surroundings and novelty of the technology-based teaching had on the improvement in attitude.

In addition we can conclude that although using ICT in mathematics seamed interesting and fun to the seventh grade pupils, they do not think that it could help them in learning mathematics, because in their opinion, fun and mathematics do not mix. The results of the questionnaire need further research and analysis. It would be interesting to see whether the rest of the pupils from the school—and even the pupils from other Serbian primary schools—agree with the pupils from the seventh grade.

As a result of the survey, the school mathematics teachers will consider a wider use of ICT in mathematics. Based on what this survey demonstrated, ICTs will be used at least during revision lessons and to demonstrate more visually challenging mathematical concepts and topics, such as geometry and trigonometry. In that regard another whiteboard coupled with teacher's tablet is ordered for mathematical classes.

ACKNOWLEDGMENT

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Internet Based E-learning

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Abstract - This paper points out that the Internet is an inevitable companion of education. The essence of using the Internet in education is to help the learning process, to create a correspondingly learning environment. Internet based e-learning provides fast and easy access to information, greater involvement of students in learning about the educational content, as well as their study. Within this learning there is a quick and easy communication among the participants of the teaching process. The Internet is there to encourage and motivate both students and teachers.

I. INTRODUCTION

Today life is conceived in two worlds, which are real and media world. The real world is "bounded" space and time. It can not be entirely to be creative, or in an easy and quick way to get to the desired information. Unlike the real world, the media world offers far more information available. With it, you can find out what's going on in the world, in a very short period of time. Temporal and spatial distance is no longer a problem. Everything is easily

Figure 1.   Real and media world

accessible in the media world.

The media world is divided into "old and new" media world. The "old" media as radio, television, newspapers ... While the "new" media Internet and mobile telephony. Across the old media can find out many details, even those that are not of interest at a given moment. So far as providing a "new" media are better.

What you should do every media literate internet user is to separate the real from the unreal and truth from lies. [1] Each user receives a variety of different types of information. From the user depends on whether the Internet will exert a positive or negative influence on him. It depends on the age, sex, national origin, different interests ...

Many say that the Internet has bad impact on users. However, if users have the ability to take advantage of all the possibilities offered by the Internet will be able to enjoy the benefits of this media world.

II. MODERN EDUCATION

The rapid development of scientific knowledge, particularly the development of new technologies has led to the modern world in the process of deep, permanent and unstoppable change. [2] Education in the world and in our country gets a new dimension and significance for the further transformation of society and the position of man in it. The times we live requires open society to the world. Direct dependence of education and development is more pronounced every day. For the quality, it is important knowledge, its research, its transmission in the process of life, work and decision-making. In developed societies, the main developmental resource is human capital, and its quality is substantially determined by education.

Figure 2.   *New and old school*

Throughout history, it changed the way of education. Much depended on who you are, where you are and what you wealthy. Children in developing countries had a poor education, while children in developed countries was a better education. This does not mean that a child who is born in the example. South Sudan is less intelligent than a child from the United States, but also means that the child is in such a poor country provided poorer education. Everything is of course linked to the economy and politics of the country.

Information and communication technologies have provided opportunities for children in less developed countries can achieve much greater opportunities in education. All this can pose a "danger" for highly developed countries, because I know that the key to overcome the economic crisis is certainly a highly educated population. Internet is the one who can help millions of people out of poverty and that these countries begin to thrive.

Earlier we could attend some events, but today the Internet allows us to follow the lectures over the net to take the exam ... it allows us to better educate. He is available to many people regardless of which part of the world are located. In recent years we have witnessed that it is in our primary and secondary schools was introduced internet in the curriculum. Students in the classe s using

the Internet, and communicate among themselves and with their teachers.

III. E-LEARNING

Electronic learning (E-learning) and distance learning is usually equal. [3] In any case we are not talking the same type of education. Distance learning refers to all teaching when the professor and the student does not meet personally (physically).
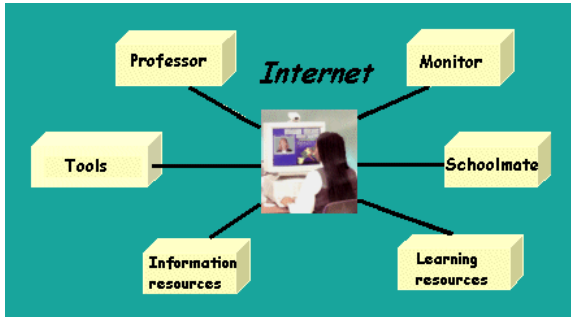
Figure 3.   Internet based e-learning

E-learning refers to learning that supports information and communication technology. [4] The educational process must be understood as an interaction between a student - content - the teacher - technology. It may occur

- in the classroom to support traditional education,

- a virtual classroom where the overall material is processed online and the students never personally acquainted.

E-learning involves the use of electronic applications in the learning process. Interenet allows greater scope and rapid flow of information by using a variety of applications (digital libraries, online simulations, virtual labs, ...). [5]

E-learning makes a major contribution to the acquisition and exchange of knowledge at global level. It was created to provide consumers a free educational programs over the Internet. Today everyone has the opportunity to be educated. However, the school does not allow the acquisition of knowledge in all domains of interest to students. On the other hand, online education offers possibility of further education, whether to extend their knowledge or to acquire new knowledge. The Internet allows access to any learning material, and even those materials at elite international universities.

All you're interested in can be found on the Internet [6]:

- **Web pages** - through the Website universities can deliver information that are important both for students and for their parents, as well as the wider public, in connection with the work, the type of program, conditions of entry, as well as other information of interest .

- **teaching subjects pages** - are sites that are designed for students and providing basic information about teachers, content of curricula,

as well as the activities carried out within the framework of the case. It is important that these sites be standardized and made at a pre-defined pattern, so that students be easy to obtain information through them.

- **electronic reading** - allows students to easily search of the content, as well as to any place where there is Internet, can access their books or materials for exam preparation. In the old system of education books were printed.

- **preparation of teaching** - it enables teachers to be faster and more effective preparation for the educational process and to complete their courses using the latest information and knowledge from different fields.

- **preparation of exams** - it enables students to complete insight into the material they learn, thanks to which the students acquire the breadth in understanding the material and, through interactive content that are available in all areas, they are able to easily and quickly memorize the material.

Traditional education is becoming unfortunately more expensive, because online education is becoming increasingly popular. It provides a chance even to those people, who can not be educated for example. some obligations, and in this way they can improve their skills and knowledge. [7] Today on the market there are many forms of online education, which are free. They provide services to all interested persons, who are not educated, but also to all those who wish to obtain additional diplomas and continue their education.

Online education does not aim to replace the traditional, but tends to improve. It does so by providing interactive textbooks and open educational materials that are closely associated with educational institutions. The students were able to through online forums discussing some topics related to education. As technology progresses more so will develop online teaching, and thus will be translated into a large number of world languages.

IV. ON-LINE CLASSROOM

The most interesting application of the Internet in the context of e-learning is a new kind of classroom - on-line classroom. Every day a growing number of courses available on the Internet that functions on the basis of višenedeljnoj via email and forums. From management to musicology - the possibilities are limitless.

However, this way of learning is not suitable for everyone. Prerequisites for accessing online classroom are [8]:

- **computer literacy**, which means more good knowledge of computers

- **fast Internet connection** to easily follow the material stripped materials, watch videos, participate in discussions.

Figure 4. On-line classroom

These prerequisites can be easily fulfilled. Much more important is that you have to be disciplined. One of the advantages of traditional classroom routines, which binds you. You know where you need to be, how long you stay, it is clear what is expected of you. Something outside forces you to obey it. In the online classroom you have the freedom to choose where and when you learn. Setting their own pace. This requires a great willingness and readiness to work. Yard and lemonade? Café? Bed? In the middle of the night or in the afternoon? Anything can, if you persuade yourself. A similar problem exists with the motivation and when you plan to exercise regularly, then pay training instead of working at home, because you know you'll make it easier. So, it is this flexibility and availability of the Internet's biggest strengths and weaknesses of this method of learning.

These courses are used and different methods than those you are used to. Conventional lectures know how to be boring, according to the principle - you, listens to leave. Internet courses offer multimedia content, forums where you can follow and comment on the work of others and they are yours. Of course, these methods are used (or at least should) and classical schools, but they were out of necessity much more developed on the Internet. Various media through which transfers knowledge will make it easier to adopt it without endless reading and underlining.

On-line courses are valid and the general benefits of Internet communication - eg. you have more time to consider his response and the way in which it will formulate. We are aware that our language is sometimes faster than the mind - our comments will certainly be thoughtful if you write them down, but if we say them now. One unexpected advantage is anonymity, which in these conditions is preferred. Why? Nobody knows what you look like, what your gender, your age, etc., so from that side there is no discrimination. Prove with their work, which means that provided a special kind of academic atmosphere that helps increase productivity.

All in all, online courses are a great opportunity to Douce that what you are not sure or accept completely new skills that have always interested you and you have not had the opportunity to commit them. It's not so bad to go back to the bench, right? It is your final choice, traditional or online classroom.

V. ADVANTAGES AND DISADVANTAGES OF USING INTERNET

Teaching and learning via the Internet today is becoming more widespread and popular as it has mnogobrijne positive side. Today, more and more students who start primary school with the knowledge about computers and the Internet. Using the Internet in class more and more people will be able to better teach. [9]
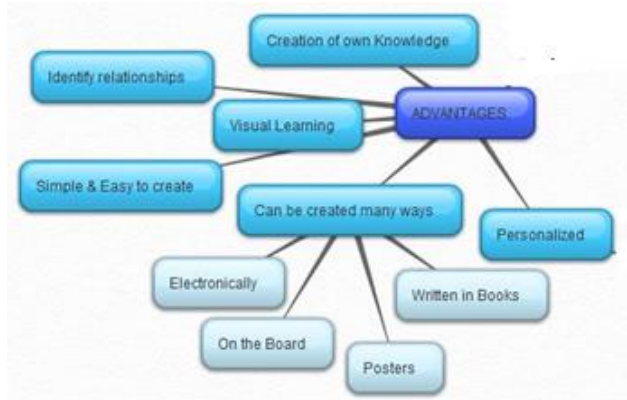
Figure 5. Advantages of using Internet

a) **The benefits of the Internet for students:**

- Sound, various animations, applications and videos can make learning more interesting.

- The pace of learning is adjusted according to personal needs of the individual students.

- The time to learn is optionally students can learn whenever they want and keep as much as they want at certain facilities.

- The possibility of simultaneous opening of several internet sites

- Access to educational facilities regardless of the spatial and temporal distances.

- The possibility of electronic books, textbooks and other teaching materials.

- The ability to communicate among pupils and students with teachers regarding certain items.

b) **The advantages of using the Internet for teachers:**

- Provides better and better preparedness classes.

- Provides good motivation that teachers want to encourage in students and to use the content propraćenih image, sound, animation.

- Allows the teacher to provide students access to educational facilities that are increasingly tailored to individual students' needs.

The main characteristics of the goods by the Internet is a wealth of information and data in its possession. Therefore, it is important to learn how to use the Internet effectively, and its advantages and options that are used for the acquisition of knowledge.
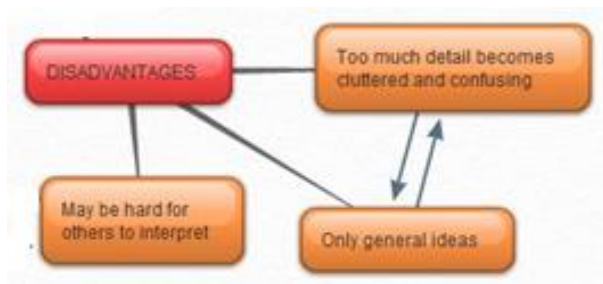
Figure 6.   Disadvantages of using Internet

The richness and variety of data and information, which are abundant in the Internet is in fact double-edged sword. Its facilities are to his advantage and his disadvantage. Inernet has many unsubstantiated and unreliable data. [10] These data are different and sometimes calls into question their accuracy. Different contents can be written by anyone, so they should be checked, especially when used for the purpose of acquiring knowledge and education.

One of the problems when using the Internet in teaching is an overloaded network, so it is sometimes necessary to wait long for access to desired information, which the pupils can pose a big problem. [11]

What is the worst side Inernet in education, is that for those purposes and not used much. Young Intrenet increasingly used as a form of entertainment, "chatting" on various social networks, listening to music, "taking" series and movies ...

VI.   CONCLUSION

Iternet made a great impact on today's education. He contributes to the improvement of teaching in schools, because the students have great access to information and thereby enhance their knowledge. Online education has enabled large numbers of students to join universities for them was "mission impossible". The good side of the Internet is that many books and magazines available to everyone free of charge. In this way there is no longer any obstacles to read and educate herself. The only question is what kind of attitude the young to books and education. Unfortunately, young people today are more interesting stuff such as games and various other entertainment facilities. We should therefore encourage as many students and instruct them how to properly use all the information available on the Internet.

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Java Development Environments – A Comparison

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Abstract - This paper will consider 3 leading Java IDE environments: Eclipse, NetBeans, InteliJ and analyze them as programmer, student and teacher and show advantages of using particular environment depending on the role of the user. Since no other author ever considered these environments from different aspects, and none of the existing papers considers these three development environments together, this paper has a goal to question the use of these environments and give leverage to one of them in different programing focus.

I. INTRODUCTION

Java IDE is one of the leading programing languages globally. Several environments have battled over the years to become the leader and the first choice for experts for this programing language. Since it is an endless battle, this paper will give some facts from several aspects that will give advantage to one of the environments analyzed. First, it is important to do a thorough analysis of emphasized environments separately, then to find their similarities and, finally, to show their differences.

II. SEPARATE ANALYSIS

A. Eclipse

Eclipse is a platform that has been made by IBM funded project VisualAge made by IDE experts since 2001 for building integrated web and application development tooling. First release was in 2004, when Eclipse was transformed to a non-profit organization. The Eclipse defines a free, open source so that each plug-in programming team is able to apply their expertise and contribute to the Eclipse community. Repository experts build the back ends and the usability experts build the user interface tools. [1]

Eclipse is an environment for dynamic discovery, loading, and running of plug-ins. The platform handles the logistics of finding and running the right code. The platform UI provides a standard user navigation model. By design, the platform does not provide much end user

functionalities. Advantage of the platform is what it encourages: fast application development with integrated features because of plug-in programming model. Eclipse offers ordinary user interface model for working with tools. It provides running on all operating systems while it also provides robust integration including all plug-ins.

Eclipse is famous for Java Integrated Development Environment (IDE), but C/C++ IDE and PHP IDEs aren't leaving behind. Eclipse offers language support and several features for their default packages.

B. Netbeans

NetBeans developed in 1996 as Xelfi, a Java IDE student project under the guidance of the Faculty of Mathematics and Physics at Charles University in Prague and now it represents a software development platform written in Java. It emerged as an open source platform after it was acquired by Sun in 1999 an now is part of Oracle. NetBeans IDE is a free and open source integrated development environment for application development on Windows, Mac, Linux, and Solaris operating systems.

This IDE simplifies the development of web, enterprise, desktop, and mobile applications that use the Java and HTML5 platforms. The IDE is primarily intended for development in Java, but it offers support for the development of PHP, HTML5 and C/C++ applications providing comprehensive editors and tools for their frameworks. It also offers tools and editors which can be used for XML, JavaScript and more.

NetBeans IDE can be installed on all operating systems that support Java, from Windows to Linux to Mac OS X systems. The NetBeans community is large and active. Users are developing new plug-ins all the time because NetBeans IDE is extensible and has well-documented APIs.

C. Intelij

InteliJ is a platform made by JetBrains and release in in 2001. At the time, it was the first Java working enviromments with advance code navigation modes. InteliJ has two editions: community, free one and business, paid one.

This environment is well-known for its simplicity in use and writing smart code. The IDE recognizes written code and helps by giving smart and relevant suggestions in every context: smart and fast code completion, analysis of the written code, simple navigation across the project and highly graded and valued refactoring tools. Feature offered is that this IDE automates the tedious and repetitive development tasks, making the programming easier, quicker and more productive.

IntelliJ also supports mission-critical tools such as integrated version controls systems and a wide variety of supported languages, such as Android 2.0, PHP, HTML, Javascript and CSS. Also, database support plug-ins for MySQL databases are included into this IDE. [2]

III. TECHNICAL CHARACTERISTICS FROM A PROFESSIONAL STANDPOINT

A. Similarities

All of the IDEs mentioned have much more similarities than differences, because of the nature they were created for. Both NetBeans and Eclipse provide frameworks for desktop applications development. A number of features are provided which offer solutions for programmers for faster, better and smarter coding, from an integrated framework, to an action system, to update facilities, and much more besides. In both cases, a rich set of APIs are provided, accompanied by many tutorials, FAQs, and several books.

All of them are basically Java developing environments with long history of working on exclusively Java. The IDEs in this show the richness and the power of Java tools. They all have excellent support for coding and development but also strong support for refactoring, syntax control, code completion and debugging process. These IDEs are capable of handling thousands of code lines quick and accurate. They also enable deployment of projects directly and offer remote debugging from original development system. All of three environments use de facto standard module system, which is OSGi.

Important thing to emphasize is that both environments have cross-platform support. It is possible to have application running on Windows, Mac, Linux, Solaris and any other platform, as long as JVM (Java Virtual Machine) is installed.

B. Differences

In further research, InteliJ stands out as a non-open-source environment, which is unavailable for analysis from a student's standpoint. This environment is highly accepted with professionals, but has no academic and community benefit since it is not accepted in university circles and freelance programmers environment.

Basic difference between two main competitors, Eclipse and NetBeans, is their fundamental build idea: Eclipse is a plugin based IDE. Their functionalities come from plugins which are installed by individual programmer. Mobile application SDK's, Internet applications, and Architectural driven are developed separately using different plugins in the same environment. It can be assimilated to iPhone's functionalities: They both depend on individual user and its purpose. On the other hand, NetBeans is a tool based IDE. It incorporates many platforms using tooling support, making it less isolated.

Concerning Java family support, basically both of them are strong, but NetBeans has a stronger support when it comes to developing MVC based application.

NetBeans comes with in-built support for and SQL, MySQL and Oracle drivers, and gives strong database support. It has highly productive, few-clicks installation and connection, and does not imply high knowledge in database configuration and performance. Eclipse has JDBC driver support – but it demands more time and knowledge for configuration of this feature.

NetBeans uses Swing as UI toolkit. It is considered to be a better solution comparing to SWT used by Eclipse. The main reason for it is wealthy libraries made by users which are easy to integrate and offer diversity in application final look.

When considering GUI design, NetBeans has highly awarded Matisse builder with drag-and-drop capabilities and point-and-click features. Eclipse has much more simplified design, which is considered to be out of date, but also offers Matisse builder for a fee.

A feature specifically used by NetBeans Platform is its build system based on Ant. As a result, it is possible to use the command line to build NetBeans Platform applications and much more when connecting with Maven. When speaking of Maven, NetBeans can open any Maven project without conversion. NetBeans' Maven integration has a feature to install a non-maven artifact into local repository, unlike Eclipse which does not have this feature - there are only workarounds.

When talking about coding and productivity, the Eclipse's Java code formatter seems to be much more obvious that NetBeans'. Spell check is for many programmers prominent feature. Quick complete is an underused NetBeans feature, Snippets also. Eclipse has a "synchronize" view which displays differences between Server's original code and the local working copy as a tree view. NetBeans has a kind of synchronization view, but it displays the information as a table. NetBeans focuses on a smooth, integrated experience with the consequence on expense. The Profiler is fully integrated into the editor, but still is by quality behind Eclipse's profiler. At the end of this theme, it must be acknowledged to NetBeans that it has the ability to open projects in different directories

Enterprise tools include functions commonly used by larger businesses, such as modeling and reporting. The delivery mechanism for these tools highlights the difference in approach between these two IDEs. NetBeans tends to bundle, while Eclipse tends to make "platforms" available. Eclipse is much better when it comes to reporting: Eclipse's Business Intelligence and Reporting Tools (BIRT) is an extensive system for formatting and generating reports which will be hardly replaced with any other.

When it comes to UML modeling, NetBeans has a built-in modeling tool that supports UML. Code can be abstracted into a UML diagram, and UMLs can be converted to code. On the other side, Eclipse offers the Enterprise Modeling Framework (EMF), which is a platform for building tools, and the graphical editor framework (GEF) which aren't commonly used as much as UML.

To conclude, because all of the features already built-in, NetBeans takes much more time to load, and loading on the first instance is really slow in case of NetBeans IDE, unlike Eclipse, which is very simple to get started with.

IV.   ACADEMIC EXPERIENCE

A.   Students as academics and young professionals

Personal development of students as future professionals in coding, lead us to conducting a survey which will demonstrate experience of students in working with different environments. The main purpose of these environments for this focus group is ease of learning, focusing on important and basic concepts of programing in Java and realization of assignments in teams or individually. Though, from an academic stand point, students have built attitudes toward these environments by their professors, majority of them, as it will be shown in the survey results, already had had some professional experience and have made their own opinion on advantages of chosen environment.

Through research we conducted a survey on 80 students, 44 of them (55%) use Java frameworks for academic and professional purpose, and other 36 (45%) only for academic purpose.

Most common framework for these students is Eclipse, probably because it is used also on some courses on their University, especially on Java beginners' course. From our sample of 80 students, 42 use Eclipse (52.5%) as their preferred environment for programming in Java. In part where students were asked to specify reasons for picking chosen environment (multiple choice was allowed) for this group of students main reason for choosing Eclipse was simplicity (62%), then design (36%), GUI (33%) and speed (29%). Results show that plug-ins (17%) and modularity (7%) were not recognized as reasons for picking Eclipse environment, which confirms professional experience stated earlier. One part of questioned group (7%) highlighted that the use of Eclipse is imposed by Faculty. Several Eclipse users from the survey also for professional purpose suggested that this environment uses fewer resources to work. This group also mentioned better IntelliSense and shortcuts as one of the reasons for using Eclipse environment.

The second most commonly used Java environment for students of our faculty is NetBeans (38.75%). Ranking of reasons for this IDE is simplicity (61%), speed and GUI (39%), design (32%), modularity (29%) and plug-ins (23%). Considering it is also used on some courses on the Faculty, especially working with databases, students mentioned this functionality as reason to choose NetBeans as well. Students who use this environment not only for academic purposes, suggested IntelliSense, Javadoc, shortcuts, plug-ins, speed, GUI and better support for JavaEE applications.

The rest of examinees chosen IntelliJ IDEA (4 examined students), JDeveloper (2 students) and Android studio (1 student). The group who had chosen IntelliJ IDEA highlighted modularity, great integration with programming languages, frameworks and other development tools such as web servers (Tomcat, Jetty), build tools (Maven, Gradle), VCS etc.

The results show that design-connected, mostly relative features, such as design, GUI and speed are depending on the taste of the examinees, but features considering

specific projects (such as plug-ins , modularity and cross-platform integration) tend to give precedence to NetBeans, since it has covered it all by opinion of questioned students. On the other hand, students emphasize good sides of Eclipse in academic purposes, as its simplicity and design are a great start for Java beginners.

B. *Professors' standpoint as teachers and professionals*

In order to confirm students' academic-use preferences and to get an insight on a professors' standpoint, we conducted several interviews with our professors and assistant professors at Faculty of Organizational Sciences. All of them confirmed low interest for InteliJ since it is not free software and it is not suitable for massive use on faculties.

Most common features that give precedence to NetBeans are more stable, better integrated GUI which is commonly used by them in professional purposes and better editor for the interface; Great use of wizards which don't require background knowledge about the feature, which might be an obstacle in demonstrating knowledge during classes. They also emphasize use of NetBeans for different languages, such as PHP, which is not offered by Eclipse. Main characteristic that gives precedence to NetBeans, from a professional side is productivity and professional development of a programmer by using this environment. Interesting fact imposed by one of the assistant professors is that NetBeans has been written in Java, unlike Eclipse which originates from operating system.

On the other hand, Eclipse, by their opinion, has much more serious professional plug-ins and better development network, which is crucial in some points of professional engagement. As it was noticed before, all professors had a strong attitude about using Eclipse as a first environment, since it is the best environment for learning basic concepts of object-oriented programming and programming in general, but also it gives great support in debugging and writing clean code.

Their conclusion is that Eclipse is better environment for academic purposes and focused projects with pre-determined plug-ins and NetBeans is better for GUI-focused applications and general professional coding.

V. CONCLUSION

Looking back at all three aspects these environments were analyzed from, it can be concluded that InteliJ has strong influence on professional programming but it is

closed circle of users. Because of that, it can be considered to be premium environment available to minority of companies who know its' precedence and know how to, by using them, improve their business.

NetBeans and Eclipse have an infinite fight over customers but several characteristics made authors recommend NetBeans if a programmer's day-to-day coding differs drastically or if programmer's applications have dependency on graphical user interface written also in Java. Authors recommend Eclipse for academic purpose and professional coding which is highly focused, but also when working on technologically outdated machines.

Since they are both free software with strong networks, the future will show their development and future focuses.

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Estimating e-Commerce Revenues by Web-based Simulation and System Dynamics Approach

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Abstract – **The Internet has profoundly changed the nature of doing businesses worldwide. Since e-Commerce paradigm has radically prevailed in everyday shopping activities, calculating online revenue estimates has already become one of the most common questions regarding e-Commerce projects, especially the ones on the loom. Taking into account specific classes of e-Customers, the workload characterization of a given e-Commerce website, as well as the principles of the system thinking approach, the paper aims at describing the development of a Web-based simulation model, suitable for estimating the e-Commerce revenue across multiple operation profiles, i.e. working scenarios. The result of this research was the creation of a complete simulation model available online, which reflects the system dynamics logic, rather than the logic of conventional discrete-event simulation (DES) approach. Encompassing multiple adjustable input parameters, the model can be successfully utilized in making 'what-if'-like insights into plethora of business-oriented performance metrics for a given e-Commerce website. The project is also a great example of the power delivered by InsightMaker®, a free and Web-based tool, suitable for online development of any model following the systems thinking paradigm.**

I. INTRODUCTION

Since e-Commerce paradigm has radically prevailed in everyday shopping activities, e-Commerce companies started out their everlasting longing for attracting more e-Customers and for increasing their vital performance metrics, in order to generate more revenues. In business, revenue typically refers to the total amount of money received by the company for goods sold or services provided during a certain time. Among all other business-oriented metrics (e.g. Revenue per Visit, Revenue per Visitor, Conversion Rate, Average Order Value, Buy-to-Visit Ratio etc.), revenue is the ultimate one that reflects the wealth and current positioning of e-Commerce companies on the global market. Apart from selling goods or services, many online companies generate revenues from multiple, yet different income streams, such as advertising, subscription, transaction fees, or affiliate marketing, altogether known as 'revenue models'. However, the sales revenue remains the keystone of doing business online.

Realizing the gravity of estimating e-Commerce sales revenue, authors suggest a standardized way for its calculation. They suggest, with negligible differences, that

Revenue [$] can be assessed by using few business-oriented metrics, including the number of Visitors (daily, monthly …), the Conversion Rate [%], being a ratio between the number of Buyers and Visitors, and Average Order Value [$/order], as in (1) [1] [2] [3]. The product of *AOV* and *CR* is also known as Revenue per Visitor [$/visitor].

$$R\ [\$] = AOV\ [\$/\text{order}] \times CR\ [\%] \times V \qquad (1)$$

Estimating e-Commerce sales revenues according to (1) is quite straightforward, though somewhat disputable, since it approximates roughly the input variables, which yields a significant estimation error. Furthermore, (1) is purely deterministic by its nature, i.e. it does not include any stochastic parameters. Finally, (1) does not include any behavioral components specific to various e-Customers' classes, nor does it takes into account the workload characterization.

Having minded previously elaborated shortcomings of the standardized way, in this paper we propose a significantly different approach to estimating e-Commerce sales revenues, based on Web-based simulation, and using system dynamics logic. In particular, our aim is to develop a framework, i.e. a simulation model based on the workload characterization of a hypothetic e-Commerce website that will take into account not only various e-Customer classes, but also various operating profiles, i.e. working scenarios.

II. WEB-BASED SIMULATION

Until recently, technology stood on the way of achieving high levels of flexibility and business performance. Thanks to the emergence of the Web 2.0 paradigm and open standards, technology now gives an opportunity to all companies, including those that deal with e-Commerce, to become more innovative and to gain substantial competitive advantage. More and more, the Web is being considered an online environment suitable for providing both modeling and simulation tasks. The emerging new innovative and alternative approach to computer simulation, which strives to become *de facto* an adequate replacement of the traditional workstation-based computer simulation, has been named as a 'Web-based simulation' (WBS). Simply, WBS is an integration of the Web with the field of simulation. It assumes an invocation

of computer simulation services over the World Wide Web, specifically through a user's Web browser [4] [5] [6] [7]. WBS is currently becoming a quickly evolving area in computer science, which is of significant interest for both simulation researchers and simulation practitioners. Such great interest is a direct consequence of the successfulness of the Web 2.0 paradigm, and its associated technologies, e.g. HTML, HTTP, CGI, etc., as well as the great popularity of, and reliance upon, computer simulation, as being a problem-solving and decision-support system (DSS) approach. Therefore, WBS, as being an emerging area of exploration and application within the simulation community, has already been considered a state-of-the-art discipline, which is expected to proliferate and even prevail in the forthcoming years [6] [8] [9].

III.   THE SYSTEM DYNAMICS APPROACH AND INSIGHT MAKER®

System Dynamics (SD) modeling is a powerful method for exploring systems on an aggregate level. By 'aggregate', it is meant that SD models look at collections of objects, not the objects themselves. For instance, a SD model of e-Customers population would look at the population as a whole, not at the individual e-Customers. If compared to Discrete-Event Simulation (DES), System Dynamics uses a quite different approach. Contrary to DES, SD is essentially deterministic by nature. It models a system as a series of stocks and flows, whilst state changes are continuous, resembling a motion of a fluid, flowing through a system of 'reservoirs' or 'tanks', connected by 'pipes'.

SD models are visually constructed from a set of basic building blocks also known as 'primitives'. However, behind the scene, these primitives are 'converted' into differential equations that describe the modeled system mathematically. Since only the dynamics of extremely small and/or well-known systems could possibly be solved analytically, the dynamics of large and/or ill-known systems requires numerical simulation [10].

The key SD primitives are Stocks, Flows, Variables and Links.

- Stocks are graphically presented by rectangles; they store some kind of 'material', e.g. a population of e-Customers.

- Flows, graphically depicted by bolded solid lines with arrows, move the 'material' between stocks; they can be either inflows (inputs into stocks), or outflows (outputs from stocks), e.g. a flow of e-Customers' arrival in the online store.

- Variables are graphically portrayed by ovals; they can be dynamically calculated values that change over time (governed by an equation) or they can be constants (fixed values), e.g. e-Customer arrival rate.

- Links, graphically shown by dashed lines with arrows, show the transfer of information between the different primitives in the model. If two primitives are linked, they are related in some

way. Links are generally used in conjunction with variables to build mathematical expressions.

Because of its great flexibility, its ability to combine both qualitative and quantitative aspects of the modeled system, and its tendency to model and simulate the dynamics of a system at a higher, strategic level, SD has been applied in many fields. The aim is to gain a holistic insight into the dynamic behavior and interrelations among different parts of the complex system under study.

To demonstrate the usefulness of Web-based simulations being applied in estimating e-Commerce sales revenues, we revert to Stock-and-Flow simulations, which are constituent part of the SD paradigm: a methodology, as well as a mathematical modeling and simulation technique, suitable for framing, understanding, and discussing complex issues and problems.

Insight Maker® is an innovative, free-of-charge, Web 2.0-based, multi-user, general-purpose, online modeling and simulation environment, completely implemented in JavaScript, which promotes online sharing and collaborative working. It integrates three general modeling approaches, including: (1) system dynamics, (2) agent-based modeling, and (3) imperative programming in a unified modeling framework. The environment provides a GUI aimed at model construction, offering advanced features, such as model scripting and an optimization tool. Insight Maker® has been developed for several years, and has gained significant adoption. Currently it has almost 26,000 registered users [11].

To the best of our knowledge, it is the first, yet the one and only free-of-charge Web 2.0-based Internet service that can deliver a plethora of advanced features to its online users, including Causal Loop Diagrams, Rich Pictures Diagrams, Dialogue Mapping, Mind Mapping, as well as Stock & Flow simulation. All these can offer thorough insights into various aspects of a system's dynamics. By supporting agent-based scenarios, storytelling and sensitivity analysis, Insight Maker® exhibits a wide gamut of features that not only rival, but also, in many cases, outperform the traditional, commercially available simulation software packages.

IV.   WORKLOAD CHARACTERIZATION

The workload of a system can be defined as "the set of all inputs that the system receives from its environment during any given period of time", whilst workload characterization is "the process of precisely describing, in a qualitative and quantitative manner, the global workload of an e-business site" [12]. Since it is difficult to handle real workloads due to the large number of constituting elements, it is more practical to reduce and summarize the information needed to describe the workload. However, the choice of characteristics and parameters that will describe the workload depends solely on the purpose of the study, having minded the fact that the model needs to capture the most relevant characteristics of the real workload. This way, in order to reflect changes in the system and/or in the actual workload, it is possible to gain various insights into the system's behavior simply by changing its model parameters.

We have based the workload characterization of a hypothetic e-Commerce website on two fundamental premises: (1) e-Customers' online shopping behaviors mutually differ; (2) e-Customers access the e-Commerce website and invoke the specific e-Commerce functions in a rather unpredictable and stochastic manner [13].

The first premise reflects the qualitative aspects of workload characterization. Many studies have pointed out the fact that it is possible to distinguish among different classes of e-Customers, regarding their specific online shopping behaviors [14] [15]. Recently, the fields of behavioral economics, buyer psychology and neuroeconomics have been put in focus due to their great contribution in understanding why and how e-Customers make purchases, which are a proven route to successful marketing, as well as to producing conversions and revenues. By combining research methods from neuroscience, experimental and behavioral economics, psychiatry, statistics, as well as cognitive and social psychology, neuroeconomics is defined as "an interdisciplinary field that seeks to explain human decision making, the ability to process multiple alternatives and to follow a course of action" [16]. Previous research endeavors in this field reported the existence of three main/universal types of e-Customers, regardless of the type of industry, including (1) 'Tightwads', (2) 'Average Spenders', and (3) 'Spendthrifts' [17]. Moreover, the latest research findings claim that in any population of e-Customers, 'Tightwads' comprise 24%, 'Average Spenders' cover 61% and 'Spendthrifts' involve 15% [18] [19]. Based on these three classes of e-Customers, a discrete random variable that resembles the operating profile, along with its probability mass function (pmf), can be defined. The operating profile defines the mix constituted by various e-Customer classes: if k classes of e-Customers have been identified, (t_1, t_2, t_3, …, t_k), then each class can be associated a corresponding probability, drawn from the probability mass function vector (p_1, p_2, p_3, …, p_k), such that $\sum_{i=1}^{k} p_i = 1$. These probabilities are, in fact, a measure of the participation of each e-Customer class within the workload mix.

The second premise is related to the quantitative aspects of the workload characterization. The arrivals of e-Customers in an e-Commerce website can be mathematically described by a Poisson process, defined by the number of arrivals per unit time, i.e. the arrival rate λ [e-Customers/s]. The times elapsing between each consecutive arrival comprise an i.i.d. (independent and identically distributed) random variable, exponentially distributed. Since the Markov property of the exponential distribution holds for each particular moment, the expected (mean) time to the next arrival is a constant, given by $1/\lambda$. Moreover, let λ be the total arrival intensity of e-Customers belonging to different classes (t_1, t_2, t_3 …, t_k), which comprise the workload mix. If the probability of classes' presence in the workload mix is represented by the probability vector (p_1, p_2, p_3, …, p_k), where $\sum_{i=1}^{k} p_i = 1$, then the arrival intensity of e-Customers, belonging to each particular class t_i (i = 1, 2, 3, …, k), is given by the product $\lambda \times p_i$ (i = 1, 2, 3, …, k) [20].

V. THE WEB-BASED SIMULATION MODEL

The Web-based simulation model is completely done using Insight Maker®, and it is freely available for use at https://insightmaker.com/insight/34138/e-Commerce-Revenue-Estimator. It entirely incorporates the system dynamics approach. Due to its robustness, it can be logically divided into three parts (*A*, *B*, and *C*).

A. e-Customer classes and the operating profile

The first part of the simulation model is depicted on Fig. 1.
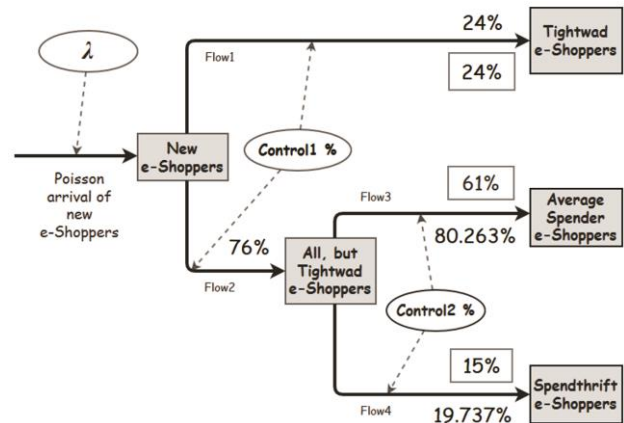
Figure 1.   The first part of the Insight Maker® simulation model

On Fig. 1, the flow entering the container 'New e-Shoppers' denotes the arrival of new e-Customers into the online shop, which is a Poisson process with intensity λ [e-Customers/s], described by the expression =RandPoisson([λ]). The intensity λ is an adjustable variable, linked to the input flow. At time t = 0, the container labeled 'New e-Shoppers' contains 0 (zero) e-Customers, although its initial quantity may be set to any positive integer. As simulation time elapses, the inflow causes filling the container 'New e-Shoppers' with intensity λ. The adjustable variable 'Control1 %', being initially set to 24 [%], defines the portion of the total number of e-Customers that belong to the 'Tightwad' class. These e-Customers, through the flow labeled 'Flow1', pour into the container named 'Tightwad e-Shoppers', in accordance with the following equation: =[New e-Shoppers]*[Control1 %]/100. The rest of e-Customers (i.e. 76%) through the flow 'Flow2' go into the container named 'All, but Tightwad e-Shoppers', according to the following equation: [New e-Shoppers]*(100−[Control1 %])/100. Now, identically, the adjustable variable 'Control2 %' separates the number of e-Customers that belong to the two other classes, by initially setting the flow of 'Average Spender' e-Customers to 80.263 [%] (out of 76%), which yields exactly 61%. The rest of e-Customers (19.737 [%] out of 76%, which yields exactly 15%) flow into the container labeled 'Spendthrift e-Shoppers'.

In this manner, the first part of the simulation model introduces the three e-Customer classes as discussed in the previous section, i.e. t_1 = 'Tightwad', t_2 = 'Average Spender', and t_3 = 'Spendthrift' e-Customers. The vector of corresponding initial probabilities (p_1 = 0.24, p_2 = 0.61,

$p_3 = 0.15$) defines the operating profile, i.e. the level of participation of each particular e-Customer class into the workload mix.

B. Logic and dynamics of online shopping sessions

Fig. 2 shows the second part of the simulation model: both the logic and the dynamics of 'Tightwad' e-Customers initiating online session, which is identical by its structure for the other two types of e-Customers.

The flow labeled 'Start Session - Tightwad', which is an output from the container labeled 'Tightwad e-Shoppers', represents the Poisson arrival of 'Tightwad' e-Customers into the online shop, controlled by the adjustable variable '$\lambda 1$'. This flow is an input to the container labeled 'Browse-Search 1', which contains the e-Customers who are currently browsing or searching for items. This container has three outflows, including 'Flow5' (those who have put something into their shopping carts), 'Flow6' (those who have terminated the session without putting anything in their shopping carts), and 'Flow7' (those who have continued to browse/search for items). 'Flow5' goes into the container labeled 'Put items in cart 1', 'Flow6' is directed towards container labeled 'Tightwad e-Shoppers', and 'Flow7' pours back into the same container from where it came out, represented by its 'ghost' primitive. Each of these outflows is controlled by a corresponding variable. The value of one of them ('Add to cart rate T %') is adjustable, the other one ('Terminate session rate T-1 %') is drawn from the Normal distribution $N(\mu, \sigma)$ with fixed values for its parameters that correspond to each particular type of e-Customer, and the third one ('Continue session rate T-1 %') complements the sum of previous ones to 100.

The similar logic has been applied with the container labeled 'Put items in cart 1'. There are three flows going out from this container, including 'Flow8' (those who have paid for the items already put in the shopping cart), 'Flow9' (those who have terminated their online session leaving the non-empty shopping cart unpaid), and 'Flow10' (those who have continued browsing or searching for other items). 'Flow8' goes into the container labeled 'Pay items in cart 1', 'Flow9' is directed towards container labeled 'Tightwad e-Shoppers', and 'Flow10' pours back into the container labeled 'Browse-Search 1'. Each of these outflows is controlled by a corresponding variable. The value of one of them ('Buy rate T %') is adjustable, the other one ('Terminate session rate T-2 %') is drawn from the Normal distribution $N(\mu, \sigma)$ with fixed values for its parameters that correspond to each particular type of e-Customer, and the third one ('Continue session rate T-2 %') complements the sum of previous ones to 100.

The container labeled 'Pay items in cart 1' has two outflows: one ('Flow11') is going back towards the container labeled 'Browse-Search 1', and the other one ('Flow12') is pouring back into the container labeled 'Tightwad e-Shoppers'. Both of them are controlled by two distinct variables. The value of the first of them ('Terminate session rate T-3 %') is drawn from the Normal distribution $N(\mu, \sigma)$ with fixed values for its parameters that correspond to each particular type of

e-Customer, whilst the second one ('Continue session rate T-3 %') complements the first one to 100.
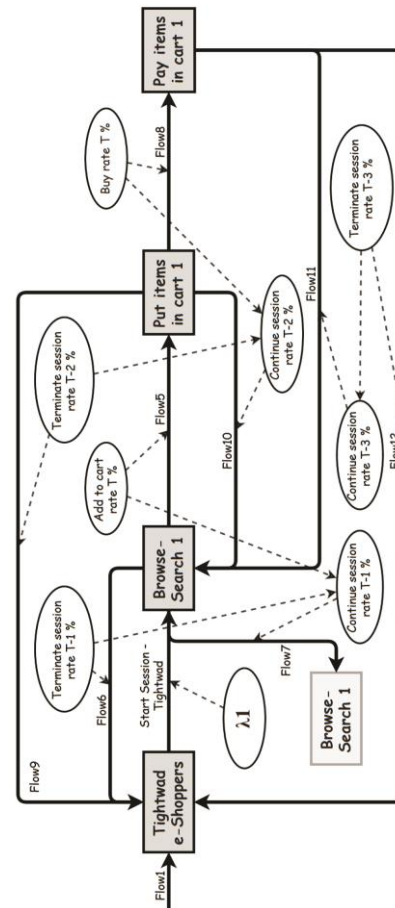
Figure 2. The second part of the Insight Maker® simulation model (a fragment that corresponds to 'Tightwad' e-Customers)

Table 1 contains the equations, as well as range values associated to the variables and flows presented in Fig. 2.

C. Estimating sales revenues for each e-Customer class and the total sales revenue

The third part of the simulation model, which corresponds solely to the class of 'Tightwad' e-Customers, is presented on Fig. 3. In each particular time instance t, the container labeled 'Pay items in cart 1' contains the fraction of those e-Customers who have paid for the items put in the shopping cart. Knowing this number (C_t), and assuming that there are M items in total available for selling, whose buying probabilities (i.e. relative buying frequencies) are b_i ($i = 1, 2, \ldots, M$) at selling prices pr_i ($i = 1, 2, \ldots, M$), the revenue R_t, gained at time instance t, can be estimated by (2).

Based on (2), which is used for calculating the value of the output variable 'Revenue - Tightwad', one can estimate the cumulative revenue (CR_T), up to the time T, according to (3). Just for testing purposes, our simulation model includes only three items, whose buying probabilities and selling prices are shown in Table 2.

On Fig. 3, the output variable 'Cumulative revenue - Tightwad' uses the following expression to estimate this value: =Sum(pastValues([Revenue - Tightwad])). For the

other two classes of e-Customers, cumulative revenues are estimated in an identical manner.

TABLE I.   FLOWS AND VARIABLE SETTINGS ('TIGHTWAD')

SD Primitive	Equation/Value associated
'Tightwad' e-Customers	
Variable: λ1	adjustable; Values: $0 \leq \lambda1 \leq 50$, step 0.1
Variable: Add to cart rate T %	adjustable; Values: 0% - 10%, step 0.1
Variable: Buy rate T %	adjustable: Values: 0.00% - 0.50%
Variable: Continue Variable: session rate T-1 %	=100–([Terminate session rate T-1 %]+[Add to cart rate T %])
Variable: Continue session rate T-2 %	=100– ([Terminate session rate T-2 %]+[Buy rate T %])
Variable: Continue session rate T-3 %	=100– [Terminate session rate T-3 %]
Variable: Terminate session rate T-1 %	=Abs(RandNormal(75, 8.33333))
Variable: Terminate session rate T-2 %	=Abs(RandNormal(75, 8.33333))
Variable: Terminate session rate T-3 %	=Abs(RandNormal(75, 8.33333))
Flow: Start Session - Tightwad	=RandPoisson([λ1])
Flow: Flow5	=[Browse-Search 1]*[Add to cart rate T %]/100
Flow: Flow6	=[Browse-Search 1]*[Terminate session rate T-1 %]/100
Flow: Flow7	=[Browse-Search 1]*[Continue session rate T-1 %]/100
Flow: Flow8	=[Put items in cart 1]*[Buy rate T %]/100
Flow: Flow9	=[Put items in cart 1]*[Terminate session rate T-2 %]/100
Flow: Flow10	=[Put items in cart 1]*[Continue session rate T-2 %]/100
Flow: Flow11	=[Pay items in cart 1]*[Continue session rate T-3 %]/100
Flow: Flow12	=[Pay items in cart 1]*[Terminate session rate T-3 %]/100
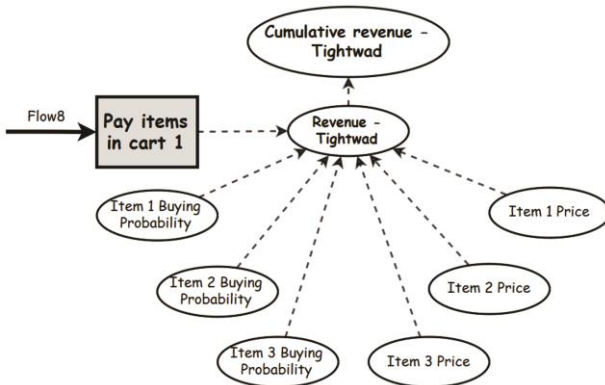
Figure 3.   The third part of the Insight Maker® simulation model (a fragment that corresponds to 'Tightwad' e-Customers)

$$R_t = c_t \times \sum_{i=1}^{M} b_i \times pr_i \qquad (2)$$

$$CR_T = \sum_{t=1}^{T} R_t \qquad (3)$$

TABLE II.   BUYING PROBABILITIES AND SELLING PRICES

Item #	Buying probability	Selling price
1	0.3	$6.00
2	0.1	$10.00
3	0.6	$2.00

Finally, Fig. 4 portrays the fragment of the simulation model, needed to estimate the total cumulative revenue, given the cumulative values that correspond to each particular e-Customer class.
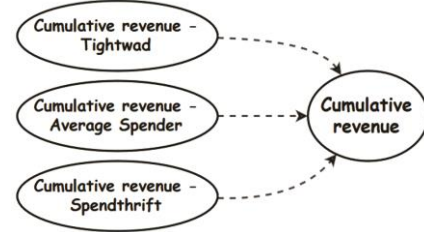
Figure 4.   The final part of the Insight Maker® simulation model

The output variable 'Cumulative revenue' is calculated using the following expression: =[Cumulative revenue - Tightwad] + [Cumulative revenue - Average Spender] + [Cumulative revenue - Spendthrift].

VI.   SIMULATION RESULTS

The simulation run took into account a time window of $T = 60$ [s]. It was accomplished according to the working parameters' values as shown in Table 3. Based on these settings, the estimated revenues for each particular e-Customer class are graphically shown on Fig. 5; the estimated cumulative revenues for each particular e-Customer class are graphically shown on Fig. 6, whilst the estimated total cumulative revenue is shown on Fig. 7.

TABLE III.   WORKING PARAMETERS SETTING

Variable	Value
Control1 %	24.000
Control2 %	80.263
λ	1.1
λ1	5.5
λ2	3.5
λ3	1.5
Buy rate T %	0.25
Buy rate AS %	1.50
Buy rate S %	5.00
Add to cart rate T %	5
Add to cart rate AS %	20
Add to cart rate S %	50
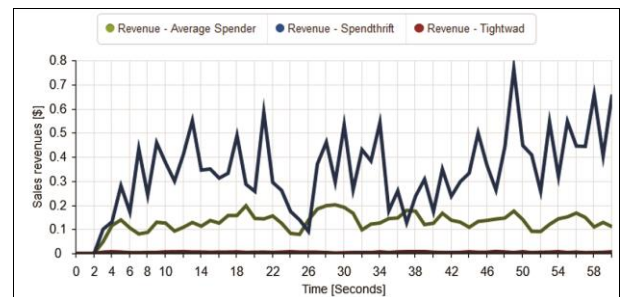
Figure 5.   Estimated revenues for each particular e-Customer class
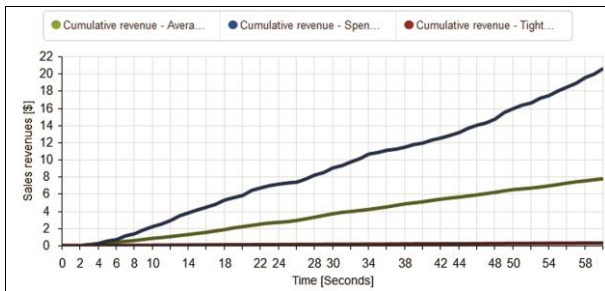
Figure 6. Estimated cumulative revenues for particular e-Customer classes ($T = 60$ [s])
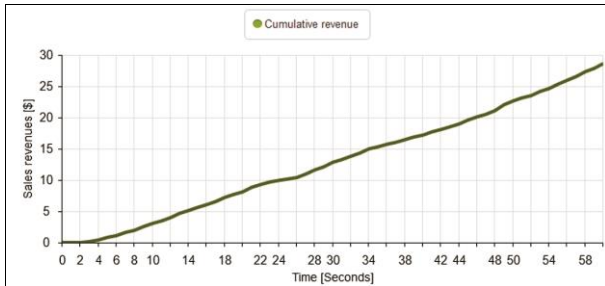
Figure 7. Estimated total cumulative sales revenue ($T = 60$ [s])

VII. CONCLUSION

In highly demanding online business environments, such as e-Commerce, estimating sales revenues is one of the crucial tasks that can be successfully accomplished using simulations. Web 2.0-based simulations, based on the system dynamics approach, can reveal new and significant insights into business processes, which will increase their effectiveness, performances and flexibility, thus creating an unprecedented competitive advantage for companies on a long term. In addition, Insight Maker® has proven to be a great innovative tool for mapping ideas by graphically visualizing them, and then, by converting maps into computational simulation models, to display specific behaviors and dynamics of the modeled system over time, as well as to carry out multiple scenario runs. However, the main drawback of the system dynamics approach vis-à-vis our resulting simulation model could possibly be the increased model complexity in the case if new e-Customer classes and/or new items are introduced.

ACKNOWLEDGMENT

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Application of E – Contactless Payment

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Abstract - **Today, in modern operating environment and new technological developments, the list of new payment methods is constantly expanding. At a time when more and more used electronic banking to realize numerous transactions and growth of e-products and e-services in the banking, one of the most modern payment methods that used in the world is the contactless payment.**

In this paper is analyzed the functioning of the contactless cards and comparative analysis of the use of the contactless payment in more countries.

I.   INTRODUCTION

Contactless payment is a payment with card so that all outlets where possible this method of payment, the payment can be realized by simply bringing the card to the sales terminal and the payment will be completed without having to enter a PIN or to put signature. The contactless technology is the simplest way for payment which is fast, simple and secure.

The contactless payment with bank cards is included for each transaction to a certain limit. The limit depends of the bank that issued contactless card. For each transaction above the limit, should be entered PIN or to put signature, such as a common practice when we pay with the payment card.

Contactless payment is possible in specially marked outlets that are equipped with this modern and safe technology. The number of such sales facilities in the world is already large, and constantly increasing. Contactless cards can be used wherever that is marked by symbols for contactless payment:

These instructions give you guidelines for typing camera-ready papers for the International Conference on Applied Internet and Information Technologies.

Figure 1. Symbols for contactless payment

Source: Komercijalna Banka AD Skopje,
http://www.kb.com.mk/Default.aspx?sel=2470&lang=2&uc=1

Increasingly traders in anticipation of the introduction of contactless payment terminals in their stores, in order to increase the speed and efficiency of their customers. The contactless cards are widely accepted by the numerous of merchants, restaurants, cafés, petrol stations, shops of every kind, supermarkets and many other places [3].

The contactless cards look just like existing bank cards, have security chip, can used on ATM, etc., but additionally equipped with contactless payment technology. Contactless payment cards contain an embedded chip and antenna that enables the consumer to simply hold the card close to a terminal to transfer the data necessary to make a payment. It is a card that work with NFC technology or short-range radio [4]. Older versions of contactless cards not containing contactless technology. The benefit of smart cards versus standard payment cards is that they can be widened to include other payment services.

The technology used by the contactless cards is with the highest level of safety. The unique encryption for each purchase will protect the customer's data for transaction. Established on special protective measures in case twice to get closer or touch the card to the terminal, guaranteeing that the transaction will be paid only once.

Contactless technology is based on global standards for safety. The MasterCard contactless cards use the name "PayPass", while the same technology in Visa contactless cards are called "PayWave".

A. Process for using the contactless card

The procedure for the use of contactless cards is realized in several steps, including (Figure 2) [5]:

Figure 2. Process for using the contactless card

Source: Bank of Scotland, https://www.bankofscotland.co.uk/bankaccounts/help/debit-card/contactless/

1. Note symbol

Contactless payment is made using contactless cards wherever you see the "PayPass", "PayWave" or "contactless" logos.

2. Bring the card to the terminal

When the terminal will be ready, Move closer or touch the card to the terminal enabled for contactless payments and that have symbol for contactless payment. No need to put or drag the card at POS terminal.

3. Transaction Processing

It should wait a few seconds while the terminal responds with a green light or a beep. You will not be asked to enter PIN or signature for the transaction.

4. Approval

Once approved, meaning that payment is made.

B. Benefits of using contactless technology

As any e-product or e-service, and contactless payment has its advantages and disadvantages. The following figure summarizes the advantages offered by the use of contactless payment [9].

A few year ago, card companies began piloting contactless payment systems in retail operations where speed and convenience are crucial [2].

As a positive aspect of using a contactless-payment, can be summarized as follows including (Figure 3) [1]:
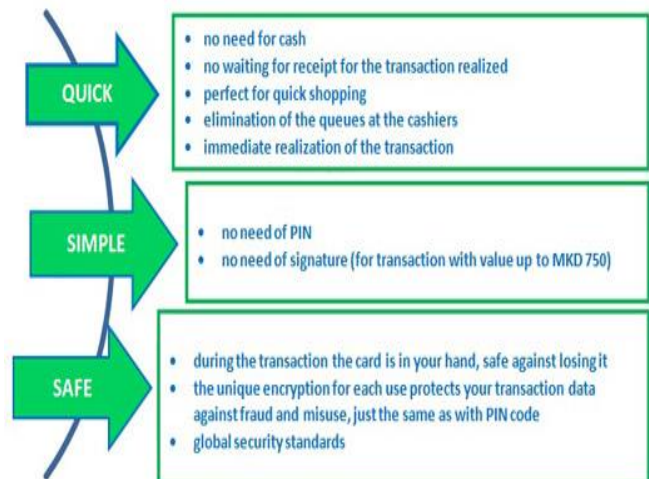
Figure 3. Benefits of using contactless technology

Source: Komercijalna Banka AD Skopje

http://www.kb.com.mk/Default.aspx?sel=2470&lang=2&uc=1

Quickly and easily - you will no longer find in a situation to search and handling cash and wait account for the realized transaction. This payment method is perfect for small purchases and helps to cut lines before coffers because the entire transaction takes just a few seconds, leaving more time to fulfill other obligations. Move closer or simply tap the contactless card to the terminal for contactless payments and the transaction will be executed at the same moment.

Easy to use - With a simple touch, without the need for entering a PIN or signing the realized transaction up to limit, the transaction will be easily realized.

Safe - The card remains in your hands during the transaction, and protects against fraud and abuse in the same way as when you are protected in the payments using the PIN and the existence of the chip cards.

However, despite numerous advantages, there are some restrictions on the use of e-products and services in the banking, and thus and e-contactless payment. These restrictions refer mainly to the need for certain costs for the physical setting and maintenance of the new ICT (websites, hardware, software programs), there are new costs associated with building customer confidence and reduce risks and etc.

However, the advantages of using a contactless-payment outweigh these restrictions.

C .Contactless payment in different countries

The contactless payment becomes a new trend in the Republic of Macedonia. From a total of fifteen banks that are part of the macedonian banking system, only two banks have introduced contactless payment as a bank product.

In 2013 Halkbank AD Skopje became the first market leader in the number of contactless terminals installed [12], and this year, contactless payment method was introduced and included in the cards of Komercijalna Banka AD Skopje.

In the Czech Republic 25% of transactions with MasterCard and Maestro are taking contactless. A similar trend has in Poland (33%), Hungary (18%) and Slovakia (17%). According to data published by the Association of Publishers of cards in the United Kingdom, consumption with contactless cards has tripled in size and in 2014 reached a record amount of 2.32 billion pounds [11].

Great influence in the spread of contactless payment has public transport. In London million users have an easier way of payment since introduce the possibility of contactless payment. Users of the subway in Saint Petersburg also can run with contactless payment.

Among Europeans, contactless payment is a significant trend, and in the region, Serbia is a leader in the use[11]. There from July all terminals will have the famous "PayPass" tag, that will enable contactless payment with Master card.In the last quarter of 2014 the number of contactless transactions increased by 174% compared to the same quarter last year, and the number of transactions per user grew by 20%. Given that contactless payment is possible more than three million sales worldwide, which is a growth of 56% compared to the previous year, the payment with contactless cards, mobile phones or other devices is more accessible than ever [11].

According to research by Deutsche Bank, is expected by 2020, migration to electronic banking to reach 60% of the population of the EU. Also on the agenda is to 2020 to invest 2 billion euros in the IT sector, and in 2015 to increase the regular use of the internet to 75%, which would have halved the proportion of 30 to 15% of the population that never using the Internet [7]. All new terminals for payment cards will have an option for contactless payment, mass banks began to issue these cards. The speed of recovery, practically without the card out of the wallet and without the need for entering the pin makes the citizens require banks to issue cards with this option.

In the future, as contactless becomes the norm, paying for goods will become quicker and simpler.

Worldwide, four in 10 new smart payment cards were contactless-enabled in 2014, a 35% increase on the year before.

Yet countries are moving to contactless at varying speeds. Differences in regional consumer attitudes, culture and infrastructure maturity all have an influence on the rate of adoption [6].

So how does the contactless experience differ across countries worldwide? (Figure 4)

Figure 4. Contactless payment around the world

Source: http://www.home.barclaycard/news/contactless-payments-around-the-world.html

Two thirds of Australians are now aware they own a contactless payment card and 53% have made a contactless transaction, research released by RFi Group has revealed, taking the country to the top of a leaderboard for both contactless awareness and usage rates. (Figure 5)
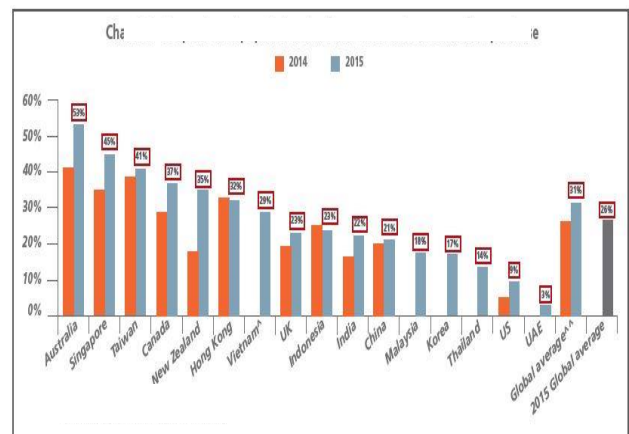
Figure 5. Proportion of population that ever made a contactless purchase

Source: http://www.nfcworld.com/2015/05/13/335191/australia-leads-the-way-for-contactless-ownership-and-usage/

The 'Global Payments Evaluation Study', based on 32,000 respondents in 16 countries, found Singapore to be the second largest market with 54% owning a contactless card and 45% having made a purchase using one. Taiwan came in third place, with 41% of its population now having used their contactless card to pay, and 37% of Canadians have also paid using contactless, compared to 29% a year previously. New Zealand registered the highest growth in contactless card ownership and usage compared to 2014, reaching 52% from 34% and 35% from 18% respectively. The US is currently the western country with the lowest penetration, with just 14% of Americans owning a contactless card, up from about 10% in 2014, and 9% have used their contactless cards to make a payment [10].

From "MasterCard", company that offers this type of contactless cards say that contactless payment will be standard for European merchants who accept Masetrcard and Maestro cards. Existing POS-terminals will be replaced no later than the beginning of 2020, while new terminals that will be introduced on January 1, 2016, must be under the new standard [8].

II. CONCLUSION

Increased banking competition requires banks to use more sophisticated technologies in order increase efficient productivity and profitability of operations, and reduce risks. Given that there is no accurate statistics that can measure the development and participation of contactless payment in the banking, there is still a dilemma whether ICT will enable banks to simplify their business process. Technology changes lead to changes in capital and labor increases capital productivity, which enables growth and development. E-contactless payment as a new product in banking will allow banks that first implement to be leaders and first users of the benefits of ICT in that domain. If we know worldwide growing trend of applying mobile and wireless communication, it can be concluded that innovative solutions in the Macedonian banking have pre conditions for further growth and even greater development.

The key factors for contactless payments are security, convenience and speed, but for the skeptics there are significant hurdles in the form of understanding and need which have to be overcome.

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The management of temporal data in relational databases

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Abstract - Possession of relevant data represents one of the key success factors of an organization's business. In this respect, there are theoretical grounds that highlight the role of databases, as data warehouses, in the successful operating performance of the organization. Bearing in mind the constant changing of data caused by turbulent business conditions, traditional database management systems do not fully meet the needs of the organization. The reason for this lies in the fact that the given systems contain only up-to-date information. They do not hold information about data changes that have taken place during a specific period. The solution to this problem lies in the temporal data support or temporal databases. These systems were developed for the purpose of monitoring the history of data changes and in this way, certain monitoring operations are performed. This paper points out the specificity and significance of temporal data support in relational databases. Temporal data support was implemented using the SQL: 2011 Standard. The advantages and specific application of SQL: 2011 Standard are shown by comparing the execution of DML statements (insert, update and delete) in tables with and without temporal data support.

I. INTRODUCTION

Time represents a very important business aspect of every organization. This is helped up by the fact that over the time there is a change in business data, thus different users and applications have different requirements for accessing data in different points in time. Changes in business data can be reflected through the addition of new data into the database or by updating the existing data. Such changes of data are viewed as a modification of old data that become out-of-date and they are deleted from the database. Deleting data from the database leads to a loss of certain information about the previous operation of the organization. For some business analysis, it is sufficient to possess up-to-date data values, while for other types of analysis it is necessary to access previous versions of the data. Traditional Database Management Systems (DBMS) do not constitute an adequate basis for carrying out such analysis since they only contain stored data related to the current operations of the organization. To be precise, they reflect the state of the organization at a given point in time. These systems do not monitor the changes in data that have happened in the past or will happen in the future, however. To overcome this problem, certain functions of time can be used, namely temporal data support, since it allows you to store different states of data and databases. Data stored in the DBMS, which supports functions of time, differs from the traditional database in such a way that it contains a period of time that indicates when

information is valid, as well as all previous data values. Data, which reflects the changing characteristics of an object in a database for a specified period, is usually called temporal data [7].

A first step towards a temporal database is to timestamp the data. Timestamps može biti predstavljen kao vremenska tačka, vremenski intervali ili pak set vremenskih intervala. Timestamps can be portrayed as a point in time, time intervals or a set of time intervals. For easier understanding of the concept of time support, the example of changes in employee salaries can be given. In traditional DMBS only the current wages are found. However, there is in fact a need to monitor changes in the level of earnings of employees over time. It should not be forgotten that the amount of earnings could be defined for a future period as well. From this point of view, without temporal data support, it would be very difficult to implement. Therefore, it is concluded that the existence of temporal data support is very important in the relational data model. Of course, there are a large number of applications for which the temporal data support is of great importance. For example, financial applications, credit applications, personnel management, geographic information systems, inventory control, reservation systems and alike. DBMS with temporal data support can be positioned so as to save any changes that occur to certain data, and to save each version of the observed data. This function can be found in literature under the term data versioning. Also, it is necessary to mention that with databases which have time support it is easier to implement data auditing for the purpose of ensuring data integrity.

Temporal data support has been developed and implemented over the years. There have been more and less successful solutions, however, with the development of SQL: 2011 standard it can be said that the functionality of temporal data support has reached a satisfactory level. Many DBMS have some kind of temporal support, but only few can boast implementation in accordance with SQL:2011 Standard and there are plenty of application programs that use hand-coded temporal logic. In this paper we want to compare the convenient and contemporary way of providing temporal support: hand-coded vs. built-in temporal data logic. For this study, we use last generation DBMSs of well-known commercial DBMS providers which claim that they offer SQL:2011 compliant built-in temporal data logic: IBM DB2 10.

II. METHODOLOGY

In-depth analysis of scientific papers written on the subject of temporal data support was carried out for the purpose of this research work. The papers were searched for in Ebsco, ScienceDirect and Emerald databases. The following requirements were set during the search of databases: that scientific papers were written in English, that they were reviewed positively, that they were presented in scientific conferences or published in academic journals. The papers that were analyzed contained in their abstract or keywords the following terms: „SQL:2011 Standard", „temporal data support" and „data versioning". Also, strings such as „time-oriented data", „time-varying data", „time-dependent data" were used in the search. These topics were found in 34 scientific papers. After that, those papers were selected based on the requirement that the scientific paper should contain information about issues relating primarily to SQL:2011 Standard. Ten scientific papers were selected based on that requirement and they were included in the further process of analysis. The process of selection of scientific papers is presented in Figure 1.

SQL: 2011 Standard   Temporal Data Support   Data Versioning
        15   13   6

Number of references=34

Title and abstract review

Exclusion criteria

Rejection=24

10 Reviewed articles
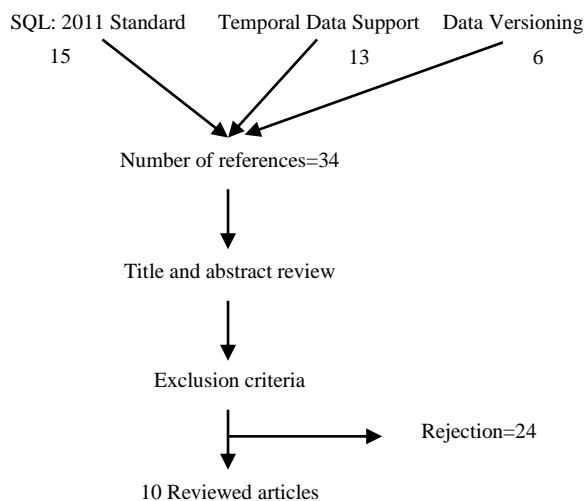
Figure 1. Selection of papers relevant to this research

III. THEORETICAL BACKGROUND

Storage and manipulation of temporal data has been the subject of research for almost 40 years. Since the late 1970s when the need for changes in data memory was first recognized and up to this day, numerous models and query languages within different DBMS have been developed and implemented. Ref. [2] has made significant progress in regards to the terminology of temporal data and temporal databases. Three different types of time have been defined (temporal dimensions): transaction time, valid time and user-defined time. Transaction time (or system time) is used to automatically record all the changes that are made to the data in the database. Valid Time (business or application time) indicates the time period during which the data were, are or will be valid in relation to real time (for example, the period for which the new employee's salary will be valid). User-defined time is the time designed to meet the specific needs of users (for example, the time when the decision to change the amount of the employee's salary was made). The latest version of

the object (data) is always saved in tables, while data about the changes that the given object has undergone are stored in historical tables [3]. Ref. [4] suggests a model of temporal tables which contain time constraints. Various authors have proposed temporal models and they differ significantly in terms of semantics and syntax. For many years, an adequate solution to the question of how temporal functions are to be implemented in relational database models did not exist. Most often, ad-hoc extensions of the existing query languages were developed, for example, TKUEL, various temporal extensions of SQL: TSQL2, SQL3 [1]. Various members of the temporal database research community have worked to transfer some of the constructs and insights of TSQL2 into SQL3. The first step was to propose a new part to SQL3, termed SQL/Temporal. This new part was accepted at the Ottawa meeting in January, 1995 as Part 7 of the SQL3 specification. A modification of TSQL2's period data type is included in that part. Discussions then commenced on adding valid-time and transaction-time support to SQL/Temporal. Two change proposals, ANSI-96-501 and ANSI-96-502, were unanimously accepted by ANSI and forwarded to ISO in early 1997 [5,6]. Due to disagreements within the ISO committee, the project responsible for temporal support was canceled in 2001. However, concepts and constructs from SQL/Temporal were subsequently included in the SQL:2011 Standard and have been implemented in IBM DB2, MarkLogic Server, Oracle, SAP HANA, and Teradata Database; other products have included temporal support. These ideas have also made their way into design patterns for things that change with time. After a series of change proposals that proposed new constructs for SQL/Temporal, the first was accepted in July, 1995, concerned the period data type. Period predicates are as follows in SQL/Temporal:

- *overlaps* is applicable to pairs of PERIOD values, too;

- *precedes*/*succeeds* stand for before and before-1, resp.;

- p *meets* q;

- p *contains* q.

The most important extension to „ordinary" SQL temporal support is to allow tables to be specified as valid time and/or transaction time tables already at creation time. All timestamp columns are automatically created and maintained (i.e.,hidden) and have period values for a bitemporal table [11].

Table 1 shows the comparison of terminology for data versioning within the SQL/Temporal and SQL:2011 Standard.

SQL/Temporal	SQL:2011
Valid time table	Application time period table
Transaction time table	System-versioned table
Bitemporal table	System-versioned application time period table

SQL/Temporal	SQL:2011
Timestamping	Versioning

SQL/Temporal	SQL:2011
Valid time	Application time
Transaction time	System time

IV.   RESULTS

The previous sections of the paper show the role and the genesis of the development of SQL: 2011 Standard. In this section, we will show it in the case of monitoring employees' wages. Table 2 shows the create table commands for tables without temporal support (left column), and then for the table with temporal support (right column). The T_employees table is the corresponding table with the built-in temporal logic support. Hereinafter, the name Employees will be used for the non-temporal table, while for the temporal table the name T_Employees will be used.

TABLE II.   TABLE 2: CREATE TABLE STATEMENT FOR NON-TEMPORAL AND TEMPORAL TABLE

Non - temproal Table	Temporal Table
CREATE TABLE Employees (EmpId INT NOT NULL, EmpName CHAR(20) NOT NULL, EmpSalary INT NOT NULL, EmpStart DATE NOT NULL, EmpEnd DATE NOT NULL, PRIMARY KEY (EmpId, EmpStart), CHECK EmpStart<EmpEnd);	CREATE TABLE T_Employees (EmpId INT NOT NULL, EmpName CHAR(20) NOT NULL, EmpSalary INT NOT NULL, EmpStart DATE NOT NULL, EmpEnd DATE NOT NULL, PERIOD EmpTime (EmpStart, EmpEnd), PRIMARY KEY (EmpId, EmpTime WITHOUT OVERLAPS));

Table Employees has to be hand-coded in order to preserve data integrity. It is necessary to introduce a trigger that will take into account the limitation of the primary key. More specifically, prior to inserting tuples, it must be checked whether there is a period overlap for the employee for whom the new amount of wages are being inserted with some existing period in the table. In addition to the primary key constraints, there are considerable differences in the DML commands. In the following section, we will present the differences in insert, update and delete DML statements executed in the above tables.

A. *INSERT* statement

Example1.
INSERT INTO Employees VALUES (100, 'Adam',50000, DATE '2015-01-01', DATE '2015-06-01');

INSERT INTO T_Employees VALUES (100, 'Adam',50000, DATE '2015-01-01', DATE '2015-06-01');

On an insertion, in both cases, the user has to provide the start and end time of the period for each row, while time values can be either in the past, current, or in the future. Time values must comply with constraints (start and end not null, start < end, no overlaps). The trigger will check the validity of the overlap period in the EMPLOYEES table, while in case of the table of T_Employees, it is systematically resolved due to the existence of temporal support.

B. DELETE *statement*

Example2.
DELETE FROM Employees WHERE EmpId = 100;

DELETE FROM T_Employees
FOR PORTION OF EmpTime FROM DATE '2015-02-15' TO DATE '2015-04-15' WHERE EmpId = 100;

The rows can be deleted with normal syntax (table Employees). All tuples that satisfy the condition will be deleted. Deletion with using the *for portion of* clause (table T_Employees) would not delete all tuples. This clause is a new temporal extension of the *delete* and *update* statements and allows you to cancel the business (application logic) validity of the data for a given time interval. The effect of a *delete* statement with *for portion of* clause varies depending on the relationship of the specified delete range and the existing application time period listed in row.

Let us begin from the assumption that for the existing tuple (tuple) in T_Employees table the following period of validity was defined as: EmpStart - 2015-01-01, EmpEnd - 2015-06-01. With respect to the entered values for the period of validity in the for portion of clause, the data in the table will change as follows:

- 2014-12-01 - 2015-03-01 – the existing tuple is deleted and a tuple which will have the following values is inserted for EmpStart and EmpEnd respectively: 2015-03-01 - 2015-06-01.

- 2015-05-01 - 2015-09-01 - the existing tuple is deleted and a tuple which will have the following values is inserted for EmpStart and EmpEnd respectively: 2015-01-01 - 2015-05-01.

- 2014-12-01 - 2015-09-01 – the existing tuple will be deleted.

- 2015-03-01 - 2015-04-01 – the existing tuple will be deleted and two new tuples will be inserted: the first will for EmpStart and EmpEnd have the values of 2015-01-01 - 2015-03-01, while the second will have the following values: 2015-04-01 - 2015-06-01.

C. *UPDATE* statement

UPDATE statement of Empoyees table must comply with integrity constraints (start and end not null, start < end, no overlaps). For an UPDATE od table T_Employees with *for portion of* clause there can be multiple types of existing time slices for an update range.

Let us start with the same assumptions as in the delete statement. In this case, the data will be updated as follows:

- 2014-12-01 - 2015-03-01– the existing tuple will be updated and will have the following values for EmpStart and EmpEnd respectively: 2015-01-01 - 2015-03-01. In addition, a new tuple, which will have the following validity period, will be inserted: 2015-03-01 - 2015-06-01.

- 2015-05-01 - 2015-09-01 - the existing tuple will be updated and will have the following values for EmpStart and EmpEnd respectively: 2015-05-01 - 2015-06-01. Also, a new tuple which will have the following validity period will be inserted: 2015-01-01 - 2015-05-01. ILI : 2015-09-01- NULL

- 2014-12-01 - 2015-09-01 – the existing tuple will be updated so that, for the period of validity, it has the values which are stated in the terms of the query (for portion of clause).

- 2015-03-01 - 2015-04-01 – the existing tuple will be updated so that, for the period of validity, it has the values which are stated in the terms of the query (for portion of clause). In addition, two new tuples will be inserted: the first will for EmpStart and EmpEnd have the values of 2015-01-01 - 2015-03-01, while the second will have the following values: 2015-04-01 - 2015-06-01.

The SQL:2011 Standard has adopted a model, where a time period represents all time granules starting from and including the start time, and ending with the last time granule before the end time (so called closed-open period model). Also, for each row in a table, the end time of a period must be greater that its start time. The standard introduces three different forms of tables: application-time period tables, system-versioned tables and bitemporal tables [8,9]. An application-time period table captures time periods during which data are valid in the real world. For this reason, the user is responsible for setting the start and end times of each time-variant attribute. Also, the user modifies the validity periods of rows, when an error is detected. Generally, the valid time support is provided by these tables. One of main requirements for system-versioning table is that any modification of rows has to automatically preserve the old state of these rows before executing the *update* or *delete* statement. By specifying a table with system-versioning, the user tells the system to automatically capture changes made to the state of table's rows and, at the same time to memorize the old state of the same rows. Therefore, the time period of a row in a system-versioning table begins at the time in which the row was inserted into the table and ends when the row was deleted or updated..

TABLE III.   TABLE 2: THE SEMANTICS OF DML STATEMENTS FOR NON-TEMPORAL AND TEMPORAL LOGIC TABLES

	Non temporal SQL	SQL Temporal (temporal extensions of SQL)
INSERT (one row)	Inserts a new object of the observed class	Inserts a new version of an object (if it is a first version an object it means a new object too)
UPDATE (one row)	Updates an object data by replacing outdated values with new ones	Updates an objects' version usually by splitting existing rows.
DELETE (one row)	Deletes the object from the table	Deletes an objects' version or splits an objects' version in two versions or changes an objects' version application time by shortening it.

V.   CONCLUSION

In database systems, which do not support built-in temporal logic, users have to implement this functionality in their application code. The SQL:2011 Standard with its specification of temporal data and databases with the implementation of the same support valid and transaction time as well as bitemporal data, thereby dramatically simplifying the code that has to be written and also shortening the time that must be used for execution of the code. Work with temporal data has become easier due to the functionality brought by the SQL: 2011 Standard. Built-in support allows automatic maintenance of the history of changes in object database. The need to manually encode tracking history in terms of the creation of triggers and procedures is eliminated. In addition, a consistent approach to managing temporal data reduces the complexity of queries and promotes an improved analysis of events over time. All this is confirmed by the analysis conducted by the IBM organization. IBM has carried out an internal study with the aim of comparing the query execution for manipulation of data with and without temporal support in the DB2 environment. All the tests were done in Linux, Unix and Windows platforms. In the cited study, it was concluded that relational databases with implemented temporal support operated much more efficiently and contributed to the increased performance of databases [10]. Firstly, there is a decrease in coding, then the time of data access is reduced; the execution of queries (Querying) is accelerated in comparison to inquiries that due to lack of temporal support trigger the execution of procedural mechanisms and in the end, the semantics of queries with temporal data support are simplified.

The future research can be lead to point out the differences between temporal data support of three major DBMS platforms (IBM/DB2 / Oracle / SQL Server 2016) with special emphasis on their compliance with the SQL:2011 temporal data specification. Also, to compare the performance of temporal data management in the cases of hand-coded and built-in temporal data logic.

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Smart Drinking Glass

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Abstract – **Water is a main building element of the human body. Decreased intake can cause headache, nausea and other long-term problems. One of the causes of hangover is dehydration, drinking enough makes us feel better. Some research shows that sufficient water intake reduces the occurrence of headache and we do not have to take any painkillers. People in the first world have access almost everywhere to clean drinking water. However, our poll showed that even though they are able, they do not drink enough. To solve this problem, we came up with the idea of The Cup, which is a smart drinking glass. It is the combination of a hardware, the client applications and the cloud service. The hardware is in connection with the cloud, the client applications are kept in sync with the cloud, too.**

The client applications show the user's progress through the day and notifies them if they have to drink. Unlike some other solutions, the required water level is computed by taking personal data, like gender and weight, the neural network in the cloud also checks current weather and if the user smokes or does some sport. During the water intake, the software remembers the current state and in specified intervals, it synchronizes with the cloud. Once the system is synced, the it can make predictions based on the user's previous water intake times, thus their biorhythm.

I. INTRODUCTION

In every part of the human body, water is presen (Figure 1.). It makes up roughly two thirds of the body, depending on the age, weight and other parameters. Every organ needs water for their work, makes the exchange of materials possible and helps the body clean toxic materials. It also cools the body (sweat). Many people misunderstand thirst, as the first sign of dehydration. In fact, when thirst appears, the body is already mildly dehydrated. For this reason, people need to drink water in regulare intervals, before, during and after doing sport. [1]

Recently, more and more mediums promote water drinking sufficient amount of water (Figure 2.). Many lifestyle related magazines and websites publish articles on this topic. Research shows that these articles are correct, many sicknesses can be avoided by drinking enough, like headache and problems with critical body functions. Hangover is also caused by dehydration, among other things. Proper water intake should also help reduce the body weight and fight against the above mentioned causes.

Figure 2. Required water in ml per each kilogram

However, people who could potentially drink enough do not do so for various reasons. [2]

One of these reasons is that keeping track of the water we drank is boring and easy to forget. After some glasses, people simply forget to note the quantity, even if a water tracking software is used. The team tested different kinds of applications of this kind and they all failed with the above-mentioned problem, we forgot that we are tracking something.

Research shows that mildly dehydrated drivers make twice as many mistakes than properly hydrated ones. In the research, they tested them with only 25ml of allowed water intake per hour. The results were comparable to those, who drive with the blood alcohol content of 0.08%, which is the legal driving limit in the UK. It mentions that people are surprised in many cases that hydration is so important and drivers should be encouraged to drink more. 68% of the

Figure 1. Water and the Human body

vehicle accidents in the UK are caused by driver errors, and even mild dehydration can cause reduced short-term memory, headache and fatigue and drop in alertness and concentration. If a person loses two percent of their weight due to dehydration, it can decrease mental functioning. [3] [4]

II. CONCEPT

The concept is to use the now actual healthy lifestyle and smart devices trends, which is expanding more than ever before. In addition, we want to help people drink more when water is available.

In the developed countries, where obtaining water is not a problem, people almost definitely do not drink enough of it. Insufficient water intake may cause headache and nausea; hangover is caused mostly by dehydration. Some research shows that instead of painkillers, only by drinking enough these could be solved.

The Cup consists of the client applications, the device and the cloud service. First, the device communicates with the client applications using Bluetooth, and then the data is synced with the cloud.

The device itself is a basic plastic, glass or metal bottle, plus the electronics and the battery.

TThe API is based on REST technology, the client sends requests to the cloud, and the cloud responds with the corresponding JSON reply. The API will be opened after a certain time to allow creative ideas to appear which would use The Cup.

The client applications show the user's progress through the day and notifies them if they have to drink. Unlike some other solutions, the required water level is computed by taking personal data, like gender and weight, the neural network in the cloud also checks current weather and if the user smokes or does some sport. During the water intake, the software remembers the current state and in specified intervals, it synchronizes with the cloud. Once the system is synced, the it can make predictions based on the user's previous water intake times, thus their biorhythm.

III. TARGET AUDIENCE

The target audience is anyone, who:

A. *Has access to clean drinking water, or*

  a. has access to unclean water but chemically or in other way can purify it and make it safe to drink

  b. has access to some sort of fluid which requires less water to break down than it contains

B. *has access to internet*

C. *can afford the device*

If one matches the above criteria, and has the will to live healthier they are a potential customer.

IV. SOFTWARE

The Application is a very simple dashboard type application, which displays the basic hydration level, a glance view of the intake history (when did the user drink less than recommended), detailed statistics about the water consumption and notifications.

The main page (Figure 3.) is the first thing the user sees. This part of the application is designed to contain all the most important information about the hardware, the water consumption level, how much the user drank during the day and basic history about the previous days' hydration levels.

The statistics page provides detailed data about the consumption habits, detailed review of device usage in case of more devices, the hardware's battery level, data about the time of the last synchronization, the last time the user drank, the total water intake for the current day and more. It is very likely that the user will not spend much time here.

The third page of the application is the profile page. This page contains all the data about the user. These include their weight, gender, age. This will be extended later with more variables for more precise requirement tracking.

The software communicates with the device using Bluetooth technology. By default, in every five minutes the App sends the „SYNC" signal to the device, The Cup
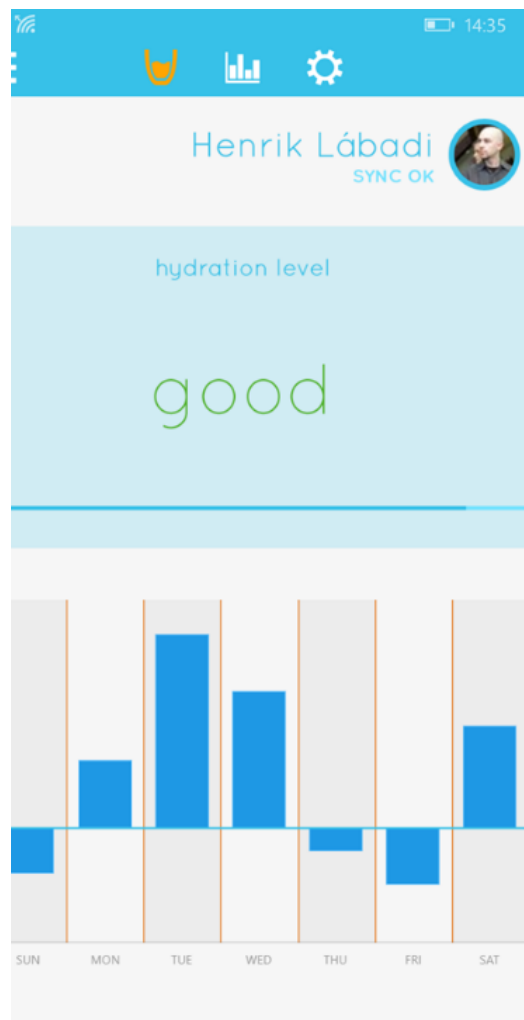

Figure 3. Software

responds to it with the total amount of water flow through the sensor during that time. The app then processes the data and stores them in the Roaming Storage area of the Phone's storage. This is important, because it makes possible that the phone app and the Windows 8.1 app are in sync. This technology involves the Azure cloud as backend.

V. HARDWARE

The device consists of three main parts (Figure 4.):

A. A water bottle

a. A common or custom built water bottle.

B. Water flow sensor

a. Attached to the bottle

b. Measures the amount of water which flows *through it*

c. Takes place between the top and the bottom straws, directly under the top cover

C. Main module

a. Power source

b. A module to process and transmit the data

Figure 4. Hardware

The hardware was designed to be simple as possible. We used a very simple water bottle, attached a water flow sensor to it, and installed the Arduino based main module to the top of the device. The main module consists of an Arduino microcontroller and a Bluetooth module. As this is a prototype, we did not isolate the electronic, so one must handle it with caution. This will be solved in the next prototype.

VI. EARLY FEEDBACK

As it is written above, the way the project communicates with the cloud is not decided yet. It is mainly because we initially planned the Bluetooth version like it is in smartwatches and fitness trackers. Then we showed the plans to a group of non-tech people and they gave rather interesting feedback. They don't have smartphones neither have the intention to buy one. But they do have the intention to drink water regularly and become healthier. Because of this reason, we are discussing the wifi version of the device, or even making it wireless only. More input is required on this one.

We have big luck with the hardcore water drinkers, because our team consists of such people too. The first feedback was that one size does not fit all. We bring differently sized bottles for running, to school, we have different preferred sizes even at home. Some of us like to drink from a flask, some from glasses. Here are some comparisons in Table I:

TABLE I
DIFFERENTLY SIZED BOTTLES

When	Kornél	Henrik
At home	Flask, 0.5l	Glass, 0.2l
Work/school	Bottle, 0.75l	Glass, 0.2l
Running	None	Bottle, 0.5l
Hiking	Thermos, 0.5l; flask 0.5l	Flask, 0.5l, bottle, 0.5l

This made us rethink much of the initial ideas again. The plan is that we make three different form factors:

A) A glass (The Cup)

B) A flask

C) A thermos

The other kind of feedback was that the prototype's design is not appealing enough. For this reason, the next prototype will be custom made to be more pretty.

VII. COMPETITION

According to our research, there is not many solutions yet for this problem.

The main competitor is most likely the classic approach, the simple glass. It has its positive sides, for example the price. But has no fancy diagrams, dashboards, and cannot measure. It was the idea which gave the spark at one of our brainstorming sessions:

"I want to drink water, I like to drink water. How much I drink? Don't ask me. How much should I? Don't know. It's probably around 2-3 liters a day. But I read that if you drink too much, you die. I need a smart glass."

Later we found that the required water intake is a combination of many factors, including gender and temperature to mention only two. But there is half a dozen more. The classic glass requires the user to have a math notebook in which they compute the actual water intake versus the required for that day. After watching the weather. We did it, it's boring and after the first few glasses, we simply forgot to keep track.

There is also another thing called Vessyl. We accidentally found out about them during the development. We think that's a great product, but The Cup will be limited only to water. And by that, also cheaper. The second generation Cup is already in early stages of planning, and there are ideas to continue in this way. For now, it's out of scope.

VIII. Personas

A. Henrik

Henrik is Mad Wake team member. He is a student, a programmer, the center of the community, an activist. He started drinking water heavily in 2013, since then, he can't go anywhere without a bottle or a flask. Knows very well the tricks of drinking water (Bear Grylls wrote in his book that it is useless to drink more than a liter per hour, the kidneys simply cannot keep up with it). His biggest problem is to keep track of his water intake. It's hard and bring to count them. He tried several software based water trackers but they were not very intuitive to use. If there were a product to solve this problem, he would likely paid for it.

B. Philip

Philip is an average man. He works, commutes to work, at home watches TV, and plays with his children. It requires much energy. He also has headaches sometimes, nausea mostly after smoking. He wakes up very hard in the morning. He drinks little water a day, partly because he doesn't know its importance, partly because it's hard to measure it, and partly because he will start drinking properly tomorrow. Or the day after that. Maybe after that.

But then he hears about The Cup. Downloads the app to his phone, starts using the Lite version, which does not require the device, but is also less precise. In this moment, if he feels better after drinking water, he will buy The Cup. According to the researches, he will. According to our expectations, he will buy.

IX. Top User Stories

All of these stories are implementation-level user stories, based on the feedback we already got.

A. User A – Easier and more accurate water intake tracking

Intended confirmation: Water intake tracking is hard and potentially dangerous using the traditional method.

"I drink enough water during the day. At least I think I do. After doing some research, I was even more desperate. How much water you should drink depends not only on the weather or whether you smoke or not, but on your height, weight, gender, how much you work out. I know that I should drink about half a liter water after waking up. Half a liter before going to bed. That's already a liter. But I also read stories about drinking too much water and dying. It messes up the osmosis in your system. How I understand biology, you suffocate cell by cell. So I drink probably much less than I should. It's better than the other way I think. I would use The Cup although I prefer the flash form factor."

B. User B – Losing weight using water

Intended confirmation: People would drink more water, they just can't organize it.

"I want to lose weight. Because I work all day, I don't really have time to work out. To be perfectly honest, I'm lazy too. But I read a method that by drinking some water before meals, the fluids take some space in your stomach so you can't eat that much. There's simply not enough space for the food. It also said that water helps your stomach digest the food. It's worth a try. I tried using a water tracking app on my phone, but it has some shortcomings and after the second-third glass I forgot about

drinking and marking it. Then there was the other one, it kept notifying me. But hey, I can't drink by its rhythm. Only if it could learn how I live my life and organize my time. It would be awesome."

C. User C – Smart device without a smartphone

Intended confirmation: Everybody is the target audience. They have such demands what we never thought about.

"I know drinking water is healthy and I should really drink. I would also use your product, but I don't own a smartphone. I simply wouldn't use its additional features. A phone should do two things: let me call people and text them. That's all. If you build this thing and I could operate it without a smartphone I'd be sold. Just put some lamps on them to indicate when I should drink."

X. Business Model

The business model is simple: the user buys the device, and with the device comes lifetime access to the service. Obviously, the cost of maintaining the server per device lowers by each unit sold. In the team there are web specialists, who can invest their time initially while the business runs up.

While we plan to keep the price as low as possible, several customization features will be offered as a premium, for premium price. These include replacement parts of different colors (straws, bottle bodies) and different materials (glass, metal).

On marketing front, we plan to deliver a simple user input based water tracker. It will help the users get to drink water, if they will feel better after doing so, they will consider purchasing The Cup with the smart tracker. Our vision here is that people are willing to pay (if they are able) to make their lives easier – with automation of water intake tracking we do ease their lives.

For the first round, we plan to deliver the software for Windows Phones and Windows 8 tablets/PCs only. This is because some reward programs require a 90 day exclusivity on the platform. After that period expires, an Android version is to come alongside with the web version, followed by the iOS one. Our goal is to reach as many people as possible.

XI. The future of The Cup

The Cup is evolving. From the feedback so far, we understood many more things about the potential customers. They want diversity, so we shall deliver a second model of The Cup, which will be wifi based. It will communicate with the Cloud, and a backend web service will process the data. This very same web service will implement a neural network, and is going to be able to predict the user's water requirements based on their habits, biorhythm, if they do sport (also, by getting data from connected devices, like smartwatches, by reading the pulse, the intensity of the exercise can be determined), if they smoke, and by knowing the local weather.

The other thing which was required, is to support multiple platforms. While Windows is the most popular operating system on PCs, the mobile market is dominated by iOS and Android. On one hand, the branding and functionality of the applications must be the same, on the other hand, the applications have to feel and look natural on the platforms. Because of this reason, we decided to write the applications the native way, without using technologies

like Xamarin, and because of performance issues, Apache Cordova-like web based solutions.

There will be at least one more prototype before we start the mass production. This will include a custom made bottle, custom made electronics instead of the Arduino used in this version. It enables us to use custom batteries because of the different voltage. At the end, it will solve our biggest problem, which was the problem with the battery. Also, the control modules are going to be isolated, so the water cannot do any harm to it.

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Bordering 2D GUI elements in 3D space using masking effects

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Abstract - This paper describes a solution to a problem of bordering two-dimensional user interface elements in three-dimensional environment. This effect is commonly used in two-dimensional user interfaces, when certain elements need to be partially or completely invisible. Implementing this feature in three-dimensional space is challenging and this paper will cover those challenges and propose a solution.

I. INTRODUCTION

Making a graphical user interface (GUI) that differs and stands out from the others is rather difficult nowadays. Creating such GUI requires a designer to take a different approach to the issue. Two-dimensional (2D) GUI within a three-dimensional (3D) environment is a good example of a different approach. What 2D GUI in 3D space represents is a GUI which is made of 3D objects that have depth (thickness) set to zero, so they end up being 2D objects with just width and height. It combines 2D GUI, which is something users are comfortable with, and 3D space and thus provides opportunities for new effects and tricks to make it stand out [1][2][3].

II. RELATED WORK

The most desired features in GUI design is a simplicity with intuitive selections that make GUI easy to use and understand. During GUI development, numerous problems may emerge, among which is bordering elements in space. The feature is required when content of an element is too large for its size, so the content needs to be cut off in a certain way to fit the size of the element. This is frequently necessary when working with lists as we can see in Fig. 1. Lists are type of GUI element which can contain multiple elements of their own. Some of the lists have all of their elements visible and user can scroll through the elements, changing focus from one to another. On the other hand, there are lists which have certain size allocated for their use and not all of the elements can fit into that space. In this case some elements need to be cropped out, and a shape of a cropping mask may be customized. A mask is a texture, which carries visibility information of elements behind it. In [4][5][6] the masking is applied in two ways – with a stencil buffer and separate frame buffer. Although masking effects, such as described in [4][5][6] are heavily used in a game development for various effects, however, to the best of our knowledge, there is no evidence in the literature that it was applied to GUI.

In this paper we applied methods described in [4][5][6] to solve the problem of bordering 2D elements in 3D space applied to GUI design. The approach provided interesting and appealing visual feel to our GUI design, yet it kept the simplicity and intuitivity needed.

We implemented masking in two different ways:

- Using the stencil buffer [4][5][6] (part of a frame buffer)

- Using the separate frame buffer [4][5][6] for each mask

Neither of these ways is a perfect way and they both have their pros and cons. This paper will cover both of those ways and give insight into possible future work that would help make these solutions better.
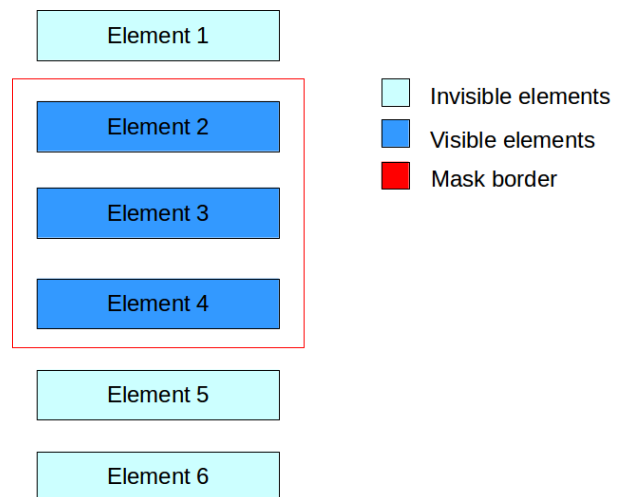
Figure 1. Illustration of a list, showing both - visible and invisible elements, bordered using a rectangular customized mask to define permitted space

III. MASKING BY STENCIL BUFFER

Stencil buffer is one of the three buffers found in modern graphics processors. It is accompanied by color buffer and depth buffer. Usage of stencil buffer can vary depending on user's needs, but it can be used for any kind of rendering output manipulation. It is commonly used to limit rendering area and that is what we will be using it for.

Stencil buffer can (most commonly) store up to 1 byte (8 bits) of information for every pixel. If we use 1 bit of the buffer for storing information about 1 mask, we can have maximum of 8 masks per one rendering cycle. Those masks carry basic information, whether the destination pixels are going to be visible or not. We will call this type of masks stencil masks.

We defined masks as planes, which are 2D objects defined by 4 vertices (rectangle). There can be two types of stencil masks - positive masks and negative masks. Positive masks hide everything that is behind their plane (creating a hole in the area where the effect applies), while negative masks hide everything that is not behind their plane (cropping).

Every entity, that needs to be rendered (a render entity) and needs a stencil mask effect, has stencil descriptor attached to it. Stencil descriptor carries information required for applying masking effect and that information is extracted and applied during rendering. When a rendering process starts, stencil masks are written to stencil buffer. After that, other render entities start being rendered. When an entity that has a stencil mask attached to it is next to be rendered, we extract information from stencil mask descriptor and set rendering parameters in accordance.

IV. MASKING BY FRAME BUFFER

Another way of making mask effect possible is by using a separate frame buffer for a mask. This implementation is rather expensive, because allocating new frame buffer takes time and takes up fair amount of memory. Despite being more expensive, this implementation is necessary, because it covers different use case that is not possible with stencil masks. Using separate frame buffer for mask allows us to have gray areas in the mask (areas that are neither completely visible or completely invisible) and this implementation is used exclusively to achieve this effect (alpha mask effect). With that in mind, we can call this an alpha masking effect. Illustration of this effect can be seen in Fig. 2.
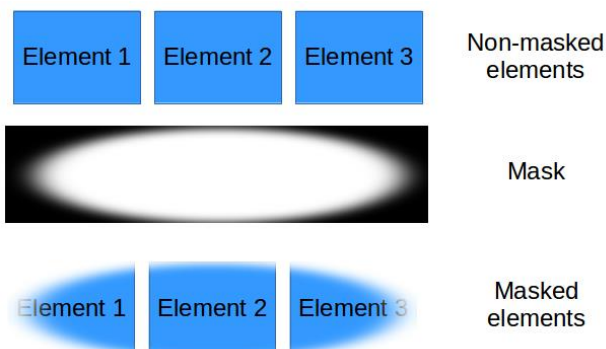
Figure 2. An illustration of alpha masking effect

This is possible because we are allowed to use frame buffer's color buffer, which has alpha component that is of importance to us. Alpha component allows us to define visibility as a floating point value between 1 and 0 (1

being visible, 0 invisible and everything in between partially visible).

Frame buffer, which is used for mask, will generate a masking texture before rendering each frame. That texture will be size of the screen and will be associated with certain render entities. While rendering those entities, alpha of each pixel of the entity being rendered will be multiplied with alpha of respective pixel of the alpha mask associated to that entity. This will be done in fragment shader [4][6][7] (which is a program that computes different attributes of a fragment and is executed on GPU). Fragment is a potential pixel, an RGBA value which needs to pass certain tests in order to become pixel.

V. USAGE PROCESS

When an element of the GUI needs a masking effect (i.e. cropping) it will invoke renderer's method (renderer is a module that takes care of rendering) for cropping by passing a masking plane (and a previously allocated frame buffer, in case of alpha masking). After starting the effect, the element needs to give renderer planes that contain actual content, which renderer uses to create render entities. When renderer finishes creating render entities, masking effect needs to be stopped. While creating render entities, renderer will associate any active masking effect with those entities.

If an element has children elements and wants to apply masking effect on them, it needs to make sure their rendering entities are created while masking effect is active. Those children elements can have masking effects of their own, and those effects will be added up to parent's mask effect (nesting).

Two things should be noted:

- Nesting should not be abused with stencil masks, because there can be only 8 stencil masks at once.

- Nesting is not available when using alpha masks due to enormous memory and GPU time (due to constant frame buffer swapping) consumption.
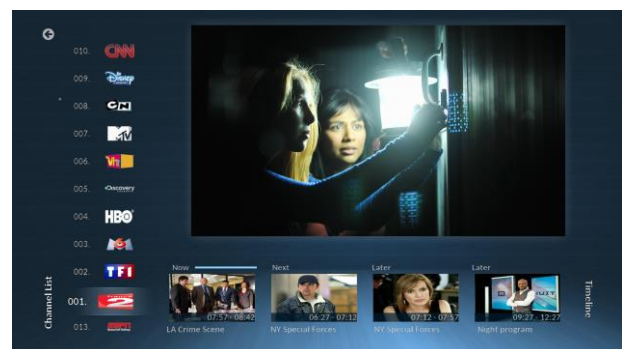
Figure 3. Application of alpha masking

In Fig. 3 we can see actual application of these effects. If we take a look at the horizontal list, under the video, we can see that it has 4 elements. What we cannot see is that the list actually contains much more elements which are located to the left and to the right of the visible elements. Those invisible elements are masked by using an alpha

mask. This was necessary because certain amount of elements needs to be preloaded in the list in order to increase responsiveness and we do not necessarily need to see those elements.

The reason an alpha mask is used instead of sencil mask is because we want elements coming from left and right to appear gradually.

VI. CONCLUSION

This paper explains implementation of two types of masking effects - masking using a stencil mask and masking using a separate frame buffer (alpha masking effect).

Both of these implementations have their advantages and drawbacks, but these implementations were designed with particular use scenarios in mind. They certainly do not cover all the cases masking effects can be used for, and the plan is to improve it over time.

One of the improvements which are planned for future is better implementation of nesting masking effects, because current implementations have serious limitations.

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Enhanced Program Recording Mechanism for Hybrid Set-top Boxes

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Abstract - Personal video recorder (PVR) is widely accepted among the television viewers thanks to the freedom and control it gives over television viewing. Main issue of the current PVR solutions is the simultaneous recording of multiple channels, due to the hardware limitations. This paper presents an enhanced program recording mechanism, for hybrid set-top boxes, which expands the number of channels that can be recorded simultaneously. Presented mechanism takes into account available channels with the same content, available network bandwidth, writing speed of the hard disk and based on that, decides what channel to record.

I. INTRODUCTION

Current television (TV) viewing habits are changing. Majority of TV watching now comes from pre-recorded or downloaded content, rather than live TV [1].

Personal video recorder (PVR) has become widely accepted among the TV viewers because of the freedom and control it gives them over their television viewing. Viewers don't have to rush to finish their activities before their favorite show starts. Using PVR they can start watching their favorite show at 7 instead of 6 o'clock. Moreover, they can automatically record their favorite show whenever it appears. Present PVR solutions are so easy to use which leads to the fact that PVRs are becoming normal way of watching TV, not the exception.

While PVRs users are generally enthusiastic about this technology, its use is not without problems. The biggest issues of traditional PVR solutions [2][3] are listed below:

- simultaneous recording of multiple channels

- simultaneous recording and watching of different channels

- writing speed of the hard disk

- bandwidth utilization in case of Internet Protocol Television (IPTV)

Kim [4] describes implementation of enhanced PVR that is capable of simultaneous playback and recording of HD quality streams, but doesn't resolve the problem of simultaneous recording of multiple channels or simultaneous recording and watching of different

channels.

Due to the hardware limitations, such as number of available TV front-ends, hard disk I/O speed - the number of channels that can be recorded simultaneously is limited and not enough compared with users' requirement. In order to solve this problem on IPTV clients, Wu [5] proposes a hybrid recording mechanism which provides extended recording capability of IPTV client by sharing the recorded program among related IPTV clients. If one IPTV client cannot record locally desired content, content is recorded on another client and using Peer-to-Peer technology shared with the first client. This solution effectively solves the problem of hard disk writing speed, but requires recording management server and community with more IPTV clients or clients with the same preference for some channels/programs.

Lu [6] proposes solution for time conflict problem. If the user schedules recording of programs that are broadcasted on different channels at the same time, recording scheduler re-schedules the recording tasks to meet the user's requirements. Recording scheduler uses the fact that some programs are always broadcasted more than once during a certain period (for example movie can be broadcasted in the evening and re-broadcasted the next morning). It also may happen that some programs are showed on different channels. This solution improves program recording efficiency but neglects the time when desired program was supposed to be recorded.

To solve the problems of traditional PVR solutions, we propose an enhanced recording mechanism for hybrid set-top boxes. Hybrid set-top boxes [7] combine one of the standard Digital Video Broadcasting (DVB) delivery methods (DVB-T/S/C) with IPTV delivery methods. Nowadays, the usage of hybrid STBs is being increased because of the many features they offer to the end users. Beside standard set of TV features: Electronic Program Guide (EPG), Teletext, multi subtitles/audio, Personal video recorder, hybrid STBs offer additional IPTV features: Video On Demand (VOD), Catch-up TV, Hybrid Broadcast Broadband TV (HBBTV), YouTube, Games.

Recording mechanism proposed in this paper combines programs available on different TV front-ends and in different qualities to expand the number of channels that can be recorded simultaneously, or to enable watching and recording of different channels.

For example, users in the field can experience limited internet bandwidth, which is not enough for watching of live IPTV channel and recording of another IPTV channel simultaneously. By introducing recording mechanism proposed in this paper, this could be easily realized by using IPTV front-end for live TV and DVB front-end for recording.

The rest of the paper is organized as follows. Section 2 describes the architecture of the system which is used as test environment for developed recording mechanism. Section 3 describes in more details proposed program recording mechanism. Section 4 compares efficiency of traditional PVR recording mechanism with PVR recording mechanism proposed in this paper, while section 5 outlines a conclusion of the presented work.

II. SYSTEM ARCHITECTURE

The set-top box, used as a test environment in this paper [8], is a hybrid STB with two front-ends: DVB-T and IPTV, based on Android4TV technology [9]. It runs on quad core central processor unit, with 2 GB of operating memory and 16 GB flash memory.

It utilizes algorithm for making unified channel list [10], where each TV channel is represented only once in the channel list. If one channel is available in the following types: DVB-T HD/SD, Over-the-top content (OTT) HD/SD, IPTV Multicast HD/SD, only channel with the best quality (regardless of the source) will be displayed in the channel list.

Fig. 1 represents software layers needed for program recording mechanism to work.
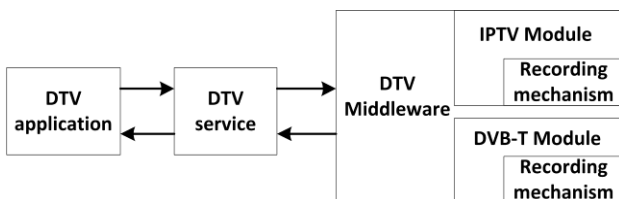
Figure 1. Software layers needed for PVR implementation

Digital television (DTV) middleware is responsible for providing all of the DTV related features and is written in C/C++ native code. The Android DTV application is responsible for receiving of the remote controller commands and for displaying of DTV data. The Android DTV application communicates with DTV middleware through DTV Java service. The DTV Java service and the DTV middleware are connected through the Java Native Interface (JNI) layer, which converts the DTV related data from C/C++ structures to Java objects and vice versa.

Proposed program recording mechanism is part of the DTV middleware and it is described in details in the next section.

III. PROGRAM RECORDING MECHANISM

Program recording mechanism represents algorithm that decides which channel to record based on the various different parameters. In case when DVB-T channel needs

to be recorded following parameters and their combinations are taken into account:

- Frequency of currently watched DVB-T channel and frequency of DVB-T channel that needs to be recorded

- Frequency of currently recorded DVB-T channel and frequency of DVB-T channel that needs to be recorded

- Bit error rate of channel that needs to be recorded

- Signal quality and signal strength of channel that needs to be recorded

- Writing speed of the hard disk

In case when IPTV channel needs to be recorded following parameters and their combinations are taken into account:

- Available network bandwidth

- Packet loss

- Writing speed of the hard disk

Based on the previous parameters algorithm checks if the TV program can be recorded on the desired front-end. If the recording is not possible, algorithm will try to record channel, with the same content, on another front-end or to record channel with lower quality (SD channel).

The following recording scenarios can be distinguished: IPTV HD channel recording is requested by the DTV application and DVB-T HD channel recording is requested by the DTV application. Recording scenarios are explained in the following sections.

A. Record IPTV channel

The flowchart for the program recording mechanism when IPTV channel recording is requested by the DTV application is shown in Fig. 2.

Figure 2. IPTV channel recording mechanism

The detailed recording algorithm in case when IPTV channel recording is requested is presented below:

- DTV application requests recording of IPTV channel in best quality

- IPTV module recording algorithm can respond with:

  - Approved: there is enough network bandwidth to record IPTV channel in wanted quality

  - Approved lower quality: there is not enough network bandwidth to record in wanted quality, but recording can be performed in lower quality (e.g. user is currently watching YouTube)

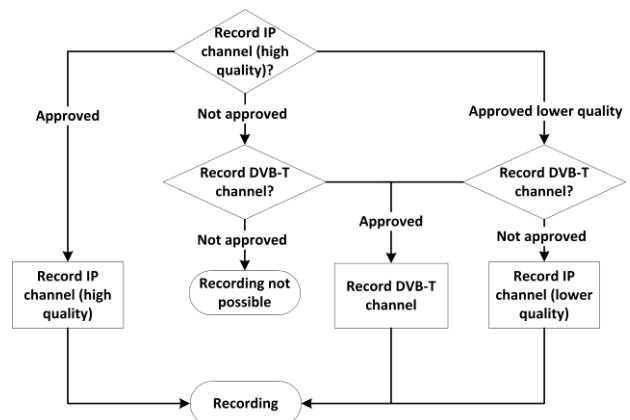 - Not approved: there is not enough network bandwidth to record IPTV channel in any quality (e.g. user is currently watching IPTV HD channel)

- In case when IPTV channel recording is not approved:

  - DVB-T channel with the same content is recorded if it is possible

B. Record DVB-T channel

The flowchart for the program recording mechanism when DVB-T channel recording is requested by the DTV application is shown in Fig. 3.
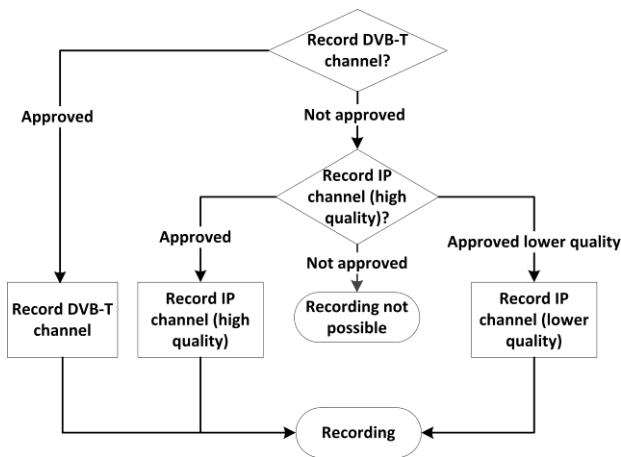
Figure 3. DVB-T channel recording mechanism

The detailed recording algorithm in case when DVB-T channel recording is requested is presented below:

- DTV application requests recording of DVB-T channel

- DVB-T module recording algorithm can respond with:

  - Approved: desired DVB-T channel can be recorded

  - Not approved: desired DVB-T channel cannot be recorded (e.g. user is currently watching DVB-T channel on another frequency)

- In case when DVB-T channel recording is not approved DTV application should request recording of IPTV channel with the same content

in best quality. Recording algorithm can respond with:

- Approved: there is enough network bandwidth to record IPTV channel in wanted quality

- Approved lower quality: there is not enough network bandwidth to record in wanted quality, but recording can be performed in lower quality

- Not approved: there is not enough network bandwidth to record IPTV channel in any quality

IV. EVALUATION RESULTS

To evaluate the proposed PVR recording mechanism, we compared proposed solution with traditional PVR recording mechanisms. Recording mechanisms were evaluated on Hybrid Android STBs with two front-ends (DVB-T and IPTV). The results of comparison between proposed and traditional recording mechanisms, under different scenarios, are listed in Table I.

TABLE I. COMPARISON BETWEEN PROPOSED RECORDING MECHANISM AND TRADITIONAL RECORDING MECHANISM

Scenario	Same content available on DVB-T and IPTV	Proposed PVR	Traditional PVR
watch DVB-T channel / record DVB-T channel on another frequency	Yes	Record IPTV	/
watch DVB-T channel / record DVB-T channel on another frequency	No	/	/
watch DVB-T channel / record DVB-T channel on same frequency	Yes/No	record DVB-T	record DVB-T
recording DVB-T channel / record DVB-T channel on another frequency	Yes	record IPTV	/
watch IPTV HD channel / record another IPTV HD channel	Yes	record DVB-T	/
watch IPTV HD channel / record another IPTV HD channel	No	watch IPTV SD / record IPTV SD	/
watch VOD HD video / record IPTV HD channel	Yes	record DVB-T	/
recording IPTV HD channel / record another IPTV HD channel	Yes	record DVB-T	/
recording IPTV HD channel / record another IPTV HD channel	No	record two low quality IPTV	/
watch YouTube / record DVB-T channel (DVB-T signal is not available)	Yes	record IPTV	/
watch DVB-T channel / record another IPTV channel (network is not available)	Yes	record DVB-T	/

The results showed that proposed solution better utilizes network bandwidth and has much higher recording efficacy in comparison to traditional solution.

V. CONCLUSION

This paper presents an enhanced program recording mechanism for hybrid set-top boxes which expands the number of channels that can be recorded simultaneously or watched and recorded simultaneously. Recording algorithm takes into account available channels with the same content (DVB-T HD/SD, OTT HD/SD or IPTV HD/SD), available network bandwidth, writing speed of the hard disk and based on that decides what channel to record. Proposed mechanism improves program recording in comparison to traditional PVR on single front-end devices and PVR on dual front-end devices which don't consider that the same content can be available on different sources and in different qualities.

Future work will be directed to implementation of the recording mechanism on hybrid STBs with different front-ends, such as combination of DVB-C or DVB-S with IPTV front-end.

ACKNOWLEDGMENT

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Analysis of e-Maturity of the Schools in Serbia with a Short Comparison to School e-Maturity Status in Croatia

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Abstract: In the time of new technologies, when the rules of everyday life adapt to new ways of work and communication, education must follow the rhythm of modern life and fit into modern trends of educational approach. Schools are reluctant to set out on a journey of modernisation and thorough reform, both due to financial problems as well as to deep-rooted, now even retrograde, opinions on what education should be like. The aim of this research is to analyse e-maturity of the schools in Serbia from the aspects of leadership vision and practical implementation, as well as to make a brief comparison with Croatia that has already been moving in that direction.
Key words: school, e-maturity, questionnaire, situation, analysis, Serbia, Croatia

I. INTRODUCTION – E-MATURITY ASSESSMENT CRITERIA

E-maturity, it is said, can be accomplished by interconnection of successful ICT integration and school development. [1] Speaking about e-maturity, the analysis has to be divided into several different aspects.
Some sources [2] list the following five items as key focuses of survey and assessment of e-maturity: 1) leadership and vision, 2) integration of ICT in the curriculum, 3) school ICT culture, 4) professional development, and 5) resources and infrastructure. To be able to carry out the assessment, survey has to be introduced parallelly at two different levels [3], level one being school management as bearers of the vision, and level two being teachers, as users and implementers of the changes to be introduced and carried out. The second model [4], however, is based on three main topics: conditions, implementation and the outcomes, while the third model [5] comprises five key points: 1) the vision of ICT implementation in school and the strategy to accomplish it, 2) secondary processes (school organisation and management, ICT coordinators), 3) resources (infrastructure, financing programmes, governmental regulations), 4) primary processes (curriculum development, ICT integration) and 5) desired results (for students, teachers, parents, society and the state).

Whatever the way we look at it, key factors of e-maturity as recognised by all three approaches are: vision and strategy, resources, curriculum development and ICT integration.

II. THE REPUBLIC OF SERBIA – E-MATURITY STATUS

Serbian Strategy of Education Development until 2020 [6] recognises the importance and the role of new technologies in the improvement of the educational system. Due to the complexity of the issue and in order to successfully integrate ICT into the educational system, with the aim to help formulate the educational policy within this area, the National Educational Committee made and adopted at its 98th session held on December 10th, 2013, a document called *Guidelines for the Improvement of the Role of Information and Communication Technologies in Education*.
Due to appearance and fast development of information and communication technologies (ICT), the circumstances have been changed under which, both economically and socially, social communities function and develop. These changes also have an impact on education which is expected to respond to numerous requirements that, among other things, result from the economy based on knowledge production. Acquiring knowledge and skills in ICT field is one of the prerequisites for social inclusion into contemporary society and labour market, while digital literacy stands as one of the key competences of the modern man. There is no doubt that ICT should be integrated into the educational system so as to be able to provide quality education for all. However, the strategic approach, the models of implementation, the methods to carry out numerous initiatives and activities still pose a challenge to both developed and developing countries.

In Serbia, many projects have been implemented that aimed at encouraging e-maturity in schools, but none so far has offered a systematic solution.
„Digitalna škola" (Digital School) is a project implemented by the Ministry of Trade, Tourism and Telecommunications in cooperation with the Ministry of

Education, Science and Technology Development. Within this project 2808 fully equipped digital classrooms have been introduced in schools throughout Serbia, which are now exclusively used for the purposes of ICT classes. The sustainability of the project lay in the competitions that were organised in three subsequent school years, offering awards for the best ICT using lesson plan and actual lesson held under the name of „Digitalni čas" (Digital Lesson).

„Kreativna škola" (Creative School) is a project that motivates teachers to make teaching materials with the use of ICT and thus form a database of teaching materials. This project has been implemented by Microsoft Serbia in cooperation with the Institute for the Improvement of Education.

Project named „Razvionica" (Developing Classroom) is a bit more complex than the previous two and within two of its many components it has been dealing with the issue of e-maturity in schools and the digital literacy of the teachers. Under the project a document has been defined called *National Curriculum Framework* that recommends the implementation of ICT through all school subject as the key transversal competence. Within its fourth stage, the project has comprised the implementation of trainings for 2000 teachers on ICT for education and learning.

There has also been activities carried out within the much wider ODS (Open Discovery Space) Project in Serbia.

After all these strategic documents adopted and projects implemented, without any institutionalised support, a survey has been made on the e-maturity status of the schools in Serbia.

III.   RESEARCH OBJECTIVES

The objective of the research is to analyse the e-maturity status of the Serbian schools.

„E-mature schools are those that are connected to the ultra fast Internet, thoroughly ICT equipped, with e-processes of teaching/learning and management. Those are places where digitally competent teachers and students work and learn and that, by everyday use of ICT, e-learning and digital repositories, prepare their students to be competitive in the labour market and ready for further education." [7]

In order to take all necessary measures to improve e-maturity of Serbian schools, it is necessary to survey and analyse the present situation in the primary and secondary education regarding the e-maturity of the schools.

To be able to reach the objective, we must start from the following issues:

1.   Survey the opinions and attitudes of teachers/school principals on the following matters:
o   School ICT vision and strategy
o   ICT as part of the curriculum
o   Teaching and learning with ICT
o   ICT assessment and assessment using ICT
o   Professional development
o   Expanding learning options
o   Availability, access and resource management
o   Impact on students' achievements

2.   Ascertain the e-maturity status of schools regarding the following:
o   Leadership and vision
o   Integration of ICT into the curriculum
o   School ICT culture
o   Professional development
o   Resources and infrastructure

IV.   SCIENTIFIC METHODS, TECHNIQUES AND INSTRUMENTS OF RESEARCH [8]

The methods used in this research have been chosen in accordance with the nature of the problem, the subject, objective and the tasks of the research. Namely, descriptive method (non-experimental empirical study) and experimental method is used. In accordance with the method mentioned above, we have used the following techniques to collect the data: questionnaires for teachers, statistical technique (processing data collected from the questionnaires).

To implement the aforementioned techniques, we used the following instruments: questionnaires (online set of questions) and interview.

V.   RESEARCH DESCRIPTION

Research population and sample: the research includes a non-measurable set of teachers and principals of primary and secondary schools in the Republic of Serbia.

The population comprises all principals and teachers of schools where the research has been carried out. The sample comprises two teachers each from the categories mentioned.

The research has been carried out on the whole territory of the Republic of Serbia during the time interval of March - May 2015.

VI.   RESEARCH RESULTS

School ICT vision and strategy refers to the school or institution policy that expresses its positive attitude to ICT use in all segments of school functioning. Such attitude should be clearly stated in strategic documents made on the institutional level. The research shows that only 8% of schools in Serbia have a strategic document clearly defining the vision and strategy of the school regarding ICT, 34% do not have a strategic document, while 58% of schools do define this matter through other strategic documents.
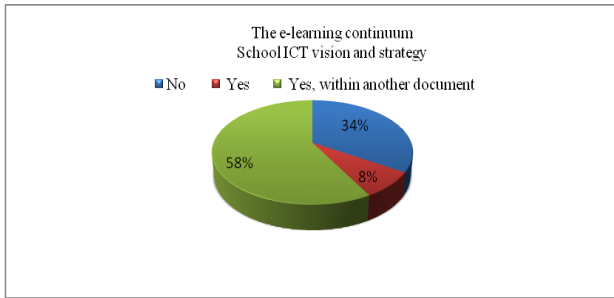
Figure 1. The e-learning continuum School ICT vision and strategy

ICT within the curriculum defines a percentage of ICT based content in all school subjects. In Serbia, digital literacy has been defined as a transversal competence, but so far the use of ICT within the curriculum depends on the initiative of teachers alone. So, 48% of teachers do not use ICT within the curriculum, 28% of them do that whenever it is possible, while 24% of teachers do it sometimes. The use of ICT within the curriculum has only been strictly defined through ICT subject, and also within 5 to 10 vocational subject in vocational secondary schools.
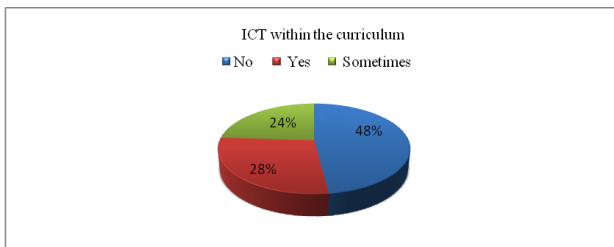
Figure 2. ICT within the curriculum

Teaching and learning using ICT refers to the level of consciousness regarding the fact that ICT can impact the quality of teaching and learning, students' attitudes, behaviour in the wider school community; however, it also analyses the use of ICT in the processes of teaching and learning in the school and out of it. Of all e-maturity segments, this one seems to be the most present. Over 70% of teachers use all types of e-learning and use ICT for teaching purposes, 20% do that occasionally, while 10% of teachers rarely do that.
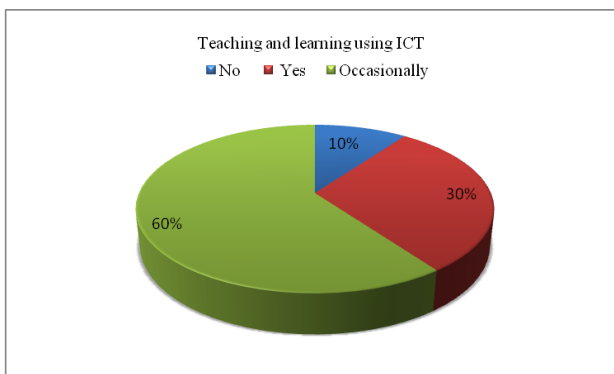
Figure 3.Teaching and learning using ICT

ICT assessment and assessment using ICT is barely present in Serbian schools, as little as 5% of schools use

ICT to assess students, 85% of schools do not do that, while 10% of teachers use ICT tools for formative assessment.
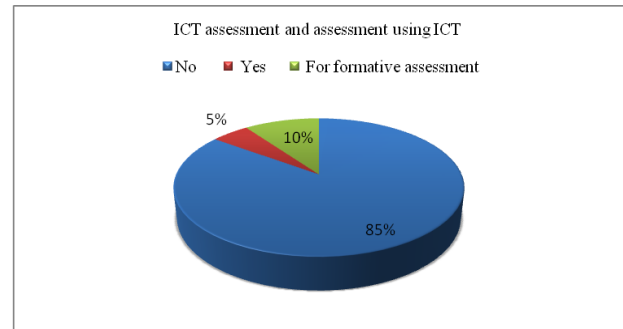
Figure 4. ICT assessment and assessment using ICT

Professional development of teachers and teaching assistants regarding ICT use for teaching purposes is dominantly present as compared to other forms of professional development and advancement. Looking at total number of hours spent for professional trainings and seminars, 82% of trainings have been carried out in the abovementioned field. The interest of teachers for professional development within this field is huge – approximately 87% of teachers would attend ICT trainings, the only thing standing in the way being insufficient financial support from the institution.

Expanding learning options is something all teachers and teaching assistants agree on when it comes to ICT, both within their fields of expertise and further.

Availability, access and resource management is a real problem in schools throughout Serbia. A total of 67% of teachers claim that they do not have a constant and adequate access to resources, 12% teachers have an adequate and constant access to resources, while 21% of teachers occasionally have access to the resources.
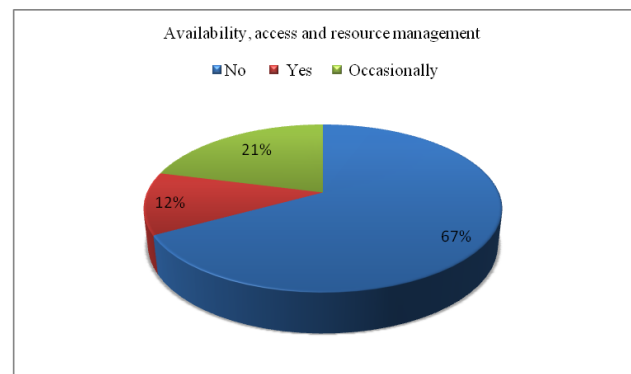
Figure 5. Availability, access and resource management

All teachers that have taken the questionnaire think that ICT use has an extremely positive **impact on students' achievements.**

To conclude with, e-maturity of schools in the Republic of Serbia is on a very low level. The results show that what is missing are strategic moves at the governmental level to increase e-maturity of schools, because schools do meet the criteria regarding the capabilities of the institution and the personal development of the teachers.

Approximately 90% of schools belong to two lower levels of e-maturity, while just 10 % of schools meet the criteria for e-mature schools.
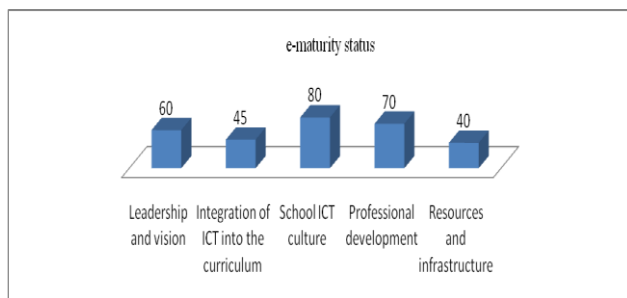
Figure 6. e-maturity status

VII. THE REPUBLIC OF CROATIA – SHORT COMPARISON

At this point, according to the data given by Carnet [9] at the end of 2014, it can be considered that less than 17% of Croatian schools can boast to have the flattering prefix – digitally mature, i.e. e-mature school. What are the problems? On one hand, obviously being the most important obstacle in the region, which stands in the way of e-maturity, are insufficient resources. The number of students that share access to one computer is far below the European average, while the access to fast Internet presents an even bigger problem. On the other hand, the willingness of teachers to use ICT for teaching purposes and to integrate it into the curriculum is on a considerable level, while the number of principals understanding the importance of ICT for teaching and learning is fairly high.

ODS (Open Discovery Space) project in Croatia [10] in 2013 came to the following conclusions:

1) On the scale consisting of four levels of e-maturity of schools, from digital beginners, via digitally enabled and digitally capable schools, to digitally mature schools, most of schools (approx. 85%) belong to two lower levels of e-maturity, while at that moment there was no evidence of any e-mature school.
2) Although ICT is used, and Internet materials considered useful for teaching and learning, listed as obstacles are insufficient education and professional appreciation, and to some extent insufficient time and support of the school management.
3) Also listed as problems are difficulties to assess the quality and the shortage of relevant Internet materials, as well as the lack of habit; there is also a problem with the absence of confidence regarding materials developed by others.
4) Rather considerable is the obstacle of adjusting digital content to the requirements of the curriculum.

However, Croatia has not surrendered to obstacles standing in its way to e-maturity. Currently underway is the project called "e-Škole: Razvoj sustava digitalne zrelosti škola" (e-Schools: The Development of the System of e-Maturity for Schools) [11], which is to encompass 150 schools, the first 20 of which will start by autumn this year, while the remaining 130 schools will join them at the beginning of 2016. The project in question is a national strategic project aiming at implementation of activities which will raise e-maturity of the schools mentioned by at least one level. According to the information available on the Internet [1], the next stage is planned for 2019, when another 700 schools will be included in the second stage of the project.

VIII. CONCLUSION

Serbia, as well as Croatia, is facing a demanding task to take all measures needed to raise the level of e-maturity of educational institutions. The situation in Serbia, as presented here, is rather depressing, with no more than 10% of schools that can be called e-mature, which is considerably lower than the estimated approx. 17% of e-mature schools in Croatia. Unlike Croatia, Serbia does not seem to even start serious consideration of this topic, not to mention all-encompassing governmental projects that would put some intensive effort in this, as the case is with Croatian "e-Škole: Razvoj sustava digitalne zrelosti škola".What we could learn from the experience of our neighbours is that we should not give up when faced with a task that needs us to start from the scratch. We can also see how important it is to have a support of experts, institutions and the wider public together with the financial support of the state led by the idea to invest in what is the most important to it – its youth.

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MSoft - a Novel Knowledge-Based Medical Information System

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Abstract- In this article we describe the needs, opportunities and the manner of development of knowledge-based medical information system, which is titled as MSoft. The main goal of the development of this medical information system - MSoft is to enable e-documenting knowledge that will be used by medical professionals, medical specialists, subspecialists and experts in the particular medical area. This article describes the components of the medical information system and it gives an overview of the existing medical information systems in Republic of Macedonia and worldwide such as: Medica 2002 - medical software, ECLIPSE Practice Management Software, Visualdx, RAMEDIS and OMIM. This comparison systematizes the advantages and disadvantages of each medical information system and hence this comparison facilitates the development of a novel medical information system - MSoft. This comparison has shown that in Republic of Macedonia there is no knowledge-based medical information system, which would support the health institutions and specialists on a high professional level. Description of the developed medical information system - MSoft is made by UML diagrams, database diagrams and other figures. The software architecture and functionality of this medical information system - MSoft are depicted using UML class and sequence diagrams. At the end of this article, conclusions and directions towards future upgrading of the MSoft database of knowledge are given.

1   Introduction

A medical information system is integrated set of components that allows making the right decisions about diagnosis of diseases and prescription of the appropriate treatment.

Medical information system is an information system for collecting, storage and processing of data for particular area of medicine and transfer of knowledge in the same time. Worldwide, many hospitals, laboratories and other healthcare institutions have their own medical information system to carry out and manage their operations, acquiring new knowledge and communication with their patients. Due to the different needs of hospitals and laboratories, they usually develop information systems with various degrees of system complexity and various type of functions that they perform depending on their requirements.

The novel developed knowledge based medical information system titled as MSoft follows the current trends and requirements of the contemporary medicine. There are many medical information systems, such as Medica 2002, ECLIPSE, VisualDx, RAMEDIS and OMIM.

Medica 2002 – a medical information system which is used in Republic of Macedonia, is focused on organizing health institutions, but it does not provide information about diseases, their diagnosis, symptoms and treatment. Also, there are many documents, which describe the medicine based on facts, prepared by Ministry of Health but searching through many documents is very time consumptive [[12]]. Based on the performed research, it was noticed that in Republic of Macedonia there is no knowledge-based medical information system, which would support the healthcare institutions, general practitioners and medical specialists with professional expertise and advice. Medical specialists need professional improvement and also they should share their knowledge with other colleagues.

Development of medical knowledge-based information system - MSoft, allows medical specialists and general practitioners to store, share and update their knowledge and experience. By using of this information system it is possible to group diseases in different medical area and to store information about them such as description of the diseases, symptoms, diagnosis, number of registered patients of the particular diseases and pictures that depict particular disease. Thus MSoft enables searching through already stored data about particular diseases: by the name of the disease / keyword or symptoms.

The architecture of the developed medical information system MSoft is shown by using class diagram and sequence diagram. The class diagram consists of three classes (physician/specialist, subspecialty and disease), their attributes, methods and the relationships among objects. While sequence diagram depicts two of the main activities in the developed medical information system - MSoft, such as adding new information about particular diseases in the MSoft and searching into existing diseases.

This rest of this paper is organized as following. The second section surveys the existing medical information systems. In the third section, the development of a novel medical information system – MSoft is described. The last section gives concluding remarks about the benefits from using of this information system and opportunities for improvement and future work on this information system.

2   A review of existing medical information systems

There are many exiting medical information systems used worldwide and in Republic of Macedonia. Medica 2002 - medical software is an information system implemented in public hospitals and it is most widely used in Republic of Macedonia **Error! Reference source not found.**. This information system does not have database with data for various data of diseases. While in the world, there are numerous medical information systems that contain databases of various kinds of diseases. Some of them are: ECLIPSE - Practice Management Software **Error! Reference source not found.**, Visualdx [2], RAMEDIS [4] and OMIM [5].

ECLIPSE is used in a number of small healthcare institutions and it integrates more modules, such as: module for documenting the routine screening of patients, automation storage of data, uploading documents and their electronic transfer, creating individual notes for patients, electronic payment accounts, review of payments, patient synchronization with smart phones and Google calendar, sending SMS and e-mail to patients, making flexible schedule, simulating a layout with more meetings, obtaining reports, the audit system and user logs and on-line support **Error! Reference source not found.**. It can make a backup of the data in multiple locations.

The Medical information systems VisualDx is used to identify the dermatological, infectious, genetic, metabolic, nutritional disorders, benign and malignant diseases and other injuries [2]. Specialists and physicians by using VisualDx can search the diagnosis, keeping records of the progress of diseases for certain patients, or to take into account adverse drug reactions caused by the drugs. This information system covers more than 1 300 conditions for diseases in children and adults.

RAMEDIS is used to detect rare diseases based on the different individual cases [4]. This information system is developed in close cooperation with clinical partners. It collects data for rare metabolic diseases with a number of details, such as symptoms, therapy, laboratory discovering and using genetic data. The data stored in the database can be compared easily with other result. RAMEDIS leads to progress in epidemiology, the integration of molecular and clinical data, and establishing the rules for therapeutic intervention and identification of new diseases.

OMIM contains a database of human genes and genetic phenotypes. This information system contains information on all-known Mendelian disorders and information for over 12 000 genes [5]. OMIM focuses on the relationship between genotype and phenotype. It is updating daily, and records contain a number of links to other resources about genetic perturbations and diseases.

This comparison and analysis of existing medical information systems was a motivation for the development of a novel medical knowledge-based information system that will integrate requirements regarding the database of symptoms, diagnosis and other data specific related to particular diseases.

3   Development of a novel medical information system - MSoft

Medical Information System MSoft is an information system for knowledge management in medicine. This information system is intended to be used locally in the hospital or medical institutions. The purpose of this information system is to enable e-documentation through different kinds of research and searching data and information regarding of particular diseases. This information system allows registration of medical staff, login, logout, and it allows changing the password, adding a information about new diseases, updating information about some diseases and searching of diseases by keywords or symptoms.

Microsoft Visual C # 2010 Express Studio and Microsoft SQL Server 2014 were used for as platforms for development of this medical information system. This information system enables data recovery, it's importing, exporting and processing. The database contains three tables: table for areas of medicine, table for diseases and table for medical specialists.

UML diagrams are used to show the architecture and functionality of MSoft. There are used class and sequence diagrams [0]. The class diagram consists of three classes: medical person, area of medicine and disease and they are created for development of the software solution of this information system. These classes represent the basis of MSoft and they correspond to the table of the database. This class diagram is shown on Fig. 1.

The class **disease** has eight attributes (name of the disease, symptoms, a brief description of the disease, image, number of patients, diagnose, who add disease, who recently add information's) and three methods: adding a new disease, adding a new information for the disease and searching a disease.

The class **area of medicine** has one attribute (name of area) and one method: adding a new area of medicine.

The class **medical person** has seven attributes: name, surname, ID area of medicine, user name, password, role and e-mail and four methods: includ-

ing: registration of medical person, login, log out and change of password.
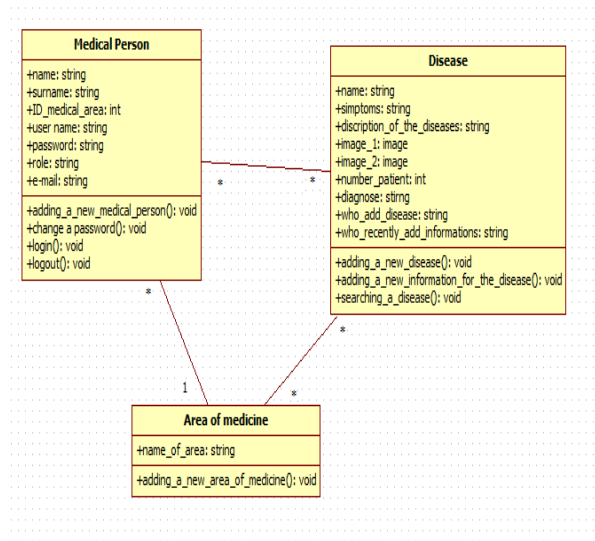
Fig. 1. – The class diagram of MSoft.

The diagram of the sequences, which is shown on Fig. 2, is used to display the three main operations in MSoft:

1. adding a new disease,
2. adding additional information for disease and searching information by keyword of the disease name or by symptom.

The sequence diagram explains two of three main operations of MSoft: searching information by keyword of the disease name or by symptoms and adding additional information for disease. When a patient goes to the hospital, he/she tells the symptoms to the doctor. Doctor has some knowledge and can use it to discover the disease, but sometimes this knowledge is not enough. So doctors can use MSoft in these cases. The doctor can search by symptoms and can discover the disease by searching and comparing the symptoms. After that the doctor knows which drug should prescribe to the patient, and after that can add more information to the system, for example: one more patient suffered by particular disease.
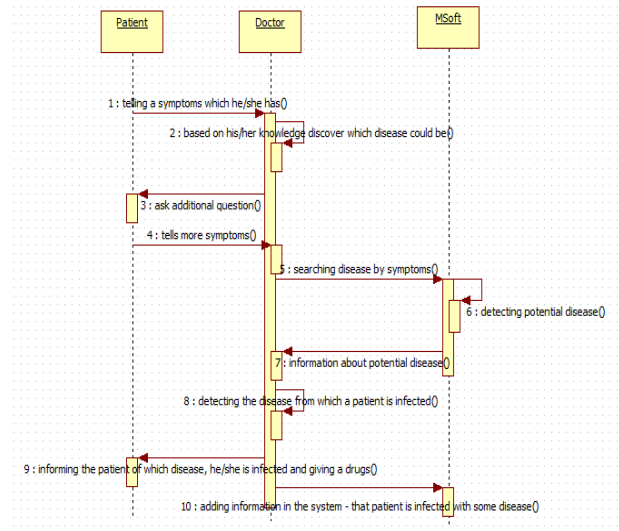
Fig. 2. – The sequence diagram of MSoft.

The user can login as an administrator, editor (medical specialist) or a general practitioner. If the user is login as administrator, he/she will have all privileges in the system. While with editor's or a general practitioner's account, he/she will not have privileges to add a new member in the system (a new medical person) nor to add a new medical area, nor to update them. Users logged in as editors can add a new diseases or additional information about diseases only from their medical specialization, while diseases of other areas are read only for them. User logged as a general practitioner will have privileges only to search diseases and symptoms in the system.

Fig. 3 shows the main windows of the developed medical knowledge-based information systems.
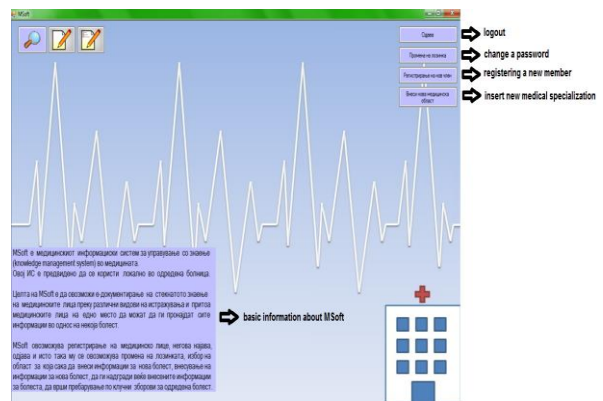
Fig. 3. – The main window of MSoft.

MSoft has main menu and navigation menu. The main menu is for login/logout, changing of password, adding new medical staff in the system and new medical specialization an sub specialization. The aim of navigation menu is for basic operations in MSoft, such as adding a new disease in the system, adding additional information in the system and for searching.

The options for "*logout*" and "*change password*" in the main menu are shown in the main window for

each user. When a user chooses the option "*logout*", the system shuts down all windows and returns the user to the login window. When a user chooses the button "*change password*" then he/she can change the old password. Only administrator can see the options for "*registering a new member*" and "*insert new medical specialization*" in the main menu. By choosing the option "*registering a new member*", a window is opened, where user needs to add values for: the name and surname of a medical person, to select one of the offered medical areas, to add a username, password, e-mail, to select an option for the role (administrator, editor, general practitioner). In this window, user have to enter values in all fields. Medical area and the role have to be chosen from a drop down list. This means that the system is protected from adding incorrect medical specialization or adding medical person from an area that does not exist in the system, and adding a role that is incorrect in the system.

When the user chose the option "*Insert new medical specialization*", a window is opened, where a medical area that does not exist in the system should be added. When the user adds the new medical area, the system immediately is upgraded with added specialization.

The options for "*Search*", "*Adding the disease*" and "*Adding additional information for disease*" are displayed in the navigation menu. All three options are presented to the administrator and editor, while for users with role "*general practitioner*" only the first option is shown. When a user choose the option "*Adding disease*" a window opens where the user needs to choose one of the offered medical areas for which he/she will add a new disease. Then the following values: name of disease, symptoms, a description of disease, diagnosis, the number of registered patients should be added and additionally images can be attached. In this window, the user have to enter values in all fields, except field for diagnosis and image uploading.

When the user chooses the option "*Updating the information of disease*", a window is open where the user needs to choose one of the offered medical area in which corresponding disease belongs. Then the name of disease should be chosen. When the user select some disease, in the window information will be shown, such as symptoms, description of disease, diagnosis, the number of registered patients and disease images. When the information is displayed to the user, then the user can make some changes and updates, as shown on Fig. 4.

Fig. 4. – Windows for updating information about disease

If the user chooses option "*Search*", a new window is open where the user might specify an option for searching: "*Search by the name of disease*" (or keyword of the name of the disease) or "*Search by symptom*". By choosing the option "*Search by disease name*", the user have to add the name of the disease or part (word) from its name and then click on the button "*Search*", as shown on Fig. 5. If the list of diseases is filled with the name of the disease, it means that this disease contains searched word. By selecting any of the listed diseases, all previously entered information about it will be displayed.

Fig. 5. – Windows for searching information by disease name.

When the user choose the option "*Search by symptom*", a new window is opened, where the user can enter some of the symptoms that patient has. Then click on "*Search*", as shown on Fig. 6. If some of added diseases have searched symptoms, then it will be shown in the table for diseases and medical areas. This window offers option to search diseases by clicking on "*Search any of the diseases >>*".
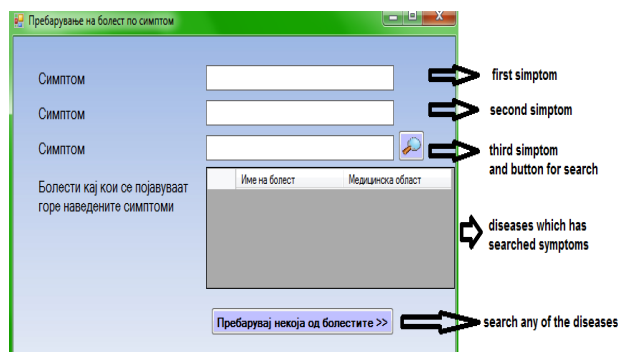
Fig. 6. – Windows for searching diseases by symptoms.

4   Conclusion and further work

Developed medical information system MSoft allows adding and updating information about new diseases of different medical areas and to search it. Patients are the ones who will have a benefit from using this information system, since the main goal of this information system is to make diagnoses of various diseases on time, to determine the most appropriate treatment. General practitioners, specialists, and subspecialists by using MSoft might easier to treat the diseases of their patients and to prescribe most appropriate drugs.

General practitioners might use MSoft to be informed about different diseases, their symptoms, diagnosis, the number of registered patients and to compare patient's symptoms with the pictures of the appropriate disease.

Specialists and subspecialists of a particular medical area, based on their experience, can add a newly discovered disease and additional data about symptoms, diagnosis and treatment Additionally, they can be informed of particular diseases from their specializations, as well other medical specializations, based on experiences of other specialists and colleagues.

As a further direction, MSoft will be upgraded as a mobile application, as well with a module that will provide different statistical analysis, such as: which diseases are part of some medical area, how many times per month are updated data about some disease, in which medical area are mostly diseases, which disease is most updated etc. This information system

also will be connected with other systems in the future for example with a patient-based information system. This connection will provide more useful information about relationships between patients – diseases and patients - doctor. Also this information system will allow prescription of drugs for patients, which suffered by particular disease.

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CRM systems: needs and prerequisites for implementation, creation and usage in the R. of Macedonia

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Abstract - In today's globalized and competitive environment, where differences among products are slight and prices competitive, strengthening the relationships with customers is a priority. Establishing harmonious relations with customers motivates them to be loyal to the company's products and services. For implementation of the process of building relationships, companies use CRM web applications that help in the process of achieving better marketing communication with their customers and gaining more information about them. This paper intends to analyze the usefulness and prerequisites for the implementation and usage of CRM in Macedonia. Also, the paper presents the creation of CRM web application in Macedonian, using analysis of off-the-shelf software, in order to show the basic needs for CRM through practical examples. We also consider prerequisites for implementation and benefits for the companies, employees and customers. The empirical research, conducted through a web survey, was done in Macedonian companies in order to detect how CRM web applications affect the overall company success, as well as some segments of their business.

I. INTRODUCTION

Nowadays in the globalized and competitive environment, where differences among products are slight and prices competitive, strengthening the relationships with customers should be a priority for any successful company. With the establishment of harmonious relations with customers, the company motivates them to be loyal to the company's products and services. For easier implementation of the process of building relationships, companies use web applications that help achieving better marketing communication. Acquisition, analysis and use of customer insights are made by using web-based information systems that support customer communication - Customer Relationship Management software (CRM). CRM collects information from all sources inside and out of the company and manages customer relationships, and makes communication fast, accurate and effective.

The purpose of this paper is to analyze the use of CRM in Macedonia, how much it is needed, as well as the prerequisites for their implementation and design. CRM web applications made for this purpose show the focus of CRM on the customers through practical examples. Also, we consider prerequisites for implementation and benefits for the compan, employees and customers For CRM web

application design, we use Eclipse and PHP. Also, we did an empirical research , in order to detect how CRM web applications affect the overall company success and some segments of their business. The web survey was conducted in companies that use web applications for web promotion and CRM in the Republic of Macedonia.

II. RELATED WORKS

Customers are the essence of any business and the success of the company relies heavily on efficient relationship management. The focus in CRM is on building relationships and communications with customers, to retain them and to get new ones. This way they would improve profitability. With the development of CRM, we have richer definitions of the objectives, logistics and the multilayer nature of CRM.

According to Law (2009), the CRM concept is described in works mainly connected with marketing and information systems. Judith W. Kincaid [8] sees CRM as strategic use of information, processes, technology and company' customer relationship management (marketing, sales, service and support) across the whole customer cycle. Parvatiyar & Sheth [8] have defined CRM as a comprehensive strategy and process of acquisition, retention and selective partnerships with customers to create superior value for the company and customers. CRM integrates marketing, sales, customers service and supply functions of the organization to achieve greater efficiency and effectiveness in the delivery of customer value. Information technology (IT) and information system (IS) can be used to support CRM and integrate the CRM process.

CRM in practice can be seen as a business strategy as well as a software set. The database is the core of CRM. CRM applications fully exploit technological innovations to collect and analyze customer data, to interpret customer behavior, to develop practical models, which have to respond to individual users. This includes policies to define the processes, staff training, marketing systems and information management. Therefore, it is important that any CRM implementation goes beyond technological considerations to broader organizational requirements. According to Gray [5], CRM means a dramatic business

improvement, business efficiency enhancing, and decreasing the cost for lost sales.

In most cases, these systems were designed to automate and enhance the user-support center, e-mail channels as well as company's mobile applications. These types of programming tools, software applications and services form eCRM (Electronic control of relationships with customers). The concept derives from the consolidation of traditional CRM and e-business applications and covers a wide range of IT used to support the company's CRM strategy.

eCRM systems are technologies used by companies to enhance and change their marketing capabilities. Bringing together technical and marketing elements, eCRM covers the experiences of online customers through the entire transactions cycle. Jutla [1] states that eCRM is the care for customer relationships in e-business. Greenberg thinks that eCRM is indeed CRM online. According to Romano and Fjermestad [12], eCRM is concentrated to attract and maintain economic value with customers and eliminate those that are less profitable. Rosen says that eCRM is about people, processes and technology. According to Romano [12] and Fjermestad [1], there are five main, but not exclusive, research areas: eCRM market, eCRM business models, eCRM knowledge management, eCRM technology and aCRM human resources.

In e-sales context, Sterne [3] proposed framework for categorizing the online consumer experience, which consists of 3 parts: pre-sale, sale and post-sale. Lu also used this framework to study the effects of e-sales functionalities of satisfaction, showing that eCRM features participate in different way in various transaction parts. The usefulness of the transaction cycle is also supported by Khalifa and Shen [10], who explore close contributions from pre-sale, sale and post-sale in the creation of total customer satisfaction. eCRM has a number of features and utilities: Contact management tools, data recording, search tools, casual summary, review of related items, customers and self-serving. The differences between CRM and eCRM are small and subtle, but very important. They relate to underlying technologies and their interfaces with users of other systems. Pourasghar [3] didn't think that there are differences between CRM and eCRM. Thought given strategic perspective, there are differences between CRM and eCRM although both have the same main objective, to increase the value for the customer lifetime and reduce service costs. However, in the process at this level, he added a few differences between the two concepts that have become apparent. He added that, when in certain time periods particular conventional communication processes are canceled, eCRM allows companies to operate in real time and most of these interactions with customers become transparent, so they have a greater ability to draw conclusions about their customers as well as to measure the success of their activities. Unlike CRM, eCRM processes enable a high level of conventionality.

According to Pan et al. [3], eCRM extends traditional CRM techniques by integrating technologies and new electronic channels. eCRM solutions supports marketing, sales and service and the progress of web-based technology and market dynamics, forcing companies to adopt eCRM. Although there are features that differentiate them [3], they have the same goals. The differences can be analyzed on the basis of characteristics such as: strategy, contact with customers, processes, prioritizing goals, emotional deals, transactions, type of communication, data warehouse, labor force, data retention, restrictions and accent.

All CRM data gained from customers have to be used according the of Privacy protection Law, which means a high level of data protection. Customers want confirmation that their data will not be shared with third parties without their consent.

III. CRM AND IT SUPPORT

With effective CRM as well as their proper implementation in the company, more benefits can be realized, such as centralized data, marketing automation, automated workflow and CRM solutions adaptability. CRM is a central joint system for contacts, calendars and files. In CRM, the history of each particular customer can be easily followed in order to help in monitoring events as well as tasks and appointments with customers. Also, it allows a shorter sales cycle, effective marketing, industrial segmentation and other benefits. Besides direct, indirect benefits are administration cost savings, efficiency of teamwork and increase in staff motivation. Advanced security and control in all areas are achieved as well as adjustments of groups or individual attitudes [13]. Many company benefits from CRM are actually benefits for employees and for customers.

Three types of CRM systems are used by the companies: analytical CRM, operational CRM and collaborative CRM [7, 11]. Analytical CRM is a segment of a larger picture with purpose to analyze customers' data, their progress, modeling and prediction of customers' behavior. Usually this is a data warehouse where, by using data mining, patterns of behavior are detected and target groups of customers are created. It also evaluates the effectiveness of a marketing campaign, proposes prices, helps in developing a new product or is used as a decision-making tool. Operational CRM mainly supports contacts with customers, direct customers' interaction through various channels of communication whereby whole communication is stored in the database and may be reviewed when necessary. Operational CRM is effective only when it is in symbiosis with analytical CRM. Collaborative CRM allows creating distribution channels and sharing information about customers to make the process result in an increase of number of new customers and enhancement of their loyalty.

Because IT has an important role in CRM concept, companies must be ready and able to adopt the whole philosophy that directs the focus on customers and data to be stored in big repository for gaining more information. Processes with customers data have to perform the basic tasks, analyze the patterns of customer behavior and turn data into information. The information is sent to the operating system component that enables information to be used for efficient and personalized interaction with

customers. The user sees the system as an activity directed to them and react to it [7].

A. CRM trends: Mobile and Social CRM

The new trends inevitably require data access and communication with customers from anywhere at any time through smart phones and other mobile handheld devices so many companies have introduced mobile mCRM applications. Rainer and Cegielski [4] define mCRM mobile applications as interactive CRM systems, which enable a business to carry out sales, marketing and services to customers using the mobile medium.

Mobile CRM applications are similar to company CRM applications, but are mainly intended to supplement the existing ones. However, implementation of CRM requires investments, which will pay off in time in multiple ways. Users of mobile CRM applications rely on synchronous technology to transmit data at the server. Synchronization should be in real time because of the necessity of obtaining accurate data. Applications as: Salesforce mobile, SugarCRM Mobile, Sales CRM EZ!, 2do CRM and Microsoft Dynamics CRM address these problems by placing strategic focus on mobile CRM applications.

Social media and other Web tools play an important role for CRM and have a significant impact on the way customers interact with the company, whether companies have control over sales as well as marketing and service of their products. They are intensively used as a tool in communication and are important for social communication because they cover a wide range of communication: social networks, blogs, forums, websites for media sharing as well as collaboration and communication tools. In each of these groups that are contained in social media, there are numerous subgroups. Social CRM is a philosophy and business strategy, supported by the technology platform, business rules, processes and social characteristics in order to engage in conversation and cooperation with the customer in order to provide mutual beneficial value in a trusted and transparent business environment [6].

Social CRM [14] enriches CRM system with: full customers' overview, faster information gathering, rapid and timely support and customers' response as well as customers' engagement. Therefore, in the future, it is necessary for the social media and CRM to be a fundamental and integral part of the communication strategy.

B. Successful CRM planning

Planning is the first and most difficult step when the success of the project is considered. When implementing a CRM system in the company, it is necessary to develop a plan that will help in the CRM implementation. The plan should include: Extensive Company commitment (Gain Enterprise-wide Commitment), creating CRM project team with management, information services and technical groups, trained users of the Sales, Marketing and Finance systems as well as external an CRM expert from whose engagement the success of CRM implementation will depend. The analysis of business needs also have to

be made and for this purpose CRM survey has to be carried out. This survey has to consider questions of areas of proper identification of business functions, which will reach optimal CRM solutions. CRM action plan should answer the questions that are essential to the success of a CRM project. Industry standard for cost estimating indicates that 1/3 of whole cost accounts for CRM software and the other 2/3 are costs for consulting, implementation and training [7]. Comprehensive cost analysis is given in the following Figure 1.

Further considerations involve accurate combination of software and technology vendors' identification. Some companies choose in-house development of their own CRM. If so decided, CRM software should provide at least the following functionalities [9]: contact and control of customer management, customer sales and services management, marketing, business intelligence, management guide and e-commerce. This functionalities list is created according to Jim Dickie (Managing Partner of Insight Technology Group), a research that was carried out in 144 companies [7] who have identified their own main criteria when choosing a CRM system.

CRM success depends on the commitment in the strategic implementation through all 7 stages of CRM implementation [9]. But system administrators should commit entirely to provide continuous support for the system users and allow flexibility of the system, from technical aspect. Creating in-house custom application has many benefits, but also disadvantages for the company. Despite the administrators' commitment, it requires additional programmers' support to company's users.
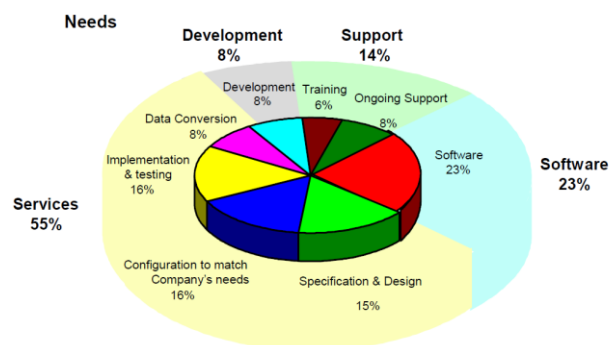
Figure 1 Graphical view of costs [7].

IV. CRM SITUATION IN R. OF MACEDONIA

The empirical research made by the authors of this paper was designed to detect how much the companies in R. of Macedonia use CRM and web applications for marketing communication. This is a quantitative research, which uses categorical data through a web survey, carried out in manufacturing and servicing companies in R. of Macedonia. During June-July 2014, in almost all cities in Macedonia, 250 surveys were sent to companies via email (random sample of companies that are present on the web), 100 surveys were sent through the social network Facebook and others through direct meetings. The survey was short, clear and precise, composed of 21 questions that had offered 5 categorical responses (categorical scale)

and focused on the use of web-based systems for CRM, marketing and advertising.

From the received survey, 110 responses were obtained, from different companies' branches, with a uniform distribution of participants by age, education and gender. The results that were obtained were statistically processed. 79.1% of respondents expressed that they always use the Internet in the company; most of them use CRM and systems for marketing and advertising (72.2%). By connecting the results through correlation analysis, it was concluded that respondents considered that the symbiosis of Web applications for marketing communication and CRM systems will positively affect the increase of interest of customers to target products and thus increasing the sales of products and services. This is confirmed by the results of the survey, because 53% of respondents said that using a CRM and such web applications would increase sales, and 57% consider that with promotional campaigns conducted through such applications will increase the interest of customers and sales thus improve the company's competitive position on the market.

V. DESIGN AND FUNCTIONALITY OF CRM

In order to develop CRM web application, a methodology of off-the-shelf software analysis was used to have an insight into the functionality and consider the possible benefits. In accordance with this analysis and detected customer needs, a database was made. Depending on the employee's position, there are different interfaces of the application. Because every employee in the company has different responsibilities, they need the application to portray this model and structure and design the application according to them. Therefore, the initial form contains a login where the user enters their username and password which has previously been stored in the database.

When the administrators sign in, a screen opens so they can manage contacts, appointments, have an overview of all employees, their contacts, meetings and phone calls to be performed, an overview of products and graphic statistics of sales in the past few years. They also have access to the current projects of the company. Unlike administrators, other staff members that are signed in have different screens because everyone needs to manage their own part and have access to it. For the company data protection, the application is created according to business ethics. When the employees are taken into consideration, all of them are shown limited data significant to their position in the company (Fig. 2). The application has the ability to send email to every employee and customer. The contacts are an important resource and therefore a screen where the user can manage them is created (Fig.3).

From the Meeting menu, data for a meeting or phone call can be added or enroll detailed information about meeting such as location, time, people and more. This task is created in order for the employees to have a better overview of their obligations and to have all information about meetings thet have to be made in one place (Fig.4).

In order to find all information about products and services in one place as well as to make a direct
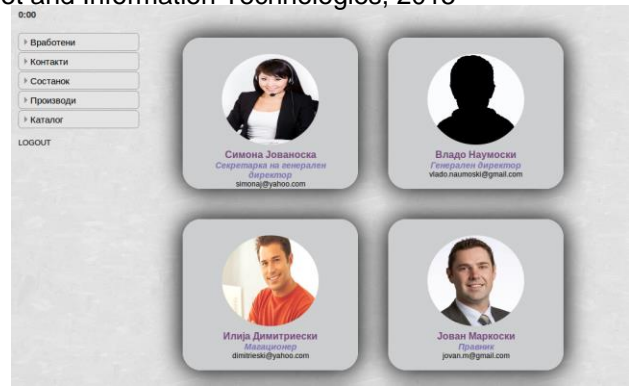
Figure 2 CRM screen for preview of employees

comparison with last year sales, the Products overview is made (Fig.5). It is always necessary to have information about the available products, their price, and their quantity of sales in the past year.

In Fig.6, a graphical representation of sales of products for the previous four years is shown. It is possible to select from administrator's menu. This graph can't be seen from the other users of this application. In this figure the possibility of selection of products is built and can be
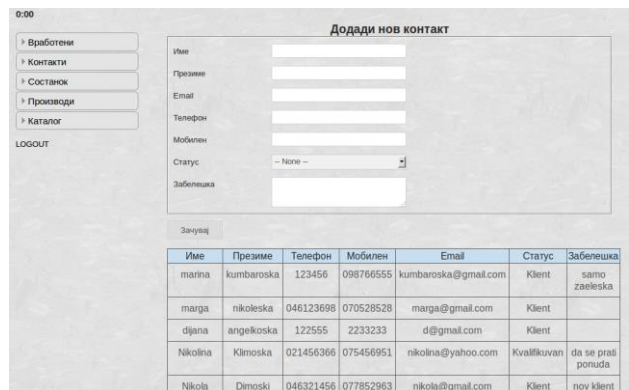
Figure 3 CRM Screen for contacts' view

designed with the other data depending on the company's demands.

The links to social media that are embedded in the application are usually considered as parts of CRM applications. In order to share information about new or existing products, administrators have to select section Catalog. This section displays all company's products with details and pictures. Each product can be shared on social networks: Facebook, Twitter or Google+ and others, if it is necessary – Fig. 7.

According to the new economy principles, the company functions and survives thanks to projects, so it is necessary to share the plan for future project activities that the company intends to launch or take, as well as put light on the existing projects with the ability to create new ones (Fig.8).

Figure 4 CRM screen for adding new meeteng and the overview of saved ones

Figure 5 CRM overview for contacts' products

The managers and team members, with such overviews, can easily access information that will help in easier decisions making process. The use of the
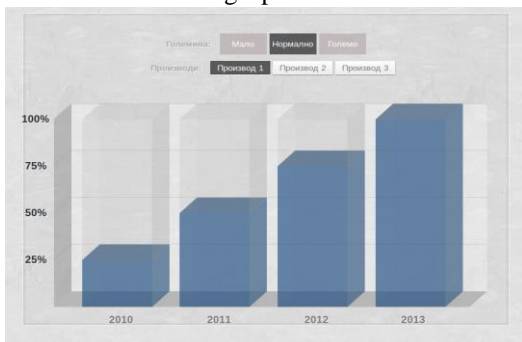
Figire 6 CRM graphical representations of the past four-year sales
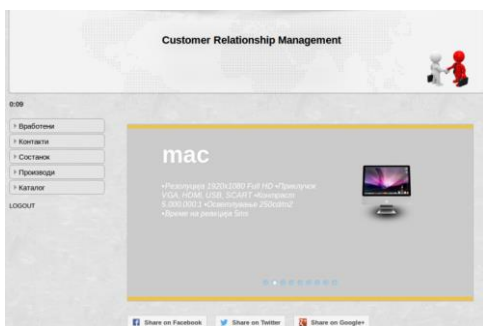
Figure 7 CRM overview of catalog of company's products with links to social networka

applications does not necessary require additional training, short course for administrator is sufficient, because it is easy to use it, if the users have basic computer knowledge.

Apart from the many advantages provided by this and other CRM applications, the main things that attract customers or companies to use it, is reduction of investments in additional software tools for collaboration, access anytime from anywhere, easy to use, centralized data and records for customers, each employee overview and summary, facilitated communication within the company and with customers, easy promotion for target groups of customers with information about the meetings, product availability, real time sales information in managing real time project activities. As part of the corporate ERP solutions, they are integrated into corporate databases and enable connection with supply chains and manufacturing systems.

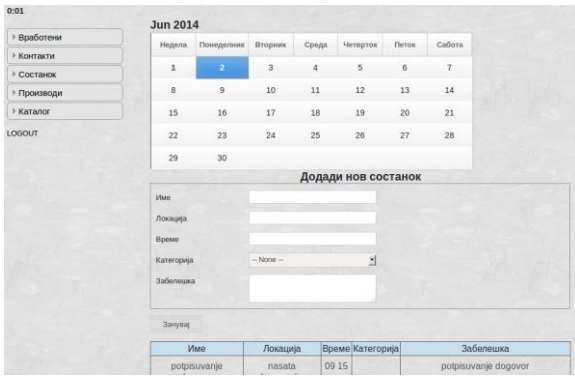Because of the many positive CRM features, many companies wish CRM to become a part of their business, as they consider that these applications will achieve their goals and will also increase their profits. Despite the advantages offered by the application, depending on the needs of the company or the customer's requirements, some changes in the implementation can be done. Additional changes made on CRM application, would certainly increase the number of positive features and benefits for the company.
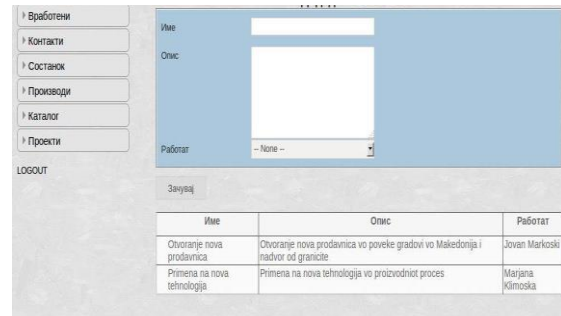
Figure 8 CRM screen for managing new projects and projects' overview

VI. CONCLUSION

Today, companies are faced with intense competition and more demanding customers and the speed with which they have to make decisions increases constantly. Therefore, Marketing management information system and CRM systems are demanded. They follow the processes that are interconnected in the company, often through CRM web applications. With a combination of marketing objectives and modern Internet technologies, CRM systems and social networks, companies receive tons of information, which can be used as tools in the struggle for survival in the marketplace. These CRM tools can recognize the needs and desires of customers, learn about competition, introduce new technologies in manufacturing and other processes. CRM systems are focused on improving customer centric processes, applying of technology and knowledge to assist companies in increasing the quality of services and

products, responsiveness and decision making process. Managers should be involved in planning and CRM implementation to ensure the project success.

In order to detect the usage of CRM in Macedonia, a research was carried out in the companies which showed that many of them use some form of website promotion systems and CRM. Many of them are familiar with their capabilities and expect and believe that the usage of such systems will give excellent results in their companies. The survey confirmed that some companies in Macedonia are already using some kind of marketing promotions via the web (72.2%) but very small part use classic CRM systems (3.1%). Others consider implementing CRM because of the conviction that it will contribute to more sales (63.3% are convinced, and 26.5% think so) and a better position on the market (78.9% are convinced that it is so). To demonstrate the basic functionality CRM web application was developed that provides basic needs such web CRM system.

It is good to note that companies, i.e. their employees, often have to be educated in new technologies and systems that will contribute to increase their skills and thus contribute to the company's development to achieve its goals. Perhaps education of managerial structures capabilities of CRM can increase the use of CRM as only 35.5% of respondents knew exactly what CRM systems are, and many (63.4%) felt that they needed education on CRM systems.

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Cloud computing as a challenge for Macedonian companies

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Abstract

With the rapid development of technology in the 21st century companies are forced to follow them and improve their business process in a way they will be more competitive.

Cloud computing is emerging as a result of the need for increased capacity and new capabilities of existing information infrastructures without investing in a new structure and additional staff. The concept and idea of Cloud computing is revolutionary in terms of offering a new way of data access and applications.

Some of the biggest benefits of this technology are the new opportunities it offers, especially for business operations. Companies no longer have to invest funds in expensive information infrastructure because they can use Cloud computing services only when they are needed and thus companies can reduce operating costs.

In this paper will be defined the concept of Cloud computing and existing models that are available to users. Also, will be presented the situation in Macedonian companies regarding to the use of Cloud computing software solutions as an alternative to the existing solutions that are currently used. This paper will also cover the challenges and opportunities that are facing the Macedonian companies with in the implementation of this relatively new concept.

I. INTRODUCTION

The evolution of ICT continues to be with accelerated pace. Companies are faced with a new challenge for the implementation of new modern technology. With implementation of Cloud Computing concept companies can transform their business models and achieve competitive advantage. Cloud Computing can be seen as a digital, virtual as a whole of all available hardware and software resources related to proper design and architecture. The connection is realized both, through the Internet and through the local networks.

National Institute of Standards and Technology gives the following definition of Cloud computing:,, Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction". [1] According to Gartner Cloud computing is "a style of computing where massively scalable IT-enabled capabilities are delivered 'as a service' to external customers using Internet technologies [2]. Forrester gives the following definition: "Cloud computing is a pool of abstract, highly scalable and administrated IT infrastructure, which provides applications for customers and is invoiced based on use." [3]

Cloud Computing, can also be defined depending on whether it is used by specialists or users. Namely, for ordinary users it will be a new and cheaper way of using programming solutions that will be hired if they are needed. While for information specialists cloud computing represents a new business model or a new technological platform.

From the definitions found in literature can be noted five basic features of Cloud Computing. They are shown in the following picture: [4]
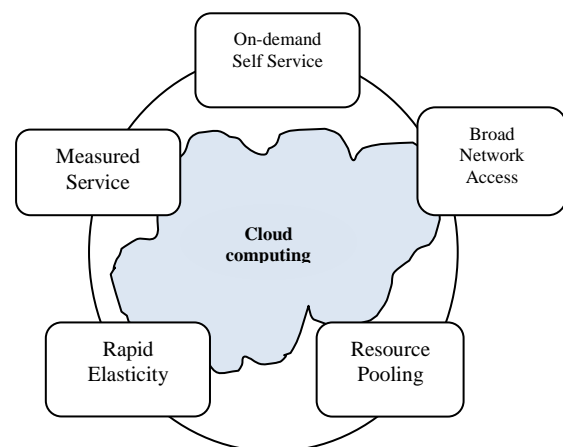
Figure 1. Basic features of Cloud computing

[1] http://csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf
[2] Gartner, Inc, Cloud Computing, Defining and Describing an Emerging Phenomenon, June 17, 2008, p3
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    (http://www.computerwoche.de/knowledge_center/software)
[4] Chris Harding, Cloud Computin for Business-The Open Group Guide, 2011, Van Haren Publishing Zaltbommel

- On-demand services - consumers use computing resources directly, without having to establish interaction with service providers. They receive services at any time, whenever they need it.
- Broad network access - the resources are available across the network and allow access from different client platforms (mobile phones, laptops, etc.). This availability is realized through standardized mechanisms. The application of standards is fundamental for greater access to services.
- Resources pooling - more organizations can share main physical infrastructure. This provides a significantly greater purchasing power for these companies because they usually can get access to more resources than in the case of acquisition of own physical infrastructure. It is necessary to emphasize that this concept of a shared infrastructure is secure. However, with proper protocols and procedures, security risks can be reduced with the cloud security operations.
- Rapid elasticity - the services must be fast and always available. Users of cloud services must feel like they have unlimited resources at any time. In fact, it seems that cloud computing resources are infinite or automatically available. This is an important feature compared to the conventional computer systems, where the boundaries of storage are immediately visible to the user.
- Measured service - in other words, pay per use. To describe this component, it is necessary to differentiate the properties of cloud services that are measurable and to specify their metrics. Measurability of services is a key factor for the selection, operation and use of cloud services.

Through these characteristics are perceived benefits of Cloud computing, and they make a distinction between the traditional model and Cloud Computing. These differences are summarized in the following table:[5]

	Conventional Computing	Cloud Computing
Acquisition Model	Hardware, Physical Space, Infrastructure of installation and operation	Service acquisition
Business Model	Cost and depreciation of assets, Administrative overhead (maintenance, support, safety of equipment, refrigeration)	Payment based on demand
Access Model	Internal network, Intranet	Internet, through various types of devices
Technical Model	One tenant, Without sharing, Static	Scalable, Elastic, Dynamic

Table 1. Differences between traditional model and Cloud computing

II. CLOUD COMPUTING MODELS

From aspect of physical layers related to the way of access of users to technology and the way of use, the models are categorized as: [6]

- Infrastructure as a service (IaaS). This is the lowest level of service which is offered to users of Cloud Computing and provides controlled access to the virtual structure upon which operating systems and application software can be deployed. Basically, this model applies to servers, networking and storage as services offered to users. This model is particularly suitable for companies that want to maintain the existing platform and data warehouse, but they need additional infrastructure in a quick and inexpensive way. Using of this concept is facilitated by applying of virtualization which enables to service providers control, management and efficient use of resources and allows to customers greater flexibility in the configuration of resources.
- Platform as a Service (PaaS). In this model, users do not manage or do not control the underlying Cloud infrastructure, but have control over operating systems, storage and applications. This model is similar to the traditional web hosting, where customers rent geographically distant servers that already have installed additional platforms. The key difference is great flexibility in terms of offering the services. In this model the service provider is responsible for all operational aspects of the service as well as maintenance and the payment based on the amount of used resources and information.
- Software as a Service. In this model, applications are accessible from various client devices. Users do not have control the underlying Cloud infrastructure, including the network, servers, operating systems and storage, but their only responsibility is input and manage their data by interacting with the software that they use. In other words the users have the opportunity to use the available applications that are in the Cloud infrastructure. In this model, the costs are significantly lower compared to traditional services.

The benefits and drawbacks of each service models of Cloud Computing, in terms of users and providers of Cloud Computing are given in the following table: [7]

[5] CEARLEY, D. et al – Hype Cycle for Application Development – Gartner Group report number G00147982 – Technical Report Gartner group. Available at: http://www.gartner.com/, 2009.

[6] Alexandre di Costanzo, Marcos Dias de Assuncao, Rajkumar Buyya,Harnessing Cloud Technologies for a Virtualized Distributed Computing Infrastructure, IEEE Internet Computing, Published by the IEEE Computer Society, September/October 2009

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	Benefits for Cloud Users	Drawbacks for Cloud Users	Benefits for Cloud Providers	Drawbacks for Cloud Providers
IaaS	Scalable infrastructure Portability	Virtual machine management Manual Scalability	Focus on hardware Exploiting internal structure	Underprovisioning and overprovisioning
PaaS	Development platform No hardware and server management needed	Forced to Solution in the Cloud	Focus on infrastructure and platform	Platform development
SaaS	Pay-per-use Update	Date Lock-in	Maintenance	Infrastructure needed Responsibility

Table 2. Benefits and drawbacks of Cloud computing services models

Despite service models there are also deployment models which are categorized as:

- Public Cloud Computing is available for the general public and is managed by an organization, which can be of a different type (business, academic, NGO, etc.). Usually it is built on standard and open technologies, providing web page, API or SDK for the consumers to use the services. In this model provider owns and manages the infrastructure of Cloud Computing
- Private Cloud Computing refers to a particular organization. In this model the resources can be managed by the organization from a single point and allocates resources as needed. This model contains many of the features of public Cloud Computing such as: pooling, self-service, elasticity and pay per use. Virtualization is an important component of the private Cloud Computing where there is continuous abstraction of computing resources from infrastructure and machines.
- Hybrid cloud environments are often used where a customer has requirements for a mix of dedicated server and cloud hosting, for example if some of the data that is being stored is of a very sensitive nature. In such circumstances the organization may choose to store some data on its dedicated server and less sensitive data in the cloud. Another common reason for using hybrid clouds is where an organization needs more processing power than is available in-house and obtains the extra requirement in the cloud. Additionally, hybrid cloud environments are often found in situations where a customer is moving from an entirely private to an entirely public cloud setup.

The benefits and drawbacks of each deployment models of Cloud computing are given in the following table:

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	Benefits	Risks
Public Cloud computing	-Fewer security concerns as existing data center security stays in place -IT organization retains control over data center	-High investment hurdle in private cloud implementation, along with purchases of new hardware and software -New operational processes are required; old processes not all suitable for private cloud
Private Cloud computing	-Low investment hurdle: pay for what you use -Good test/development environment for applications that scale to many servers	-Security concerns: multi-tenancy and transfers over the Internet -IT organization may react negatively to loss of control over data center function
Hybrid Cloud computing	-Operational flexibility: run mission critical on private cloud, dev/test on public cloud -Scalability: run peak and bursty workloads on the public cloud	-Hybrid clouds are still being developed; not many in real use -Control of security between private and public clouds; some of same concerns as in public cloud

Table 3. Benefits and risks of Cloud computing deplyment models

When it comes to which of these models need to choose despite the benefits and drawbacks which are listed in the previous tables must to be taken into consideration and a number of other internal and external factors that influence that choice.

Because of the limited paper these factors will not be considered.

III. CLOUD COMPUTING AS ALTERNATIVE IT SOLUTION FOR SME'S COMPANIES

Cloud computing is widely known as a technology that changes the perception of how things are going to the ICT sector. With the implementation of Cloud tools or the use of this technology undoubtedly every company making a big step forward not only for the material aspect of that decision, but even more because of the impact what this decision will have on the management and resource management in the company. The approach of management to apply new technology in daily operations is an additional value for the company and for the employees and is a step forward in the corporate business working of the company.

Cloud Computing offers services that are much lower costs for data centers of medium and small size and still allows to make a good profit. Application of Cloud Computing concept can help small and medium businesses dramatically reduce their cost for information technology. Benefits resulting from the use of Cloud Computing solutions enable small businesses to bring products to market faster because those who use Cloud Computing can receive access to infrastructure which until recently had access only large companies.

According to studies made in this field, Cloud Computing is an alternative IT solution with far lower costs compared to traditional ICT solutions. It concern traditional IT solutions that are managed internally within the company. Cloud computing is one of the best ideas

that have emerged in recent times because it is one of solutions for SMEs compared to traditional ICT solutions that have been used. It stems from the fact that such services are paid depending on the time and range of use that enables the company successfully managing their own costs. Also these Cloud services are acceptable as an alternative solution for small and medium companies because drastically reduce hardware costs, licensing costs for software, maintenance costs and the costs of providing highly specialized ICT staff. Thus, viewed in terms of costs that are making for information technology, the focus from capital expenditures the company has transferred the operating costs. In addition to the aforementioned costs here should be taken into account and the cost of infrastructure, capacity of the devices, data redundancy etc., that using Cloud computing concept is on the provider of the service.

Often cost for IT technology are serious obstacles for small and medium companies in the implementation of information infrastructure in the company, but with the use of Cloud Computing concept this barrier has been overcome. In support of this argument goes the fact that the value of computer equipment falls very quickly. For example, after the purchase of a computer for a very short time it will not meet the needs of the company that are resulting from the increased volume of tasks facing the company.

The most of small and medium-sized companies often use products that are part the software package Microsoft office (Microsoft Word, Excel, PowerPoint, Access) which depending on the version offered cost of $ 99.99 for Office 365 Home to $ 399.99 for Office Professional 2013. On the other hand Google offers the option of using cloud-based solution Google Apps, which costs only $ 5 per month or $ 50 a year per user. Despite the lower cost of using this solution users have the option to use a larger number of applications such as: Gmail, Google Calendar, Google Groups for business, Google Docs, Sites and Videos for business etc.

Therefore, cloud-based software applications represent very good alternative to traditional software solutions which until now were used by the companies. It is even more important because of the fact that if until recently these cloud applications can use only large corporations today on the market there are a growing number of applications for small and medium-sized companies.

IV. CHALLENGES AND OPPORTUNITIES FOR MACEDONIAN COMPANIES IN THE IMPLEMENTATION OF CLOUD COMPUTING SOLUTIONS

As an indicator of probable future growth of Cloud computing is that companies often accept it as a reality in their business activities. If the functionality of the applications previously is described as web-oriented applications, today this functionality is called cloud-oriented applications. This shows that Cloud computing

is a concept that is beginning to be widely accepted as by vendors of software solutions and service providers but also by users of Cloud computing services. Thus much of the everyday operations of companies are transferred to the Cloud environment.

When it comes for implementation of Cloud computing concept in Macedonia, one can still say that it is a concept that is relatively new for the Macedonian companies. The main reasons for this is primarily the challenge with who are facing the Macedonian companies in terms of implementation of new IT concepts and problems that this is relatively new IT technology. One of the major problems facing the Macedonian companies is that in the region there are only a small part of Cloud computing operators which exclusivity has telecom operators because they have the financial power for large investments. For example, in Macedonia only relevant infrastructure that to some extent can satisfy customer needs is T-Home infrastructure. Macedonian Telekom Cloud Program makes available its superior technological infrastructure and extensive experience to all companies regardless of their size.

It is very important to take into consideration what is Cloud computing service and what not. Website hosting or e-mail hosting does is not Cloud service, or if the solution is placed on virtualization and automation not mean that it is a Cloud service. But, because models such as software as a service, platform as a service and infrastructure as a service provide an opportunity to measure indicators as how customers can access modules that are used, transferred data, etc., so entering the field of Cloud computing. Most providers in Macedonia are offering some Cloud service primarily offered in the field of Software as a Service, where such services are often tailored for small and medium-sized companies. The first and perhaps the only serious provider of Cloud services in Macedonia is Neocom company with its NeoCloud platform aimed at companies and individuals who want to focus on the primary business objectives. NeoCloud platform is based on virtualization from VMware with complete automation and management software tools from vendors VMware and HP. Cloud services of this operator are provided by two data centers in Stretched Metro Cluster configuration for higher availability.

According to all previously stated it can be concluded that the greatest problem for Macedonian companies perhaps is the insufficient supply a small number of providers who offering Cloud services, which is essentially is a problem of entire EU because most of the major providers of Cloud computing is the United States. There are only a few serious Cloud infrastructures in Europe as a whole who can meet the needs of companies for Cloud services.

Another problem with who are facing companies in Macedonia is the incompatibility of Cloud platforms. A serious problem is when a company wants to transfer data from one to another provider no matter what the reasons for it. And perhaps the most serious problem in

Macedonia is the lack of high-speed broadband Internet. When it comes to using any Cloud solution that involves using permanent and stable Internet connection in order to avoid damage and data security. Much of the world's service providers offer the ability to transfer data measured in GB / sec while in Macedonia is still the transfer of data measured in MB / sec even in K / sec.

According to study made by MASIT (Chamber of Information and Communication Technologies) the term Cloud computing is still not well known for Macedonian companies [8]. Just like in the developed countries for Macedonian companies greatest concern is the safety and control of data. Also most companies consider a major drawback the lack of adequate training on the use of Cloud solutions. This research confirmed what was previously mentioned that the Macedonian companies believe that the biggest problems relate to the lack of technical support and complications related to migration of data. Finally, perhaps one of the main reasons for insufficient use of Cloud computing concept stating weak support from top management to implement this concept. The combination of all the above mentioned factors conditions the weak application of Cloud computing concept in Macedonian companies.

Despite the aforementioned challenges facing the Macedonian companies in the application of new information technologies however, technological development worldwide requires new concepts to slowly penetrate in business operations of Macedonian companies. There is also growing interest not only of the industry but also the academic community for the development of Cloud computing in combination with increasing the competitiveness and productivity of Cloud providers. Also, if until recently Cloud computing was a privilege only for large corporations today the market is increasingly offering Cloud solutions for small and medium businesses that are at an affordable price. The application of Cloud computing concept increasingly affects the development and increasing use of portable devices such as tablets, smart phones, laptops, etc. which would serve as a kind of remote management of data stored on servers in a Cloud provider. Despite these factors who will contribute to the future greater implementation of Cloud computing concept of Macedonian companies, there are other factors that can influence whether Cloud computing will be successfully implemented by Macedonian companies in their operations. As part of those factors can be listed:

- competitive advantages which enabling Cloud computing concept
- support from top management
- size of the company
- type of industry in which the company operates
- competitive pressure

It may be noted that none of these factors are purely technological factor, in other words, the decision on the acceptance and implementation of new technologies often is not in the hands of specialists in the field of technology, but this decision is in the hands of company top management.

V. CONCLUSION

Cloud computing although is existing in a nearly time as a concept no longer represents something completely new, but rather some services that were previously present on the IT market are now included as part of this concept. Also if until recently the use of such modern software solutions were a privilege only for large companies today come on the market a growing number of cloud solutions for small and medium-sized companies. Macedonian companies are faced with the same problems that are common to all small and medium sized companies from developing countries. As part of these problems could indicate a lack of sufficient high-speed broadband Internet, lack of adequate training, insufficient technical support, complications related to migration of data, resistance to work changes, security and privacy of data etc. However, as in the rest of the world, the implementation of Cloud computing in Macedonia have expected a bright future in terms of the benefits that are derived from this concept, which are far greater than the risks of its use.

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[4]www.ibm.com/cloud-computing

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Management Information Systems

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Abstract: Today it is much more necessary to develop a management information system. That is why it is necessary to find the most effective and efficient way of using information in order to better business it's necessary develop an information management system. The research in various areas in the city of Zrenjanin, we came to the conclusion that the hypothesis from which we started confirmed. An increasing number of companies both in manufacturing and in service industries includes an increasingly improving and developing information system. We wanted explore the extent to which are in our area are represented analytical, transactional and expert systems. Actually we want show in which areas is the most represented each of these systems of data storage. Data warehouse is a set of of data on which it is based support system in decision-making. We found out that service sector to a greater extent uses transactional model, However, the industry for which we need broader analysis of data uses analytical data processing. Actually managers who want a quick review on information without a detailed analysis of of data. Data warehouse is one of the important trends in the industry because of the need that producers be more competitive and closer to customers.

I. INTRODUCTION

Today functioning organizations and governance of the organization its process is very difficult without adequate data from information and knowledge. strategic advantage easier troubleshooting in business with increased productivity and the quality provide information technologies business systems. Their role in the future is of great importance because the very fact that to improve the service to the user, perfects communication enabling the processes in companies reorganize. In the following years a key success factor will be managing information resources „*The future does not have those who know already they who wants to learn.*" The basis of any information system is a database. Which is defined as a set of logical files which are interconnected. Information system of process information and provides the information and knowledge implementation of business operation and solving business problems of the organization [1]. Information systems aim to data in an economical way of processing and transform the information. Every information system is a systemic whole, and the harmony between its key components that perform certain activities. They are register prepared entries, organize, preserve, in the information system databases [2]. Business Information System is a collection of interconnected and synchronized elements that contribute to the process, output, memory and control activities aimed at converting data into information used to support the processes of forecasting, planning, control, coordination, decision-making and

operational activities of the company [3]. Business Information System consists of management information system as a subsystem. Constant a global pressures with increased progress of innovation in the increasingly forcing organizations to the introduction of of information technology. As it is necessary the introduction of e-business, trade, enterprise resource planning, it is necessary to improve storage systems, work on constantly improving its relationship with customers and business partners. Information systems provide a number of advantages to enterprises one of them is that their business focus that takes place in remote areas so that they could follow world trends thrive and grow in this way offers its products and services.

II. TRANSACTION SYSTEMS FOR AUTOMATIC DATA PROCESSING

Transaction systems business transactions are processed in real time. In these transactions, the data can be updated. These systems include the collection, storage, processing and provision of information using a computer [4]. They are formed by automation of specific business functions. The automatic processing of data consists of specific applications that include specific functions: personal records, tracking customers, suppliers, monitoring storage systems, payroll. Benefits transactional information systems accelerating the collection and processing of of data the possibility that employees IT education data is systematized and increases the quality of the reports. Their main characteristics are as handle large amounts of data, requiring high reliability, a high level of accuracy.

III. ANALYTICAL INFORMATION SYSTEMS DATA PROCESSING

The analytical information systems as opposed to the transaction system show the value of data in the past few years. Analytical systems are designed exclusively for reading and analyzing data in order to help decision makers [5]. Analytical information systems include monitoring strategies in enterprises. Advanced computing solution provides maintenance of the strategic management process, allowing constant monitoring of the market and the movement of goods and services on the market. Using analytical information system we can get a clear picture of whether the necessary development of new, improved existing products or require the withdrawal from the market.

IV. RESEARCH REPRESENTATION TRANSACTION AND ANALYTICAL DATA PROCESSING MODEL IN THE SERVICE AND PRODUCTION ACTIVITES

1.   The research problem

Computer systems and systems based on the network today can be found in the smallest businesses. Today, an increasingly, these systems are represented at many enterprises and companies. Possible lack of information managers can lead to wrong selection systems for storing and processing data [6]. The fact is that bad data processing to a greater extent may affect the success of the entire company. The consequences of misinformation company in the field of information technology are many. As a research problem can be given a small number of studies in the city of Zrenjanin on the topic. „The representation transactional and analytical model data processing in the service and manufacturing industry service industries. „

2.   Subject of research

Modern efficient business environment, decision-making can not be imagined without information systems [7]. The modern business environment demands a new type of manager who combines his managerial skills with new knowledge in the field of information technology. It is essential that managers develop new strategies for information systems in order to increase in the company's success. In the interest of any organization is that all useful data more efficiently process and store why need to work on continuous improvement of information systems for processing and storing data.

3.   The aim of the research

The survey is conducted to obtain information about the presence of these models in service and production activities in the town of Zrenjanin. The aim of research is finding that adequate solutions data processing for a particular area of business. It is believed that this study may encourage companies to take account of the way when you want to store your data. The ultimate goal of research is to present the advantages Transactional and analytical model to process data in certain industries.

4.   Research hypotheses

The main hypothesis - There is a correlation between the attitudes of the people surveyed The efficient way of storing and processing data in the service and manufacturing industries.

Hypothesis No. 1.- Greater representation of automatic data processing in the service industry

Hypothesis No. 2- Automatic Data Processing as a factor of successful operation of the company

Hypothesis No. 3. - The largest number of respondents highlights the automatic processing of of data as a more efficient way to keep track of inventory and raw material resources in enterprises

Hypothesis No. 4. - Analytical data processing is very important for the industry for which we possess the necessary information on the total number of items sold for a certain period of time in different cities

5.   The method of investigation

The survey was conducted in the city of Zrenjanin. Data collection was performed by a questionnaire in which it was pointed out that the survey is anonymous and the results will be used exclusively for research. Given the complexity and diversity of operations on the territory of the city, we did our best in the research include as many people and collect information from a larger number of employees. Respondents are employees of different professions, age, gender, years of service and the qualifications that are located at different positions within the organization, perform various tasks, in order to thus form a picture of the situation as regards the processing of data and that what we a better way show the situation in the city of Zrenjanin in its entirety. The study was conducted over a period of 23.07. to 10.08.2015. Number of respondents was 37. The applied questionnaires containing questions related to the efficient way of storing and processing data. Based on the obtained of data analysis was performed using Microsoft Excel.

6.   Research results

The first assumption refers to the fact that there is a correlation between the attitudes of respondents on more efficient ways of storing and processing data in the service and manufacturing industries. Research we proved this assumption respondents in services considered it is a more efficient way of processing of data automatic processing of of data because of demands a high level of reliability of and process large amounts of data. While respondents employed in the manufacturing industry believe that many e efficient manner analytical data processing system because they can constantly monitor data from previous years. Respondents employed in the service industry have declared that in their the industry to any greater pleaded in their the industry to any greater extent automatic data processing. Respondents point out that one of the major factors successful business companies efficient processing and storage of data and as a way of reliable processing allegations automatic data processing. The largest number of respondents highlights automatic data processing more efficient way to keep track of inventory and raw material resources in companies. Respondents report that analytical processing of data is of great importance in the industry for which we possess the necessary information on the total number of items sold for a certain period of time in different cities. During our research, we came to the hypotheses from which we started research. Figure 1 shows the percentage of representation of analytical data processing in the manufacturing industry. Figure 2 shows the most significant features of automatic data processing Figure 3 is a graph representation of the percentage of automatic processing of data in the service industry. As Figure 4

shows the basic characteristics of analytical data processing.
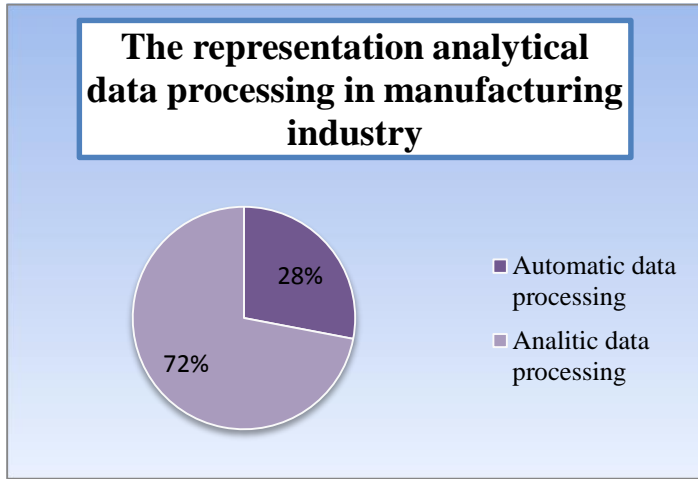

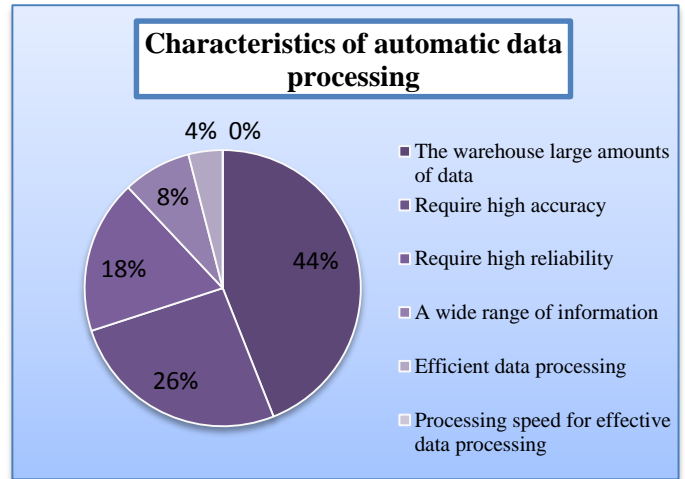Figure 1. The representation analytical data processing manufacturing industry

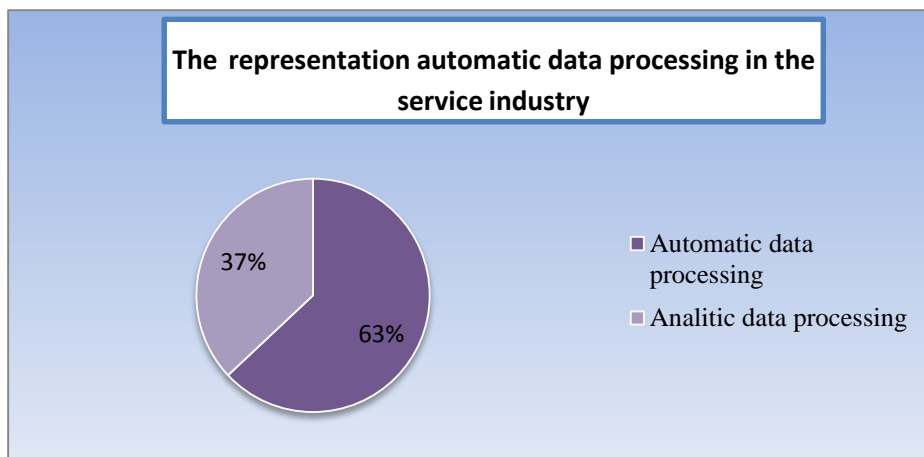Figure 2. Characteristics of automatic data processing

Figure 3. The representation automatic data processing in the service industry
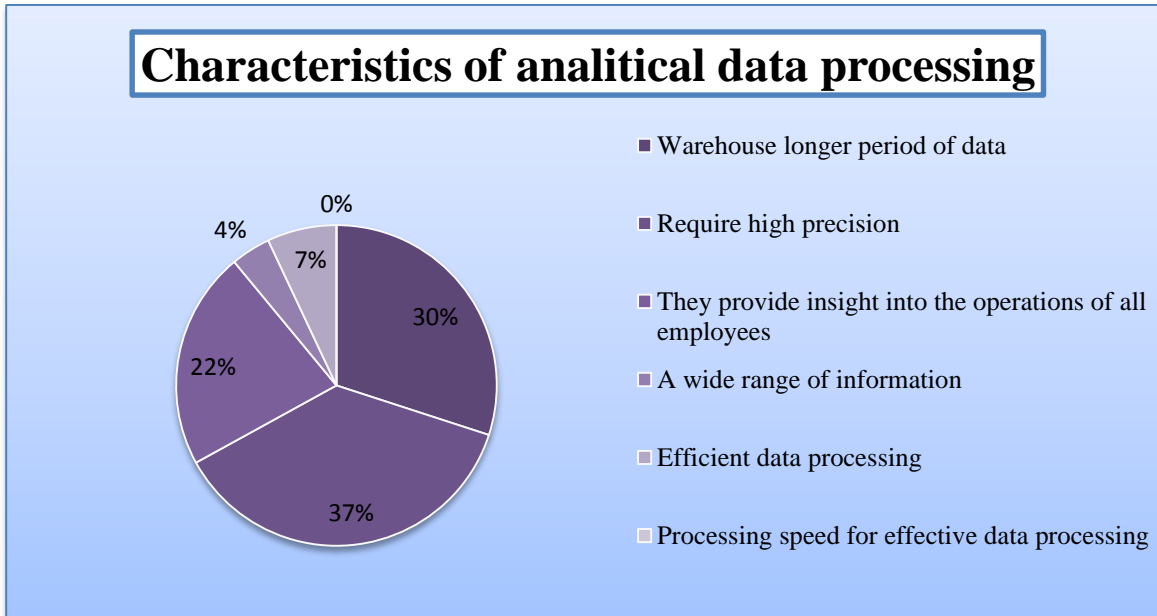
Characteristics of analitical data processing

- Warehouse longer period of data
- Require high precision
- They provide insight into the operations of all employees
- A wide range of information
- Efficient data processing
- Processing speed for effective data processing

0%
4%
7%
30%
22%
37%

Figure 4. Characteristics of analytical data processing

V.   CONCLUSION

Research results show that each of the above methods of processing and storage of of data has advantages that can enhance the success of enterprises and companies in the market. Depending on what is the primary activity of the company selects the method by which they want to preserve the information. If we are in the first place be efficient and faster and higher quality way to process data and to be of service to clients then decide for the implementation of automatic data processing. If you wish to change some of the strategic solutions wants to be the best at the same time then the company can decide for analytical processing of of data which can constantly follow the movements of their article at a market whether it is necessary to work on improving innovation or withdrawal. Through this method may be for a longer period of time to have access to their data of importance. The polling of employees from different areas come to the realization that any method effective enough if known exact focus of business. This study concludes that the analytical method of data processing and automatic processing of of data has its advantages in the form of trust, accuracy, length of storage efficiency of of data that will be used in the best possible way in order to prepare them for data processing, and thus the success of the entirety of the company.

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Software tool for selection restriction enzymes for modification of DNA sequence in plasmids

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Abstract - Paper describes software tool that can be used in a process of planning genetic recombination. This software tools enable analyzing DNA sequence of plasmid and make selection of appropriate restriction enzymes for cutting DNA to fragments. Decision which restriction enzyme will be applied is based on criteria such as position where restriction enzyme cuts DNA of selected plasmid, number of cuts, temperature range of enzyme's activation and shapes of cleavage ends at DNA fragments. Those DNA fragments could be again assembled together, in different order related their original positions, creating new DNA molecule.

I. INTRODUCTION

Synthetic biology is interdisciplinary field that combines disciplines such as genetic engineering, biotechnology, evolutionary biology, molecular biology, systems biology, biophysics, electrical engineering and information technologies[6] The major tools of genetic engineering and synthetic biology are bacterial enzymes called restriction enzymes, DNA ligase and plasmids. DNA recombination represents process of where the DNA of one organism is inserted into the DNA of another. Synthetic biology often adopts the language of engineers: rather than talking about genes, networks and biosynthetic pathways, practitioners prefer to talk about building blocks, parts, devices and modules[8,9].

Software tools help genetic engineers to analyze available genetic information, identify those elements before they perform experiments in the laboratory. Genetic experiments are expensive and time-consuming, with the increasing complexity of engineered biological systems, there is great need for robust standard assembly methods that are able to rapidly translate designed compositions into physical entities while minimizing financial and time costs[1,2,3,4,5,7,10].

A **restriction enzyme** (or restriction endonuclease) is an enzyme that cuts DNA at or near specific recognition nucleotide sequences known as restriction sites. Restriction enzymes are proteins produced by bacterial cells, to prevent invasion by foreign DNA, they are act as defense mechanism against viruses. The restriction enzymes selectively cut foreign DNA in a process called restriction; while host DNA is protected by a modification enzyme (*methylase*). It was discovered approximately 3000 different restriction enzymes until now and more than 600 of these are available commercially[11].

Many bacteria contain **plasmids**, small circular DNA fragments that carry specific pieces of genetic information. Plasmids can be transmitted from one bacterial cell to another, or from the environment into a host bacterial cell, this process is called transformation. Plasmids can incorporate pieces of DNA into their DNA sequence from different organisms. Plasmids that contain incorporated foreign sequence of DNA are called recombinant plasmids. The construction of specific plasmid DNA sequences is a routine technique in molecular biology laboratories.

DNA **ligase** is a specific type of enzyme that facilitates the joining of DNA strands together by catalyzing the formation of a *phosphodiester* bond. DNA ligases are used in combination with restriction enzymes to insert DNA fragments, often genes, into plasmids. DNA fragments generated by restriction digestion can be put back together with the enzyme DNA ligase, which forms *phosphodiester* bonds between the 5' and 3' ends of nucleotides.

II. SYNTHETIC BIOLOGY AND GENETIC ENGINEERING

Recombinant plasmids are used in synthetic biology as basis to reproduce designed DNA strains. Bacterial cells with such modified DNA strains are capable to produce various substances form other species. The result of that process is a bacterial colony in which the foreign gene has been cloned. That modified bacteria's can be grown commercially for various purposes, for example to produce biofuels or to provide the needed substances such as, human insulin, growth hormone, some specific proteins, vaccines and many other drugs [13, 15].

Restriction enzymes can cut DNA fragments from almost any organism. That fragments can be inserted into bacterial plasmids. Every restriction enzyme recognizes one specific nucleotide sequence. Restriction enzymes work by finding palindrome sections of DNA (regions where the order of nucleotides at one end, is the reverse of the sequence at the opposite end) this is called the enzyme recognition site.

All restriction enzymes make two incisions on DNA, once through of each strand of the DNA double helix. Restriction enzymes recognize and cut at specific places along the DNA molecule called restriction sites. Each different restriction enzyme (and there are hundreds, made by many different bacteria) has its own type of site. This sequence is also a restriction site for the restriction enzyme.

For example, restriction enzyme *EcoRI* comes from the bacteria in which it was discovered, ***Escherichia coli RY 13*** (***EcoR***), and "I", because it was the first restriction enzyme found in this organism. Restriction site is a 4- or 6-base-pair sequence that is a palindrome. A DNA palindrome is a sequence in which the "top" strand read from 5' to 3' is the same as the "bottom" strand read from 5' to 3'. For example, 5' GAATTC 3' 3' CTTAAG 5' is a DNA palindrome.

pBR322 is a plasmid and was one of the first widely used ***E. coli*** cloning vectors, this plasmid contains 4361 base pairs in length (figure 1). This plasmid can be cut at several positions with restriction enzymes[12], some of those restriction enzymes are shown in figure 2.
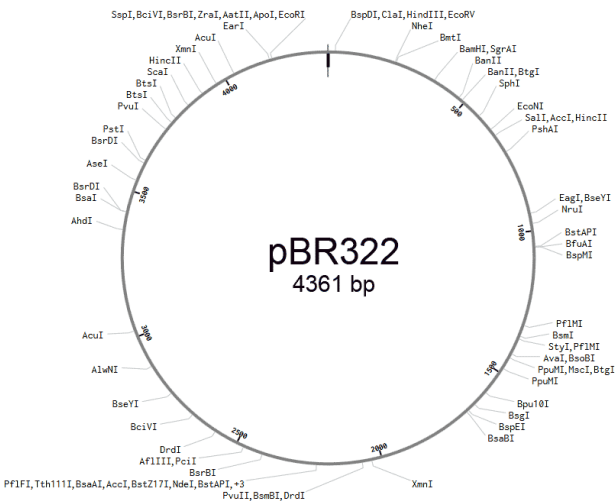

Figure 1.   Restriction map of enzyme ***pBR322***

DNA strand is constructed of four types of nucleotides (*Adenine*, *Cytosine*, *Guanine*, *Thymine*) and they are covalently linked to a phosphodiester backbone. This nucleotides are marked with a letters A, C, G, and T. In the typical case, the sequences are printed abutting one another without gaps, as in the sequence AAAGTCTGAC, read left to right in the 5' to 3' direction. While A, T, C, and G represent a particular nucleotide at a position, there are also letters that represent ambiguity which are used when more than one kind of nucleotide could occur at that position.

The rules of the *International Union of Pure and Applied Chemistry* (*IUPAC*) letters used for coding nucleotide position are shown at figure 3.

A = *Adenine*
C = *Cytosine*
G = *Guanine*
T = *Thymine*
R = G A (*purine*)
Y = T C (*pyrimidine*)
K = G T (*keto*)
M = A C (*amino*)
S = G C (strong bonds)
W = A T (weak bonds)
B = G T C (all but A)
D = G A T (all but C)
H = A C T (all but G)
V = G C A (all but T)
N = A G C T (any)

Figure 3.   Letters used for coding nucleotide position

Restriction enzymes recognize a specific sequence of nucleotides and produce a double-stranded cut in the DNA. For example, place where restriction enzyme ***BamHI*** cuts DNA of plasmid ***pBR322*** is shown at figure 4.
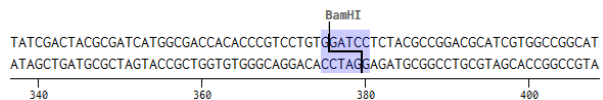
Figure 4.   Place where restriction enzime ***BamHI*** cut DNA

Different restriction enzymes can recognize the same sequence, for example ***SmaI***, ***AccI*** and ***HincII***. Recognition sequences in DNA differ for each restriction enzyme, producing differences in the length, sequence and strand orientation (5' end or the 3' end) of a sticky-end "overhang" of an enzyme restriction. Restriction enzymes such as ***SmaI***, ***AccI*** produce "sticky" ends, and ***HincII*** restriction enzyme cleavage produces "blunt" ends (figure 5). Also there are different restriction enzymes that cut DNA at same position but they recognize different sequence with different length.

"sticky" end   "sticky" end   "blunt" end
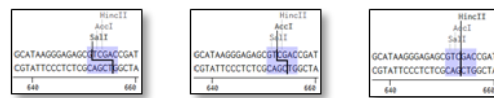
Figure 5.   Shape of cleavage ("sticky" and "blut" ends)

Enzyme	Source	Recognition Sequence	Cut
EcoRI	*Escherichia coli*	5'GAATTC 3'CTTAAG	5'---G AATTC---3' 3'---CTTAA G---5'
BamHI	*Bacillus amyloliquefaciens*	5'GGATCC 3'CCTAGG	5'---G GATCC---3' 3'---CCTAG G---5'
EcoRV*	*Escherichia coli*	5'GATATC 3'CTATAG	5'---GAT ATC---3' 3'---CTA TAG---5'
SacI	*Streptomyces achromogenes*	5'GAGCTC 3'CTCGAG	5'---GAGCT C---3' 3'---C TCGAG---5'
HindIII	*Haemophilus influenzae*	5'AAGCTT 3TTCGAA	5'---A AGCTT---3' 3'---TTCGA A---5'
SalI	*Streptomyces albus*	5'GTCGAC 3'CAGCTG	5'---G TCGAC---3' 3'---CAGCT G---5'
PstI	*Providencia stuartii*	5'CTGCAG 3'GACGTC	5'---CTGCA G---3' 3'---G ACGTC---5'
NdeI	*Neisseria denitrificans*	5' CATATG 3' GTATAC	5' ---CA TATG--- 3' 3' ---GTAT AC--- 5'

Figure 2.   Some of restriction enzymes that can cut plasmid pBR322

III. REJOINING DNA FRAGMENTS IN TO NEW DNA MOLECULE

Restriction enzymes and DNA ligase play important role in DNA cloning. Restriction enzymes can cut DNA of plasmids at specific places, producing several DNA fragments. Those DNA fragments could be again assembled together, in different order related their original positions, creating new DNA molecule.

The restriction fragment becomes part of the plasmid when DNA ligase forms *phosphodiester* bonds between the two formerly separate DNA molecules. DNA ligase has extensive use in modern molecular biology research for generating recombinant DNA sequences.

IV. STRUCTURE OF SOFTWARE TOOL FOR SELECTION RESTRICTION ENZYMES

Software tool for selection restriction enzymes allows users to analyze plasmid's DNA. Result of that analysis is report that contain list of names with all restriction enzyme that are capable to make cut on selected plasmid. Also that software tool finds positions where is possible to make a cut on DNA chain of selected plasmid. This software tool contains a database with 1296 restriction enzymes.

The first step is to load a file that contains a DNA chain of the plasmid. After that software compares the DNA chain of plasmid and restriction enzymes from the database, all possible matches (enzyme and positions) will appear at report. First column of the report represent position at DNA of plasmid where is possible to make a cut, second column represent number of restriction enzymes that applied for cutting at that position, and after that are listed all names of those enzymes, figure 6.

For example*,* if we want to cut plasmid *pBR322* at position 5, it is possible only with restriction enzyme *CviAII*. Same DNA is much easier to cut at some other positions. It is not rear situation that several enzymes can DNA at same position. For example, if we want to make a cut at position 25, it is possible by selecting one of 39 restriction enzymes, figure 6.

Figure 7. List of positions where is possible to make a cut on the plasmid *pBR322*

Restriction enzymes with shorter recognition sequence will cut plasmid at several places. Before making final decision which restriction enzymes will be used for genetic recombination, it is necessary to check all possible position where that restriction enzyme could make a cut at selected plasmid. Goal of this analysis is to select such restriction enzymes that will not cut DNA chain of plasmid at too many places. For example, restriction enzyme *Asp26HI* will cut the DNA chain only at one place (at position 1360), comparing to restriction enzyme *CviJI* that will cuts same DNA chain at 146 places, figure 7.
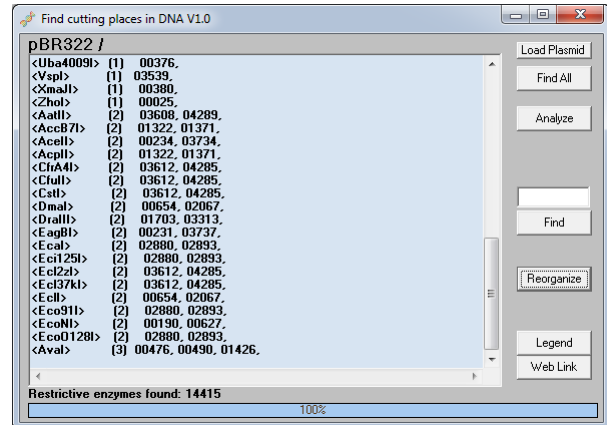
Figure 6. List of restriction enzymes and positions where they cut DNA of selected plasmid

Restriction enzymes could be activated at different temperature. In process of planning process of genetic recombination it is very important to check for each selected restriction enzymes temperatures for inactivation and incubation. These temperatures are included in database of restriction enzymes.

One of important criteria for selecting appropriate restriction enzyme is a shape of cleavage ends looks like at DNA fragments. Combining DNA fragments at desired order is much easier if DNA fragments have "sticky" ends, see figure 5.

V. CONCLUSION

Software tool for selection restriction enzymes for modification of DNA sequence in plasmids enables planning places for cutting at DNA molecules in a reproducible way opened a whole new world of experimental possibilities. Decision which restriction enzyme will be applied is based on criteria such as position where restriction enzyme cuts selected DNA, number of cuts on selected plasmid, temperature range of enzyme's activation and shapes of cleavage ends at DNA fragments. Now genetic engineers can clone segments of DNA into plasmids and viruses, and otherwise manipulate specific pieces of DNA.
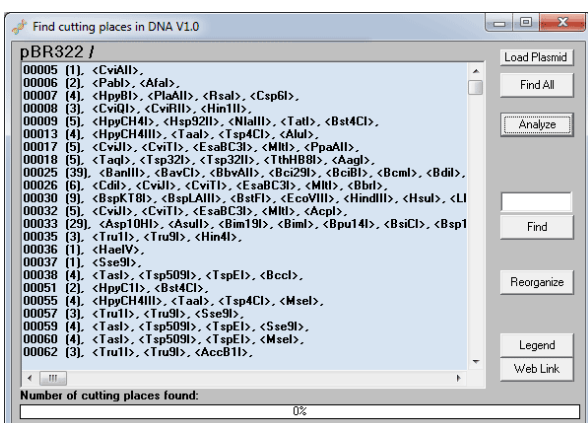
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Using Data Warehouse for ABA Basketball League Statistics

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Abstract - This paper shows how data warehouse can be used for creating statistics for regional basketball league. Data for analyses were collected from Internet site of ABA league and transformed into a relational database, in a form suitable for processing in data warehouse tool. Two OLAP cubes were projected and created in order to generate analytical data for reporting.

I. INTRODUCTION

Basketball is one of the most popular sports in the world [1]. The succes of basketball team in competition during seasons depends on the individual ability of each player, on a good basketball coach, but also on a good statistics and data for training proccess and for preparing tactics for every match in season. Also, there are many interested potential users of the sport data sets like various academia, governments and authorities, sport governing bodies [2].

Therefore, it is very important the use the data analysis for basketball coach's activities and job. So, the coach must use the data processing model and data analysis technology, which provide the coach with scientific basis and help him make the specific decisions to win the final competition [1].

Data warehouse, as a well-known concept for creating various reports and extracting analytical data from database, could be used as a support system for making decisions in basketball team management.

II. DATA WAREHOUSE CONCEPT

Decision makers in organizations make their decisions on the basis of analysis of facts obtained from various processes and data sources. These facts are stored mostly in OLTP (on-line transaction processing) systems as well as some other data sources. Purpose of data warehouse system is to integrate the data obtained from existing OLTP and other data sources, conduct computation that enable performing analysis for decision making support [3].

Data warehouse systems are based on-line analytical processing (OLAP), which is intended for interactive analysis and reporting. OLAP systems are based on multidimensionality of denormalized data [4]. OLAP architecture requires data to be transferred to multidimensional structure called a cube, by extracting and transfering data, creating aggregated data, dimensions and measures [5]. Processing OLAP data cubes is a time-consuming process depending on OLAP server and data warehouse tools performances [3].

The main goal of data warehousing is data collecting and distribution of information throughout the organisation and use of any information, anywhere, at any time due to the realization of the principle of "always be at the service for information users". One of the main data warehouse building goals is not only to store data, but also to enable managers to conduct data analysis. Decision makers in organizations are often under pressure, because they must make their decisions on the basis of analysis of current facts obtained from various business situations, processes and data sources. These facts are stored mostly in OLTP systems as well as some the data sources. Integrated obtaining data for analysis is not very easy to perform.

Purpose of data warehouse system is to transform the data obtained from existing OLTP system into a form suitable for processing which enables performing analysis with tools for business decision making support. End user of data warehouse system needs are met by enabling functionality such as using large amount of data from the company business processes for analysis, setting questions and getting answers about different business issues and diverse reporting. Data warehouse systems are based on OLAP, which is intended for interactive analysis and reporting, as opposed to the production system designed for data update and transaction processing – OLTP systems. OLAP systems like data warehouses are using multidimensionality principle of de-normalized data. Basic elements of OLAP systems are: Database - provides data for analysis, OLAP server – process and manipulate data, Interface system – for interaction with a user and other applications and administrative tools [6].

III. CREATING OLAP CUBES

Data used for analyses were collected from Internet site of ABA basketball regional league and transformed into a relational database [7]. In our case, we will conduct an analysis of the success achieved by players and teams in the ABA league in season 2013-2014. The second transformation of this data from existing OLTP DBMS

system was into a form suitable for processing which enables performing analysis with data warehouse tool.

This database with basketball data was made up of eight tables: city, player, team, league, season, team statistics, and individual player statistics per season and association that connects teams and league (figure 1). The database is designed so that the team achieves and the results of playing games are in the form of statistics within one season in the league. The player plays for the proper club (team) placed in a city and achieved results during the season are the data that was entered in the statistics table for each individual. This data are: total number of points, assists, offensive rebounds, defensive rebounds, blocks, errors, number of made and attempts for one, two and three points, and minutes made in the game.
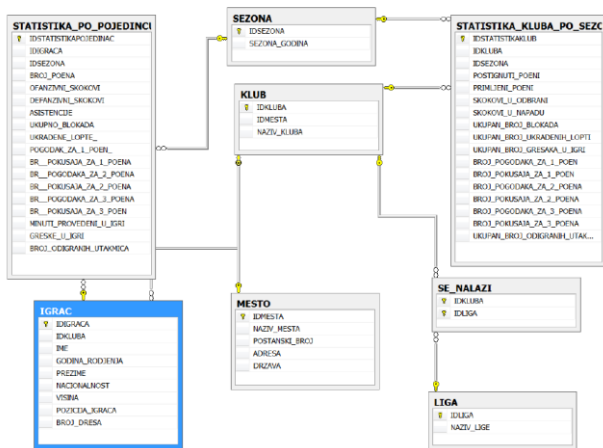

Figure 1. Relational database schema

Olap cubes have been created in the tool for creating data warehouse Microsoft Business Intelligence Development Studio (BIDS) which is based on transactional and relational Microsoft SQL Server database management studio (DBMS). A new project created in BIDS is analysis services type of project. This project has a data source that connects BIDS with relational database with basketball data. After creating a data source view, user must define which part of database will be analyzed and has to define data source view. Our database is a small database with only eight tables, so the created data source views include all tables. In a greater database with hundreds or thousands of tables this would not be practical.

The next step in designing the olap cube is to define measures and dimensions.

Physical architecture of dimensional model in OLAP can be described by a scheme that is defined by the stars or snowflakes from two types of tables - dimensional tables and fact tables that contain measures. Fact tables contain quantitative data that users want to analyze. These data are usually numeric type and can consist of up to several million rows and columns. Dimensional tables are much smaller and contain information describing data on which the analysis is performed. These data are called attributes.

The basic feature of the star scheme is that the dimensional tables are de-normalized. This approach uses

data in DBMS to simplify the repetitive design and performance. De-normalization is the process of combining tables to improve performance. This procedure reduces the number of connections that must be processed by entering queries. This has a direct impact on improving system performance, because the lower the number of connections, the system is faster information requested.

Standard dimensions of the cube projected with star schema are:

- team - team name,
- season - season year,
- player – first name,
- player – last name.

Measures for this cube are all defined for team:

- one point attempts,
- one point made,
- two points attempts,
- two points made,
- three points attempts,
- three points made,
- total number of scored points,
- total number of accepted points,
- played games, offensive rebounds,
- defensive rebounds,
- number of errors,
- number of steals.

Standard dimensions of the cube projected with snowflake schema are:

- team - team name,
- player – first name,
- player – last name,
- player – team name,
- player – height,
- player – nationality,
- player – birth year,
- city – name,
- city – country,
- season – season year.

Measures for this cube are defined for single player during the whole season:

- two points attempts,
- two points made,
- three points attempts,

- three points made,

- number of assists,

- played games,

- minutes played per game,

- total number of points.

For the cube based on snowflake schema (figure 2) we had three computable fields: player percentage for one point (1%), player percentage for two points (2%), player percentage for three points (3%) and they are obtained by dividing the number of hits with the number of attempts for one, two and three points.

For the cube based on star schema we had two computable fields: player average minutes per game, average points per game and they are obtained by dividing the points scored by the number of games played and total minutes played with the number of matches.

As we mentioned earlier two OLAP cubes are projected, the first cube presents statistics clubs achieved in a particular season (star schema). The second cube presents an analysis of players with most scored points in a particular season and the league (snowflake schema).

There are two ways for creating cubes. The first method is to create an empty cube, and then subsequently add the dimensions and measures. Another way is

through the wizard within the steps to choose the dimensions and measures.
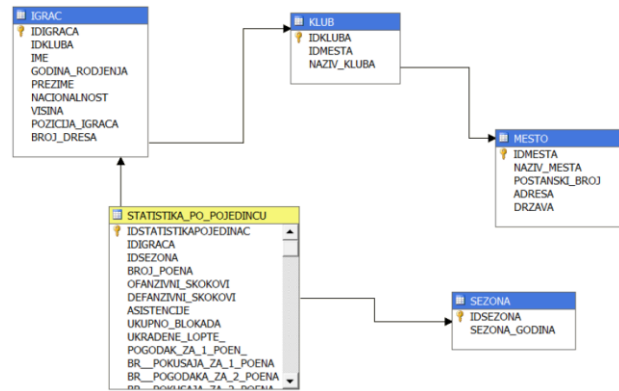
Figure 2. OLAP cube snowflake schema

The next step in using data warehouse tool is a cube creation. User can choose to create an empty cube, to start the wizard or to activate a template. We used a first solution to create an empty cube. The next step is to choose the appropriate data source view. In cube editor were added previously created dimensions, measures with aggregate functions (sum, count, count of rows, minimum, maximum, etc.) are defined as it is described in paper earlier, and finally the calculated fields were defined in the last step.

Figure 3. Data warehouse cube reader

When user choose to create a cube by wizard, through the set of windows there are following actions: choosing tables that will allow us to represent the facts and then program provides some measures that can be used or not. After that the list of dimensions is displayed with options for user to choose all of them or some, depending on the analysis type.

When the cube structure is finally projected user has to deploy the cube because the whole project is placed in various files in the project folder and the data is placed in one or more DBMS software files. Deploying may take a while, depending on the complexity of cube structure and the amount of data from database that have to be de-normalized and placed into the cube.

After deployment BIDS software add a new tab in cube editor called Browser where users have to place dimensions, measures and calculated fields in a form that looks like pivot table. There are three regions for placing dimensions: on rows, on columns or on page as a filter for all aggregated data that have to be displayed. Measures and calculated fields must be dragged and dropped in central part of table.

IV. REPORTING AND RESULTS

The reports were created in the Microsoft Business Intelligence Management Studio for table type reports (figure 4) and Microsoft Excel for graphs and charts (figures 5 and 6). Excel is a very suitable tool for processing tabular data orderly. It is very useful in modern business where quality information is required. The advantage of Excel is that it provides an interactive and direct work with data, so that it can be used by people with different levels and types of education for automation primarily his personal business, without any programming knowledge.

FIRST NAME	LAST NAME	TEAM	NUMBER OF POINTS	2 POINTS MADE	2 POINTS ATTEMPTS	3 POINTS MADE	3 POINTS ATTEMPTS	PLAYED GAMES	MINUTES PER GAME
Nolan Derec	Smith	Cedevita	372	131	283	21	66	28	27.3571428571
Dario	Saric	Cibona	467	134	243	30	87	28	32.8928571428
Jaka	Blazic	Crvena zvezda	290	77	142	25	84	27	23.7037037037
Nemanja	Gordic	Igokea	374	98	202	33	88	26	28.2692307692
Edo	Muric	Krka	281	68	147	39	108	23	28.8695652173
Ratko	Varda	Mega Vizura	356	94	188	19	58	26	21.8461538461
Bogan	Bogdanovic	Partizan	374	76	168	55	162	27	28.7407407407
Tarenece	Kinsey	Partizan	274	85	183	21	57	23	27.3478260869
Marko	Matinovic	Radnicki	352	53	110	50	184	26	30.6538461538
Savo	Lesic	Radnicki	411	123	208	20	60	26	29.5769230769

Figure 4. Data warehouse reporting services table

In BIDS tool a new project was created from the list of templates as a report server type of project. The wizard guides user to create a report with a new and separate data source to OLAP cube. After that in a special tool called Query Designer, user has to create a Multidimensional (MDX) query for slicing data in cube that will appear in the report. MDX query for reading data that is necessary to design a layout table with similar syntax to Structured Query Language (SQL), but the difference is in working with cube dimensions and measures in MDX while SQL handles tables and columns of relational database. One page of report is shown on figure 4, while the whole report has a dozen of pages.

For creating charts in Excel that are connected to data from OLAP cube, the pivot table must be put on worksheet. Pivot table is a dynamic table with pooled data from an external data source. This kind of table was a source for creating a special type of chart (Pivot Chart), with possibility for dynamic changes of graph series when the data in pivot is filtered for example.

Figure 5 is one of the created graphs with clubs percentages in shots for one, two and three points. First column filled with blue color presents percentage for one point, second marked as red is percentage for two points, and the green is percentage for two points.
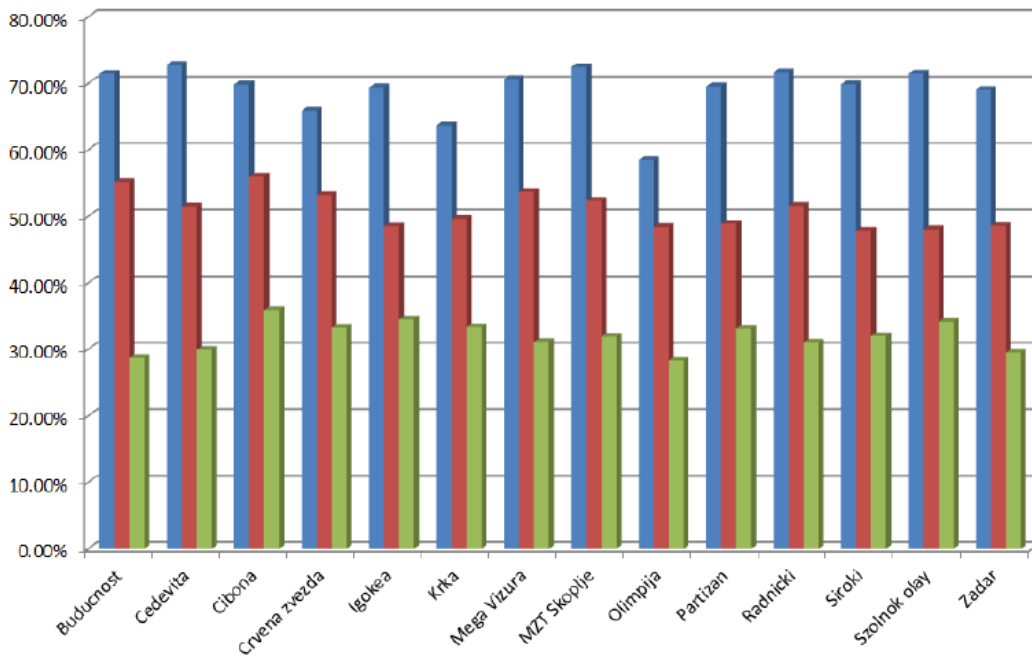
Figure 5. Percentages in shots for one, two and three points

Figure 6 shows in six series total shots for one, two, and three points. First series (column filled with light blue color) on the left shows total one point made. Second column filled with dark blue color shows one point attempts. Third column filled with light green point attempts. Fifth column filled with yellow color shows three points made; while sixth column is for three points attempts during the whole season.

shows two points made; while fourth column is for two points attempts. Fifth column filled with yellow color shows three points made; while sixth column is for three points attempts during the whole season.
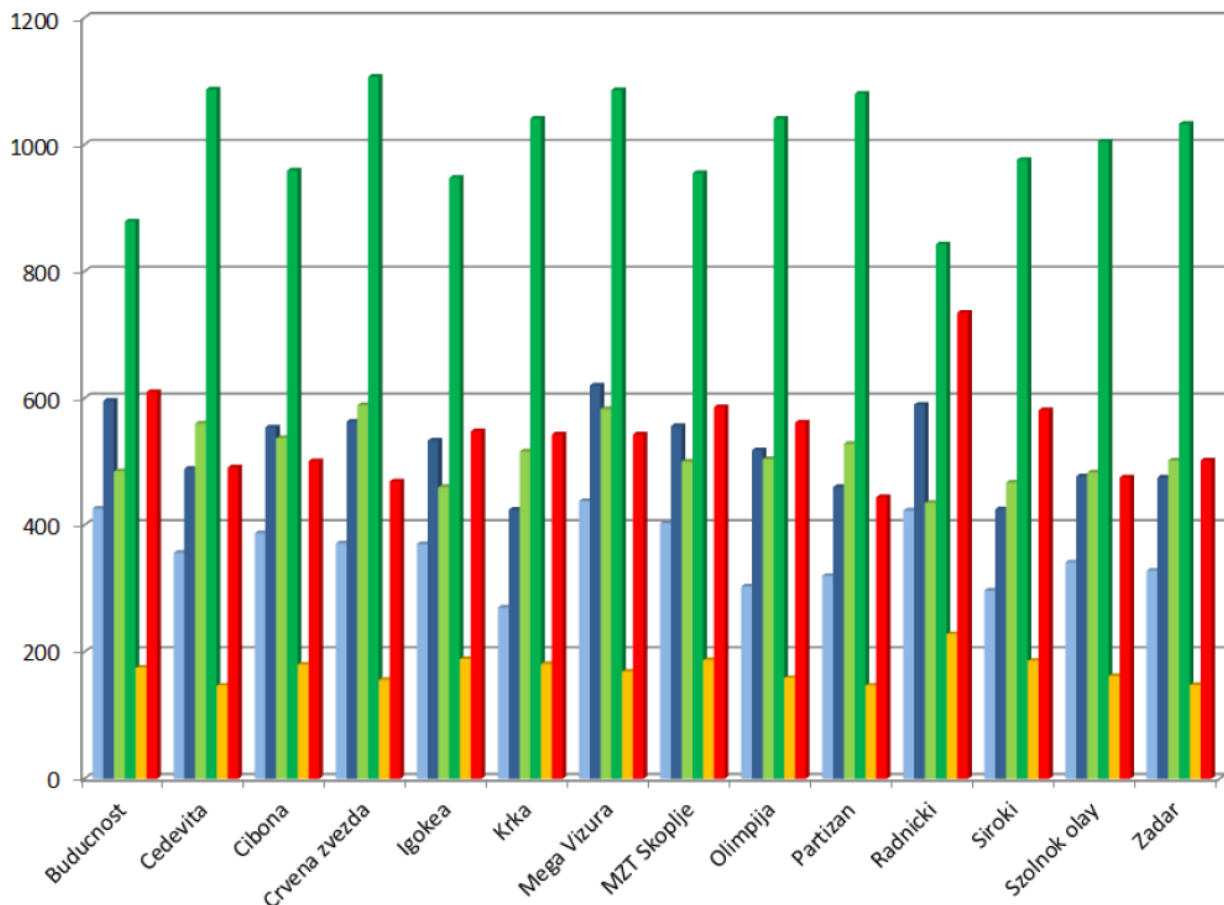
Figure 6. Statistics in shots for one, two and three points

V. CONCLUSION

Aim of this paper is to show how OLAP cubes and data warehouse could support statistical computation of data for basketball team management. Results of projecting and creating data warehouse are cubes with browsed analytical data, reports designed in reporting services and charts created in spreadsheet program.

From this kind of charts and statistics a basketball coach has decision making support and could prepare and modify training process or prepare tactics for different matches.

Further work could be creating mining structures in BIDS for more complex analysis for finding significance in the relationships between a specific data elements and creating data patterns.

ACKNOWLEDGEMENTS

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Outsource IT Project or Do it In-House

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Abstract - **This paper elaborates how to make quality decision about handling IT project within own company and its available resources or outsource it project based on comprehensive analysis of available resources, costs and benefits. Companies which do not have IT as their own core business rarely have necessary resources to handle and serious it project and their IT departments can handle only smaller projects, therefore decision to outsource their it projects are being made with clear logic behind them. However, companies which have IT as their core business make decisions about outsourcing with far more variables and tradeoffs. This paper is considering characteristics of those decisions and proposes algorithm and criteria for choosing whether to do IT project "in-house" or to assign whole or partial work to another company with better resources and lower expenses.**

Key words - IT projects, outsourcing, decision making

I.   INTRODUCTION

IT projects require comprehensive analysis, planning, highly skilled engineers and other highly specialized experts. They are often carried out in turbulent environment and are subject to strong and adaptable competition from other companies. IT technologies are rapidly growing and slow delivery of project can render project results worthless because they are obsolete in even one single year. Because of that IT projects must be carried out with utmost performance and care. Project scope and resources must be optimized and used in most efficient and effective way possible. Modern companies can not exist without relying on strong IT support and they are forced by the market to create and implement new IT solutions in order to optimize their enterprises.

Companies which do not have IT as their core business have only supporting IT departments with limited human resources and other resources to perform any kind of serious development and implementation.

Because of this, it is rational and cost effective to rely on specialized IT companies for accomplishing their IT goals. Unlike previous case companies with IT as their core business have much harder and complex decision about outsourcing part of their IT projects to other companies.

This sort of decision requires complex analysis with multiple factors included. They need to make careful analysis of costs and benefits as well as analyze availability of human resources within company and delegate them from ongoing projects. Participating in IT project also creates knowledge and improves human capital in the company as well as improving company reliability and flexibility, therefore one of the hidden costs of outsourcing is knowledge and flexibility loss. Handling IT project in-house also contributes to economy of scale and brings other synergetic bonuses. Not only visible monetary aspects shown in total cost and total value should be considered when making decision about outsourcing part of business activities, other hidden costs, benefits, opportunities and treats should be considered.

Other IT companies are their direct competitors but because they have different areas of specialization they can perform required job within shorter terms or with lower costs. Despite lower expenses companies have to consider external risk of outsourcing. When IT companies make decision about outsourcing IT project their external risk significantly increased because outsourcing companies are their direct competitors and they should not risk handling vital project to their competitors or risk important knowledge or technology disclosure.

There are also some important aspects which can not be clearly related to cost efficiency such as growth of know-how, greater quality and better response to requirements, easier implementation, confidentiality enclosure, human resources improvement, intellectual property issues, etc. which must be taken into consideration. These concerns clearly show complexity of decision about outsourcing IT projects and this paper attempts to shed some light on this multifarious topic.

II.   IT PROJECT

IT project in an effort to produce desired result using limited resources and limited timeframe with application of various information technologies and services. IT projects are usually managed and carried out by IT companies and only small portion of companies which do not have IT as a core business have IT departments strong enough to carry their own development of IT projects.[7]

IT projects are therefore outsourced by IT companies which as a result often do not have intimate knowledge and know-how about project which they are managing and developing.

Commonly used term IT project actually cover entire portfolio of various projects with different aims and structure. Extensively available literature rarely offers systematical and analytical analysis of different

categories of IT projects.[10] Good example of IT project classification is list offered by "University of Iowa" and it classifies IT projects in ten diverse categories as listed beneath:

- Exploration Projects - Exploration projects are used to learn about a new technology, or a new application of an existing technology. Exploration Projects are very common because of rapid technology growth and innovative coulter which is present within IT community.
- Service Pilot Projects - Service pilot projects are used to gather information about a potential new service. By deploying a service on a smaller scale, a pilot provides an opportunity to uncover problems and understand what resources a new service would require.
- New Service Projects - A new service project is used to deploy a new service for a set of users in a production setting. The scope of a new service project is usually to perform whatever installation or configuration is needed to prepare the service, ultimately delivering a supportable, sustainable service to users.
- Service Change Projects - Service change projects are used to manage changes to existing services. They are very complex and risky because they often have to be carried out whiteout service interruption.
- Organizational Development Projects - Organizational development projects are used to pursue organizational changes or improvements. Organizational changes and improvements are often initiated and driven by application of modern IT technologies while they optimize business performance.
- Infrastructure projects - focus on improving the ITS technical infrastructure.
- Software Development Projects - Software development projects may result in a product which is turned over to a customer. Software development projects are most commonly seen type of IT project and because of this public mostly considers them as only category of IT projects.
- System Deployment Projects - System deployment projects are typically used to install, configure, and deploy software purchased from a vendor. The deployment may or may not result in a new service.
- Needs Assessment Projects - Needs assessment projects are used to determine the needs of users with respect to current services or potential new services. Depending on the results, a needs assessment project may be followed by a new service or service change project.
- Umbrella Projects - Umbrella projects are high-level projects used to coordinate a group of other inter-related projects. The umbrella project may have a particular focus (such as needs assessment, exploration, or organizational development), and new projects are create as needed within that focus. Umbrella projects

provide a way to divide large efforts into smaller, more manageable projects, while allowing for careful coordination of the smaller projects within a larger context."[3]

III. OUTSOURCING

"Two organizations may enter into a contractual agreement involving an exchange of services and payments. Outsourcing is said to help firms to perform well in their core competencies and mitigate shortage of skill or expertise in the areas where they want to outsource."[8] Another party may have necessary resources and knowledge which enable it to do required project work in more reliable and quality manner for lower cost and/or in shorter period of time. Better business performance is achieved through highly specialized and focused enterprises with significant knowledge and know-how which enables them to perform required tasks in more quality manner in shorter period of time and with lower expenses.

Modern business philosophy states that companies should "Stick to the Core" business and stay focused instead of expanding their services and capabilities. Every company is recommended to differentiate itself and bring its core business to the perfection and if all companies follow that advice economy will prosper because that way all available resources will be used in optimal manner.[5]

Outsourcing has exceptionally simple business logic behind which drive companies to outsource part of their activities:

- focus on core business,
- cost reduction,
- greater efficiency,
- quality and reliability improvement,
- increased availability of human resources and facilities,
- gaining advanced technology and know-how without investment.[6]

Using another party for outsourcing has certain downsides which effect company decisions about contracting other parties to outsource part of their activities:

- increased external risk,
- information and technology disclosure,
- knowledge loss,
- imperfect information about outsourcing company capabilities,
- slower feedback,
- decreased management role,
- hidden costs,
- quality related issues,
- lack of customer focus.

All of these and many other pros/cons have to be addressed when making decision about outsourcing part of activities to other companies. Decision about outsourcing cannot be made solely on profitability of

outsourcing, IT projects can have non-monetary benefits such as knowledge growth, human capital increscent, economy of scale, etc., also outsourcing can have potential hidden costs such as quality loss, flexibility loss, increased external risk, etc..

IV. OUTSOURCING IT PROJECTS

Outsourcing IT projects have similar benefits and downside as outsourcing any other company business activity. However, depending on whether company has IT as its own core business, impact of these factors shift their influences and additional factors come into play.

If company does not have IT as a core business then general advantages and disadvantages of outsourcing listed above can be applied.[1] Additional disadvantage of outsourcing becomes increasingly important - IT companies which are contracted to outsource it project are by nature highly focused on IT and often lack knowledge and business related know-how about business which they are providing their services to.

Company which hires outsourcing services has imperfect information about market and available companies to hire. Flexibility loss is increased because of contractual nature of outsourcing - hired companies stick rigidly to contract terms and requirements. Slower feedback as a disadvantage gains influence. Because of these disadvantages and several other positive and negative influences companies which specialize in IT outsourcing services adopted IT sector methodology of IT project management called agile project management.[4]

Agile methodology is a software development method created by selection, adaptation and evolution of best practices in software engineering. These practices promote adaptive planning, change acceptance, continuous improvement, sustainability, simplicity and working software as a measure of success. Agile project management methodology promotes adaptive planning, evolutionary development, continuous improvement, early delivery and flexibility to counter these disadvantages.

When IT company hires other IT company's services to outsource its own business activity IT sector specific outsourcing disadvantages and advantages influence that decision. Increased availability of human resources and facilities as well as growth of human resources straighten its influences. Risk of information or important technology increases as outsourcing company is direct competition within IT sector. Knowledge loss becomes greater because lost knowledge is directly related to core business of company which is hiring outsourcing services.

When IT companies join forces and combine their differential focused core businesses they gain synergetic effects from outsourcing. This is one of the main reason why IT sector has many communities of practice and partnerships. This practice has some disadvantages which are important to consider such as information and

technology disclosure, losing know-how and improvement of own human resources, intellectual property issues, decrease of reliability flexibility and adaptability of own company, etc.

V. DECIDING WHETHER TO OUTSOURCE IT PROJECT OR PERFORM INHOUSE PROJECT IN IT AND NON IT COMPANY

This decision is carried out by company management which takes into consideration all requirements and potential benefits with taking care of potential disadvantages, visible and hidden costs, internal and external risks. Cost is equivalent of sum of resources spent on development - funding, time, development team availability, opportunity cost of developing project without gaining befit from its result, external and internal risks, etc.[9]

If company does not have enough facilities, human resources, necessary expertise, know-how, licenses and other requirements to bear required IT project and can not obtain them or it is not reasonable to invest in obtaining them they have logical choice to outsource IT services they need.

In case that company has enough resources to carry their own IT project company management still needs to perform comprehensive analysis and measure all potential benefits against all potential costs and disadvantages. After that analysis management can make decision to hire outsourcing service to carry out their project. (Figure 1)
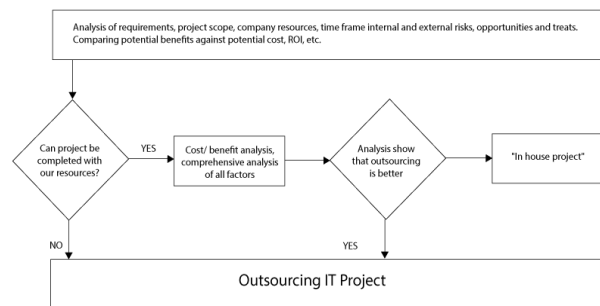
Figure 1 The Algorithm of deciding hire outsourcing services or perform in-house project for non IT company

When IT company considers hiring outsourcing services for their own IT projects they have to take into consideration several important factors prior to performing cost benefit analysis and determine if the outsourcing is profitable.

It company is in danger to handle project which is vital to survival of company to another party which in their direct competition then no matter the profitability of outsourcing contract in-house project is essential. (Figure 2)

Further even if cost/benefit analysis show that in-house project is not profitable, if project provides additional benefits to the company in form of knowledge growth or flexibility or/and the opportunity cost

combined with cost suppresses benefits then in-house IT project management is favored.[2]
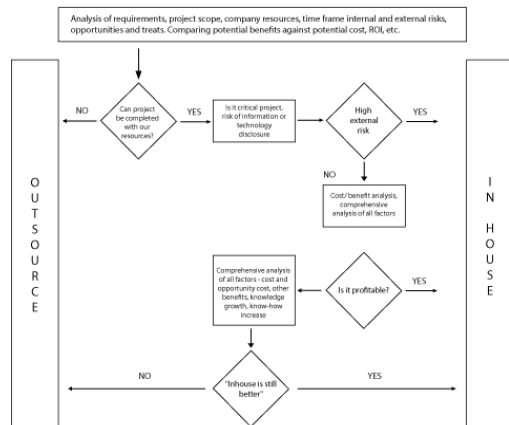

Figure 1 The Algorithm of deciding hire outsourcing services or perform in-house project for IT company

VI. CONCLUSION

Non IT companies because of their focus on core business rarely have resources to carry their own IT project independently and it is logical and rational that they hire outsourcing services for their IT projects. Even if they have necessary resources and know-how to the project analysis will probably show that specialized IT companies can provide quality service with lower cost and in shorter time table because of their differentiation, focus and related knowledge and experience.

IT companies face much more complex analysis when deciding to outsource their IT projects. Because of rapidly growing IT sector and great diversification and proliferation of IT technologies there are many specialized and highly focused IT companies. The fact that company has core business in IT sector does not imply that there are no other more capable and focused companies which can carry out project requirements with lower cost, shorter time frame and with greater quality.

Decision about outsourcing cannot be made solely on profitability of outsourcing, IT projects can have non-monetary benefits such as knowledge growth, human capital increscent, economy of scale, etc., also outsourcing can have potential hidden costs such as quality loss, flexibility loss, increased external risk, etc..

However, since IT companies face competition within IT sector, company must take external risk factor over profitability factor when deciding about outsourcing.

Performing in-house project can yield additional benefits in increased flexibility, economy of scale, human resources improvement and knowledge growth which can suppress the cost and make an in-house project management positive for the company despite it is not profitable.

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Iteration in Development of IT Projects Using Agile Methodology

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Abstract - This paper elaborates possibility of additional iteration instead of accepting results and issuing a project release while using agile methodology for development of IT project. Paper is considering characteristics of such projects, common practice, lessons learned and stakeholder interests. It proposes criteria and algorithm for deciding whether to issue a release to the market or to complete additional iteration of development process using agile methodology.

Key words - IT projects, agile methodology, iteration, decision making

I. INTRODUCTION

Modern companies face global market and global competition. External factors greatly influence daily operation in a constantly improving and changing business environment, thus companies are very sensitive to these factors and require constant adaptation to new market requirements. Obtaining competitive advantage in such a turbulent environment is often very difficult; however delaying of company adjustments can lead losing of competitive advantage and sometimes failure of company efforts. External factors have stronger influence and ability to shift company's market position quickly. Companies have to recognize and adapt to all negative influences in short period of time and have very limited time span to mark opportunities and seize their benefits. Companies are forced to grab all opportunities for competitive advantages on the market. IT industry and company IT departments are often used as a tool to create competitive advantage in the market by decreasing costs, improving logistics, improving customer relations, sales improvement, online marketing, etc.. Good IT support, constant customer feedback using CRM, or IT project release which provide additional resource to the company and can be vital part of company adaptation and survival.

Traditional project management methodologies and practices (such as those contained in PMI – Project Management Institute PMBOK ("Project Management Body of Knowledge")) displayed low performance and significant drawbacks when applied to IT sector projects. It companies are highly specialized for their core business

and often lack necessary knowledge about projects which are managing for other companies. Business specific knowledge is often hard to capture and can cause project failure to answer its requirements or additional change requests which can drive project over budget. In traditional project methodologies project work is divided into phases and their execution is sequential – this causes slow feedback and increased cost of errors and modification requests. Because of these potential downfalls IT sector adopted IT specific project management methodology called agile project management. Using agile methodology for development of IT projects showed great performance and substantial benefits compared to traditional project management methodologies or previously used "waterfall" methodology.

Agile methodology promotes adaptive planning, evolutionary development, continuous improvement, early delivery and flexibility. "Most agile development methods break the tasks into small increments. Each iteration involves a cross-functional team working in all functions: planning, requirements analysis, design, coding, unit testing, and acceptance testing. This minimizes overall risk and allows the project to adapt to changes quickly. An iteration might not add enough functionality to warrant a market release, but the goal is to have an available release (with minimal bugs) at the end of each iteration. "[1]

Decision to end development process and issue a release is carried out together by development team, business team, management, stakeholders and other. They need to make analysis whether additional iteration is required or product can be/should be released. While performing additional iterations can improve quality, robustness and reliability of project result, completing project in timely manner is absolutely crucial. Not releasing project result on time can yield many opportunity costs and diminish project results or in worst case render project result useless and therefore cause project to fail.

Empirical studies have shown that this decision is difficult and especially when IT project is carried out by an external (outsourced) company because of the conflicting interests.

II. GENERAL CHARACTERISTICS OF AGILE METHODOLOGY

Agile methodology is a software development method created by selection, adaptation and evolution of best practices in software engineering. These practices promote adaptive planning, change acceptance, continuous improvement, sustainability, simplicity and working software as a measure of success. "Agile development methods break the tasks into small increments with minimal planning and do not directly involve long-term planning. Iterations are short time frames (time boxes) that typically last from one to four weeks. Every iteration involves a cross-functional team working in all functions: planning, requirements analysis, design, coding, unit testing, and acceptance testing. At the end of the iteration a working product is demonstrated to stakeholders. This minimizes overall risk and allows the project to adapt to changes quickly. Iteration might not add enough functionality to warrant a market release, but the goal is to have an available release (with minimal bugs) at the end of every iteration." [1]

"Agile development, in its simplest form, offers a lightweight framework for helping teams, given a constantly evolving functional and technical landscape, maintain a focus on the rapid delivery of business value. As a result of this focus and its associated benefits, organizations are capable of significantly reducing the overall risk associated with software development.

In particular, agile development accelerates the delivery of initial business value, and through a process of continuous planning and feedback, is able to ensure that value is continuing to be maximized throughout the development process. As a result of this iterative planning and feedback loop, teams are able to continuously align the delivered software with desired business needs, easily adapting to changing requirements throughout the process. By measuring and evaluating status based on the undeniable truth of working, testing software, much more accurate visibility into the actual progress of projects is available. Finally, as a result of following an agile process, at the conclusion of a project is a software system that much better addresses the business and customer needs."[8]

III. IT PROJECT

IT project in an effort to produce desired result using limited resources and limited timeframe with application of various information technologies and services. Commonly used term IT project actually cover entire portfolio of various projects with different aims and structure. It projects can be classified in roughly ten different categories based on their scope and expected result: "

- Exploration Projects,
- Service Pilot Projects,
- New Service Projects,
- Service Change Projects,
- Organizational Development Projects,
- Infrastructure projects,
- Software Development Projects,
- System Deployment Projects,
- Needs Assessment Projects,
- Umbrella Projects." [13]

IV. IT PROJECT MANAGEMENT

A. Differences Between IT Project Management and Traditional Project Management

IT projects are usually managed and carried out by IT companies and only small portion of companies which do not have IT as a core business have IT departments strong enough to carry their own development of IT projects. IT projects are therefore outsourced by IT companies which as a result often do not have intimate knowledge and know-how about project which they are managing and developing.[12]

Business specific knowledge is often hard to capture and can cause project failure to answer its requirements or additional change requests which can drive project over budget. In traditional project methodologies project work is divided into phases and their execution is sequential – this causes slow feedback and increased cost of errors and modification requests. Traditional project management methodologies showed poor results These poor results were also caused by rapidly changing business environment and constant need for flexibility and adaptation to new market terms.

Rapidly developing IT market and constant improvement of IT technologies and tools also contributed to increased risk of project failure and cost increase while developing IT projects. As a result of those external and internal factors IT industry and software engineering developed their own set of methodologies which try to enable IT companies to create quality software with minimum cost, in short period of time and with minimal risk.[2] They use agile methodologies for software engineering.

"Agile allows teams to deliver projects piece-by-piece and make rapid adjustments as needed. Especially useful in complex projects, agile can result in more customer needs met at less cost."[7] It results lower costs and improved expense control, ability to provide deliveries in short time spans, lover project failure risk, as well as greater flexibility and adaptability to requirements change and improved customer satisfaction. Greater flexibility and adaptability is achieved through incremental development and constant change acceptance with constant feedback from stakeholders.

Constant feedback from stakeholders improves project result by increasing management team know-how and embracing changes in ongoing project work improves adaptability. Faster feedback decreases time of error

detection, optimizes project work and diminishes cost of project errors.

Agile methodologies provides project management team with opportunity to evaluate ongoing project and apply corrective actions if they are required with minimal disturbance and risk of project failure. This is possible through regular iterations or sprints. At the end of each iteration team is a working piece of software. These iterations or sprints are repeated until project result is accepted, tested and released. If one iteration does not provide requested result, next iteration should correct its predeceasing integration mistakes with minimum time and resource cost. By doing this risk of project failure is minimized.

In traditional project management time and budget cost of corrective action increases as project advances to later phases of the project and can cause critical failure of the project. (Figure1)
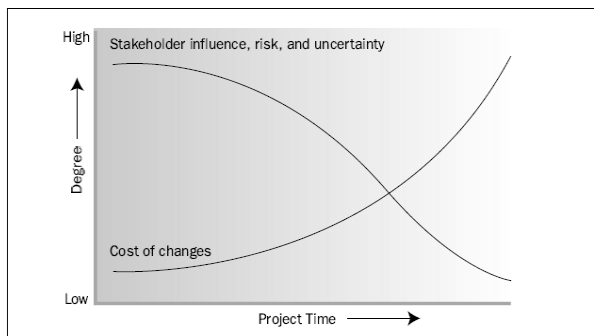

Figure 1 Impact of variable based on project time (Source: PMI PMBOK Fourth Edition, (2008) page 17.

When using traditional methodologies for project management such as those recommended by PMI degree of internal risk and uncertainty is decreasing as project time and work are advancing, however cost off changes increase significantly.

B. Specifics of Software Engineering

Software engineering creates unique product - software which meets its project requirements placed by project stakeholders. Each project, including a software project, is unique. It is often created at geographically different location/s in relative to the location where it is going to be deployed/implemented and used. Ongoing software development project is often exposed to technology changes, other software product appearance and "local variables" such as local market/sector conjuncture, legislative changes, standard changes, etc.[10]

Therefore software engineering developed their own set of project management methodologies which enable software engineers to create quality software in short periods of time with minimal cost and risk of failure.[4]

Thru using iterative project development where each iteration tends to create working piece of software, even if project is terminated before time, company which ordered the project still gets "best possible product" for time and other resources invested in project. This allows additional flexibility and adaptability during project lifecycle. Because of turbulent environment which increases project eternal risk even project requirements can change during project life cycle.

Modern methodologies and best practices of software engineering are capable of answering even that crucial and critical changes.

IT projects often include participation of multiple companies at geographically dislocated sites, they require large amount of manual labor from highly skilled software engineers and other experts. This type of manual labor is very expensive and requires great deal of human resource management in order to provide adequate highly skilled professional engineers and other expert during project development cycle.

C. Agile development cycle

"An agile development cycle is different (Figure 2). Instead, the initial planning and analysis is kept to a very high level, just enough to outline the scope of the development project. Then the team go through a series of iterations, analyzing, designing, developing and testing each feature in turn within the iterations."[6]

An iteration is simply a fixed, short period of time that the team chooses to work within. Typically for agile teams, an iteration is between 1 week and 30 days. Strictly speaking, the Scrum agile development methodology advocates 30 days, but I've encountered very few teams that actually do this. 2 or 3 weeks seems to be more common.

The Extreme Programming agile methodology advocates 1 week. This is very short and in my experience requires quite a lot of maturity in the team and its processes to achieve, because getting to a stable release every week can be difficult.

Either way, the principles are the same. The idea is to stick to short, fixed-length iterations and complete all stages of the development cycle for each feature in turn within an iteration.

The key difference this creates is visibility of complete working features much earlier in the project life cycle, allowing for a better gauge of progress and quality, and allowing for feedback and adaption along the way. The result is to see some results earlier, mitigate risk, and to allow flexibility to accommodate change."[11]
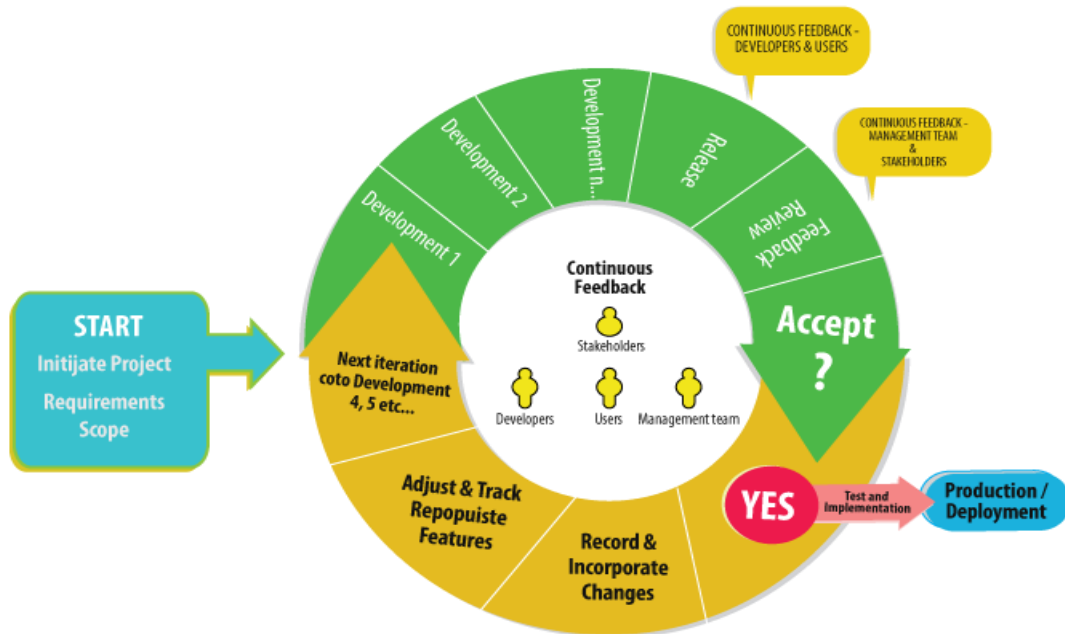
Figure 2 Agile development cycle

V. DECIDING WHETHER TO ISSUE A PROJECT RELEASE OR TO CREATE ADDITIONAL ITERATION

This decision is carried out by project management team, stakeholders, developers and users. All developed functionalities, additional requirements, change requests, user experience, experience and potential benefits are compared against cost of resources needed for further development of requested functionalities as well as currently spent resources are compared to project scope. Newly requested functionalities and change requests are facing certain cost/benefit analysis.
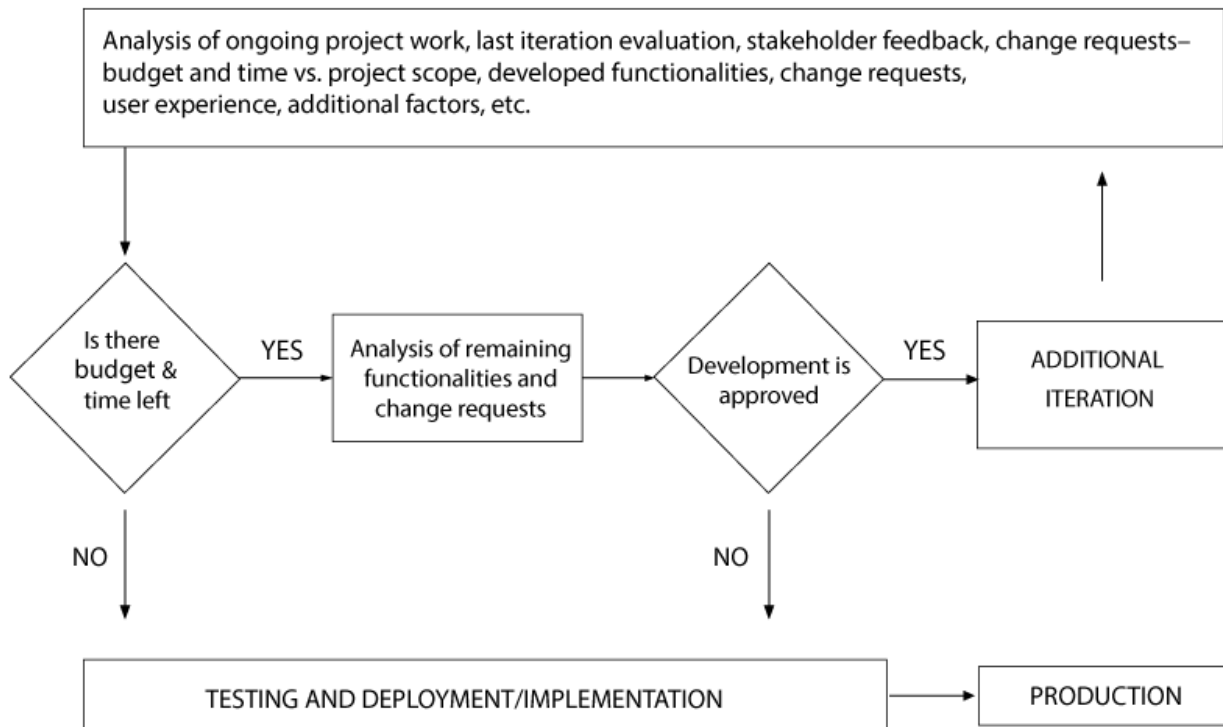
Figure 3 - The Algorithm of deciding to enter test and deployment phase or additional development iteration

Cost is equivalent of sum of resources spent on development - funding, time, development team availability, opportunity cost of developing project without gaining befit from its result, external and internal risks, etc.

Additionally considered factors are: business requirements, legal requirements, standard requirements, profitability, reliability, functionality, promptness of developing of certain functionality, quality of software, etc. This requires multi-criteria analysis, however iterations are often and usual iteration cycle duration usually varies between 1 and 30 days, and analysis is taking place on iteration review meeting.

Each functionality is developed, integrated and tested, then integrated into demo version and reviewed by stakeholders for feedback. Stakeholders evaluate result of each increment and accept it or issue a change request. If increment was successful, depending on the analysis stakeholders approve additional requirements development or decide to test, implement and release project results. At the end of each iteration project management team and other stakeholders are evaluating ongoing project work and deciding whether to enter additional iteration or to test project result and issue a release to the market or to place software in operation/production. (Figure 3)

VI. CONCLUSION

Each project by its definition has a unique final result as an output. Therefore there are no universal rules, only general rules and conclusions can be drawn and every project should be analyzed separately. One thing is certain – every project has very limited scope and every developing functionality and change request should be analyzed and considered in regard of that scope. It is a common practice to go over budget and recent studies (Standish Group - Chaos report for 2013.) show that IT project success rate slowly raises over years, increases in budget and project scope overstep also increase. Great percentage of developed functionalities are never or rarely used by end users but their development greatly influenced project time and funds expense. This is especially important in the initial phase of project planning where project goals should be considered thoroughly. Comprehensive study of project requests and goals enable project management team to carry out project work successfully. Because of flexibility and constant adaptation which are required from modern companies from external factors and continuous

improvement and feedback from stakeholders', project management teams using agile methodology embrace permanent change culture. However each change request should be subject to analysis in the same manner as analysis of functionalities and project requirements in the initial stages of the project.

General objective of each project as an effort is to maximize benefit for its stakeholders within given scope, therefore it is necessary to make decisions about project based on comprehensive analyses and not only on previous practices because every software development project is unique.

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ERP systems in Human Resources Management

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Abstract - **Organization development and achieving extra profits in the modern environment, is directly related to the balanced using the resources that are available to the company. One of the key point's successful businesses is human resource management, which today implies significant use of information technology. Human Resource Information Systems (HRIS), information systems for capturing, feeding of, analyzing and retrieving data is relating to the shell resources of specific organizations. The aim of this paper is to highlight the importance of HRIS systems and to provide a comprehensive insight into this topic. Special focus of this work will be on display the level of implementation of these systems in Serbian companies.**

I. INTRODUCTION

Social and organizational changes in the social and economic environment are numerous. In this context it is important that human resources, as one of parameters of successful business, are in line with the upcoming trends. The application of technological achievements and advantages of information technology is an imperative in the field of human resources.

Enterprise Resource Planning - ERP has a wide application in the work of the Department of Human Resource Management. With these systems efficiently monitored lifecycle employees and plans hiring new workers. These types of changes can be seen as transactional events, because they are characterized by the fact that starting employment workers and end its allocation within the organizational structure companies. As such, they are ideal for a traditional ERP infrastructure [5].

In accordance with stated, HR management processes were found very quickly appropriate support ERP systems. However, the modern employment statistics impose the need for consistent initiatives, which are carried out in real time, so that department's human resource management must provide this initiative long before the actual employment of workers. For these reasons there is a need separation HRIS system of standard ERP solutions, because HRIS systems could offer a wider range of options, such as a permanent adjustment report. Goal of the work is to comprehensively displayed HRIS systems, their evolution, structure, the advantages, as well as one process of introduction of the organization and thus emphasize the importance that they have in modern business.

The last couple of years in Serbia it starts to speak of integrated information systems enable and facilitate the management, optimization, planning and monitoring of all business segments one company. It helps to be in the right time right decisions; more easily analyze business processes and timely detect or anticipate possible critical point in the company's operations and timely prevent unintended consequences.

II. ABOUT ERP

ERP system is a corporation strategic tool for the integration of business processes that take place within its organization and working environment. ERP is a set of internal ("enterprise-wide") tools that facilitate better management and integration of production and other back office operations within the enterprise. These tools further provide means for effective interfacing of the aforesaid "better managed internal activities" with front office jobs such as customer/supplier relationship management. This interfacing in turn assists the enterprise to open its doors for online commerce [8].

ERP systems offer companies the following three major benefits: business process automation, timely access to management information and improvement in the supply chain via the use of E-communication and E-commerce.

The ERP system is a new kind of IT for small and medium-sized enterprises (SMEs). Many small and medium-sized enterprises adopt ERP systems to achieve of inventory reduction, data integration and cost reduction [6], [3].

ERP systems now cover all business functions so that they are available on the much larger market of business systems. Any business information system has the following characteristics that could be qualified as an ERP solution:

1. Flexibility. Modern ERP system characterized by the possibility of adapting the real need certain business systems that implement it in the certain environment, and industry practices. Flexibility initiates to the ability to set general parameters and parameters of the process, working with various data sources, and so on.

2. Modularity and open architecture. ERP system is composed of modules. Each module is designed for a certain field of business functions. Furthermore, each module can be connected to other modules or some

software components. System or its parts can be implemented on different hardware and software platforms.

3. Availability. ERP system must be available to all its organizational units. The system provides appropriate interfaces, which is designed for enterprise partners and its customers.

4. Simulation of real business conditions. This is the one of the most important functions of the ERP system. Appropriate simulation scenarios make this prediction by the domain real business data. Simulation results of real business conditions are basis for business decisions [4].

ERP when successfully implemented links all areas of a company including order management, manufacturing, human resources, financial systems, and distribution with external suppliers and customers into a tightly integrated system with shared data and visibility [1].

III. ERP SYSTEMS IN HUMAN RESOURCES MANAGEMENT

Information system for management of human resources is a software product that provides a complete solution for the management of human resources in business systems of various sizes, regardless of the activity. It is an open software solution, which is designed to respond to current and future customer requirements.

Modern information systems for human resources management should provide: management of all employee information, reporting and analysis of employee data, benefits administration of enrollment, status changes and updating personal information and complete integration with payroll systems business and other financial software and accounting systems.

An effective information system for human resource management provides information that business system should monitor and analyze about employees, former employees and applicants. Each operating system selects an information system for human resources management and adapts it to needs.

With appropriate information system for human resource management data that is necessary for the management, knowledge of employees, career development easily accessible and quickly updated, and managers can finally access the information they need to legally, ethically and effectively support the success of its employees. Sources of information subsystem internal sources (strategic, tactical and operational plans, internal regulations and other documents), and external sources are legislation, technical literature, conferences and so on.

Modules information subsystem for Human Resource Management may be:

- Modules designed for transactional purposes, which have the task to monitor the movement of personnel resources and perform job analysis, selection and deployment of personnel, professional education and training and the like;

- Modules for tracking employees who provide formation and maintenance of a set of data and information on employment business system;

- Module for evaluation of jobs and compensation, which has the task of assessing the value of jobs done by employees in their workplace;

- Monitoring module of training staff members that allows the formation and persistence of a set of data and information on the monitoring and analysis of the development of training each worker through the education system.

- Reporting module state bodies and institutions, this focuses on the formation of reports and reporting institutions such as the services of the labor market, social, pension and health insurance.

IV. ADVANTAGES OF ERP SYSTEMS IN HUMAN RESOURCES MANAGEMENT

In today's global corporations, human resources play a very important role in the business. Whether with respect to employment or layoffs or is about motivation of employees, the department of human resources in any organization now enjoys a central role not only in the formulation of the rules of business systems, but also in the modernization of the business processes. To the department of human resources made it more effective and more efficient, new technologies are introduced on a regular basis to get things done a lot more modern and much simpler.

The main advantage of ERP system in HRM is not just computerization of data on employees but also to keep up to date with the decisions that are made or should be made up as part of a plan for human resource management. Also, one of the benefits of HRIS is payroll code that automates the entire process payroll collecting and updating data on the payroll of the employees. It also collects information such as the presence of staff, account various deductions and taxes on earnings, automatically generate periodic payments. With updated information this system makes the job of HR departments is very easy and simple, as everything is available in the database and all information is just a click away.

At the time of labor and management information system for managing human resources advantage is enabling staff human resources to implement new technologies for the efficient collection and evaluation of staff time and labor information. This allows the information on employees can easily track so that it can be assessed at a higher scientific level whether the employee uses at work to their full potential or not, and if any of these are improvements that can be done to help employees feel safer. Use of employees is very important because they help to motivate the employees to work better.

Information systems in human resource management also have advantages because limits the time and cost required activities that lead to more efficient department of human resources. This system reduces the long written record of human resources, which are often found in most departments of human resources, business systems and

consequently leads to greater productivity and departments, and therefore the business system.

V. DISADVANTAGES OF ERP SYSTEMS IN HUMAN RESOURCES MANAGEMENT

HRIS can also be problematic for small business systems, which are not large enough to have specialist technology for human resources and therefore should seriously consider outsourcing. Some of the shortcomings of the system for managing human resources are what are included human error while entering information and technology that is needed to maintain the system and corrected the faults in the application software to support as closely as possible the needs of human resources [2]. The existence of requests for computer technologies and specialists with a general knowledge of information technologies and finding qualified specialists in the field of human resources can be extremely difficult. With such a request, the cost of employment HRIS specialists can be far above the average salary for specialist computer technologies. Price per trip to another employee in the area of expertise can be an investment for a smaller business.

VI. IMPLEMETATION OF ERP SYSTEMS IN SERBIA

In the developed world ERP systems constitute a powerful management tool for everyday possession resource companies. The situation in Serbia is not on the high level. Republic office for statistics Serbia has conducted research on the use of information and communication technologies. In Serbia in the course of January 2014, 9.9% of companies use an ERP system. Analysis of enterprises by size shows that the total number of large enterprise ERP system has 45.7%, 22.8% medium-sized enterprises, while 5.1% of small businesses have ERP system.

Company for the supply of electricity, gas, steam and water mostly use ERP system (17.6%), followed by enterprises from administrative and support service activities (14.3%). Based on the research came to the conclusion that the number of companies using ERP system dropped 0.1% compared to 2008. The reason for this is the lack of information about the company ERP system. Also, using ERP systems in Vojvodina is about 8.8%, in Central Serbia is 8% and in Belgrade is 12.4% [7].

The automotive industry is one of the most important industry in the world. It employs millions of people, generates billions of Euros and is the basis for a myriad of related services, and related industries. It is characterized by mass production, mass marketing, globalization of production, application high technology and constantly finding new ones.

For these reasons it is important business, which is based on information and communication technologies that will enable synchronization and optimization of the processes. One of the successful examples of the application of integrated information systems is a company in the supply chain supplying the automotive industry founded in 1853, a part of a company called

ZASTAVA. Basic production program make parts of interior and equipment automotive industry. Additional production program consists of products and leather accessories dedicated products.

The company decided in 2007 to introduce ERP system called QAD Applications-Automotive Bundle, which in itself has integrated the requirements specific to the automotive industry based on MMOG/LE (Materials Management Operations Guideline/Logistics Evaluation) standard. Manufacturers have the ability to detect critical areas where automation and systems can significantly improve the efficiency of enterprises and process flows. MMOG/LE allows the flow of information accompanies the material flow. Although MMOG/LE was developed by the automotive industry, there is growing interest and use of MMOG/LE in hospitals, construction, aviation industry, chemical industry, electronic industry and so on.

In January 2008 company was put into production Datelab Pantheon in the area of finance, accounting, human resources, payroll, fixed assets, time and attendance, procurement and sales and QAD Application in the area of engineering, sales, purchasing, logistics and production. The modules in the software package Datelab Pantheon are:

- Orders - Module for monitoring of issued and received orders;

- Production - Module designed for the development of new titles by different components;

- Goods - Module in which the acceptance and issuance of titles transfer among warehouses, water customs warehouses and other customs records, prepare tax reports and overviews and work conflicts, as received, and invoices issued;

- Service - Module serves the conduct of managed complaints and other service requests;

- Money - The module contains all accounting functions. From manual and automatic posting, printing and accounting, treasury operations, liquidation and interest;

- Staff: The module is intended for personnel records.

VII. CONCLUSION

After the introduction of ERP systems in the company can be said that the quality of business built on a much higher level, because: Created a unique database available everyone and thus the quick access to all transaction information throughout the organization. Also, there is a possibility for the databases of all significant entered transactions, records, processes, monitoring and reporting; Improved communication and coordination between units within the company. Eliminated duplication of data and increased accuracy, accessibility and sustainability data; Progress on unique view of the overall production jobs for all functions and departments, which increases conductivity of cooperation and coordination among departments within the company; Enabled on an accurate prediction of the plans customers and therefore the prediction of its own procurement plans; Performed automatically receive orders from customers via EDI

without the possibility of errors when entering the customer's orders in its own system; Reduced time and automated way to create and sending orders to suppliers with optimal inventory costs and the lowest possible risk per customer; The quick and easy list of fixed assets with minimal engagement of human resources; Chance of calculation of the cost after the most current purchase price; The company has become more responsible to customers and market, so that the ERP system did company more agile.

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Performance of different primary key types

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Abstract – **Primary keys and their definition is one of the first steps in database design. It is familiar that database designers tend to use artificial, surrogate keys in order to completely, functionally define records. On the other hand, application designers prefer using natural keys which have business meaning and, therefore, are more suitable for users to understand and use them. Lately, it has been popular to use hierarchical structure in defining primary keys and referencing them in order to improve performance and decrease designing time. The questions that often come ahead are which one is better and why? Is there any performance issue that we must have in mind? This paper will show when to use which key type and what their performances on a simple and common database are.**

I. INTRODUCTION

At the very beginning of every project containing database, the most important issue to deal with is choosing the type of primary key. The fact is that in small project the difference won't be noticeable, but as every system tends to expand, it is important to prepare the system for performances it might be faced with in the future. As it was discussed in several papers as [1] and [2] both surrogate and natural key have its advantages and disadvantages depending on the specifics of use of the database.

Lately very popular and promising but still very limited concept of arranging data by hierarchy has presented its advantages in cloud computing [3], but no one ever measured its performance comparing to other two approaches.

Before making any statements about their performance, it is important to define main concepts and terms.

A. Basic terms and definitions

A key in the table can be defined as an attribute or a composition of attributes which uniquely defines a row in a table.

A primary key is chosen attribute or set of attributes which will be used to identify each row in the designed table. Primary key completely, functionally describes each record.

Natural key is a key which has business meaning. It is formed of attributes which exist in real world and have a significant meaning to the formed table [4].

On the other hand, Surrogate key is usually automatically updated attribute, an integer or a code, which has no business-related meaning to the table and exists only for the purpose of identifying an entity.

When a primary key in one table represents an attribute, key or regular attribute, in another table – that attribute plays a role of a foreign key. Using this concept of pointing to data in different tables, a certain hierarchy can be formed between the tables, or between records in a single table. This way of data composition is familiar as hierarchical relation, a parent-child relation between tables [5].

Hierarchical relation has its roots in graph theory and it has evolved and is used in many data structures. The graph can be considered to be a tree if the following conditions are met [6]:

- There are no cyclical movements in the graph. More accurately, a node can't be the parent of itself.
- A node has either one parent or none.
- If a node doesn't have a parent, it's called a root node.
- If a node has a parent, the node is referred to as the child of the parent node.
- A node can have an arbitrary number of children.

B. Past discoveries

Several websites, usually communities, have been writing and advising about composing the right primary key for any table, depending on the table's purpose.

There are several questions which are good to be asked when setting a natural primary key, for example [7]:

- Is the primary key unique?
- Does it apply to all rows?
- Is it minimal?
- Is it stable over time?

If there are any negative answers to these questions, it should lead to choosing another attribute to solely identify entities in the database.

Auto-generated values such as those in surrogate keys may cause an error or even sometimes applications sharing similar tables create new records independently of one another and the two databases will consequentially generate the same values. A natural key, in this circumstance, would definitely eliminate any possibility of duplicate primary key values [8].

Reference [4] suggests ways of composing surrogates or natural keys when creating a primary key, but also the ways of refactoring and transitions to different key type.

It is stated that refactoring is a usual process in database evolutional development and common way of fixing legacy databases.

Indexes and natural keys were compared regarding their performances in [9], even though direct search via indexes isn't questionable to be much faster, because it is a direct approach to wanted data. The question still remained how complex hash function is comparing to simple entering data such as natural or surrogate keys and how much time does it take overall?

Finally, regarding performance, [2] concluded that choosing surrogate keys as primary keys does not always mean adding columns to tables. Also, query times are better, because primary indexes are smaller. This is due to the fact that surrogate keys use an integer data type, while the natural keys they replaced used a variable length character data type.

On the other hand, hierarchical composition takes in [10] several cases into a consideration, depending on depth of the tree examined. The hierarchy which is between eight and thirteen levels deep, executed with a while loop is most often the shortest executed query. Non-traditional recursive function seems to do just a little better than the recursive common table expressions between six and twelve levels. Same execution time was when it was measured at seven levels deep hierarchy. The repeated joins method never showed any impressive executions because there were always faster performing solutions available.

II. PERFORMANCE TEST

There are three experiments: one in which we will chose a natural key for the primary key of every table, one in which a surrogate key will be used for the query and the final one where data will be hierarchically organized and then queried for the same data. The tables will be loaded with 30 rows of data and will be tested to see the response times of simple selects, queries and joins.

The test database management system is Oracle 10g Express Edition and environment this experiment was executed in is SQL Developer 1.5.5. The test computer is equipped with an Intel Core i3-4000M processor, 4 GB of RAM and 2.40 GHz speed.

Fig. 1 shows the basic scenario which the experiment will be based on.
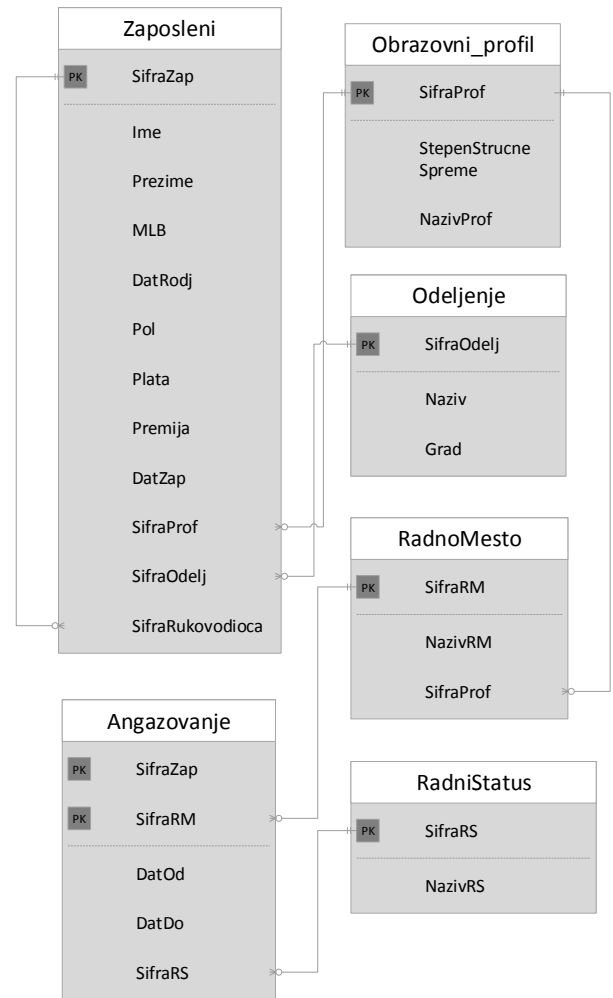
Figure 1. Entity table for surrogate keys testing

Setting is commonly used database of all employees, their education workplaces and their working time. Basic setting is that all tables have surrogate primary keys.

TABLE I.   TESTING RESULTS FOR SURROGATE KEYS

SELECT * FROM ZAPOSLENI Z JOIN ANGAZOVANJE USING (SIFRAZAP) JOIN ODELJENJE USING (SIFRAODELJ) JOIN ZAPOSLENI Z2 ON (Z2.SIFRAZAP = Z.SIFRARUKOV);	17ms
SELECT * FROM ZAPOSLENI;	1ms
SELECT Z.IME AS IMERUKOV, Z.PREZIME AS PREZIMERUKOV, Z2.* FROM ZAPOSLENI Z JOIN ZAPOSLENI Z2 ON (Z.SIFRAZAP = Z2.SIFRARUKOV) WHERE Z2.SIFRARUKOV IS NOT NULL;	1ms

Now the same setting will be refactored in order to have natural key as identification.
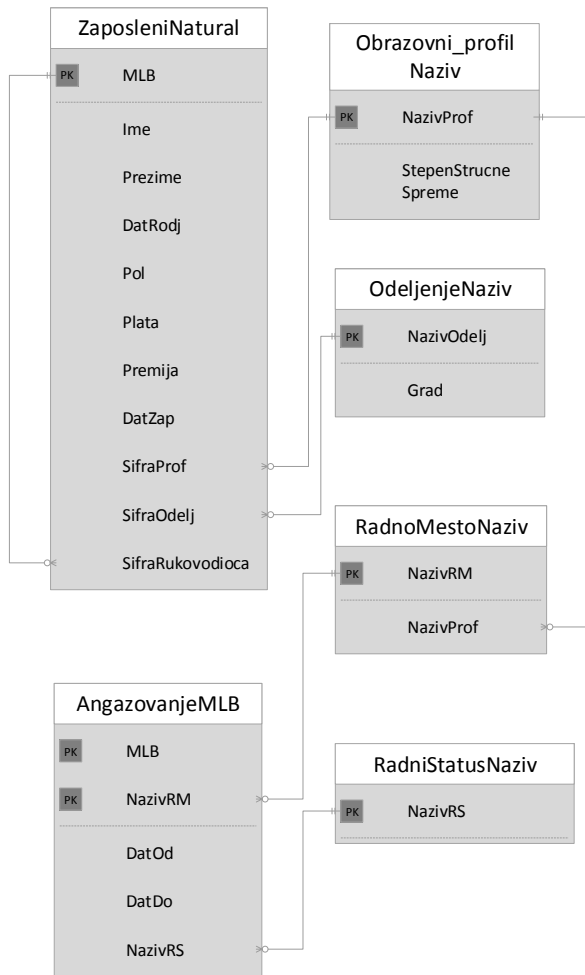
Figure 2. Entity table for natural keys testing

TABLE II. TESTING RESULTS FOR SURROGATE KEYS

SELECT * FROM ZAPOSLENINATURAL Z JOIN ANGAZOVANJENAZIV USING (MLB) JOIN ODELJENJENAZIV USING (NAZIVODELJ) JOIN ZAPOSLENINATURAL Z2 ON (Z2.MLB = Z.MLBRUKOV);	34ms
SELECT * FROM ZAPOSLENINATURAL;	6ms
SELECT Z.IME AS IMERUKOV, Z.PREZIME AS PREZIMERUKOV, Z2.* FROM ZAPOSLENINATURAL Z JOIN ZAPOSLENINATURAL Z2 ON (Z.MLB = Z2.MLBRUKOV) WHERE Z2.MLBURUKOV IS NOT NULL;	5ms

Final testing regarding hierarchical structure of data is done on the same entities as surrogate testing, except table ZAPOSLENI which was replaced with ZAPOSLENIHIERARCHY, because hierarchies work with integers when referencing themselves.
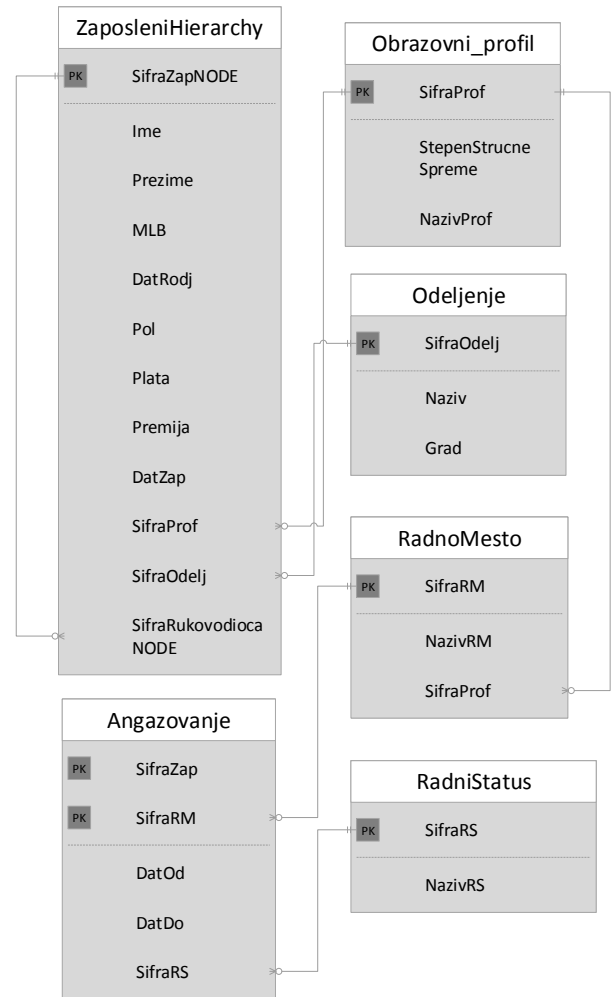
Figure 3. Entity table for hierarchical structure testing

Several papers such as [6], [11] and [12] were examined in order to find the best solution for designing the hierarchy in the table for testing. Since some vendors, Oracle Corporation being among the most notable, have extended their SQL syntax with additional functionality to support querying hierarchical data [13], it is important to choose best syntax available, in order to gain its full potential.

Table ZaposleniHierarchy was created with syntax ideologically guided by [6], in order to fulfill all requirements mentioned earlier when creating a hierarchical structure. Again, same queries were used for testing and the results are shown in Table III:

SELECT * FROM ZAPOSLENI Z JOIN ANGAZOVANJE USING (SIFRAZAP) JOIN ODELJENJE USING (SIFRAODELJ) JOIN ZAPOSLENI Z2 ON (Z2.SIFRAZAP = Z.SIFRARUKOV);	20ms
SELECT * FROM ZAPOSLENI;	13ms
SELECT Z.IME AS IMERUKOV, Z.PREZIME AS PREZIMERUKOV, Z2.* FROM ZAPOSLENI Z JOIN ZAPOSLENI Z2 ON (Z.SIFRAZAP = Z2.SIFRARUKOV) WHERE Z2.SIFRARUKOV IS NOT NULL;	0.5ms

III.   CONCLUSION

Results show that choosing surrogate keys as primary keys means better performances no matter which operation is done over data. Query times are better over other two, because primary indexes are smaller. The reason for those kinds of results is because surrogate keys use an integer data type, while the natural keys use variable length character data type. On the other hand, hierarchy means more recursive pointing, and tends to slow down regular selections and joins, but has best time when testing queries.

It can be concluded that surrogate keys still hold first position in performance race overall, but hierarchical structure has its potential when using databases for constant querying.

In the end, although surrogate keys tend to be better for performance, it can't be neglected common use of natural keys. The main reason for it is that users of databases and day-to-day use prefer meaning of data. It helps them understand programing language and data inside the database in every day's assignments.

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Towards Modelling and Analyzing Navigation Behaviour Patterns Using Generalized Stochastic Petri Nets

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Abstract - Nowadays, online shopping is becoming very frequent user activity and we are witnesses of daily evolution of this kinds of services in several directions adjusting to the user behavior, such as: predicting and proposing similar content or products that were previously previewed or purchased, personalization, targeted marketing, etc. On one hand, this leads to increased sales and turning the most browsers into buyers, speeded up and increased possibility of choosing of a big set of products, kept costumers attention, loyalty, etc., and on the other hand, adjustment and improvement of the web design or the interface in order to improve the user experience and interaction with the system. In this whole picture, besides the analysis of the user behavior in the electronic purchasing process, understanding the overall user behavior is an important indicator of user's interests. In this regard, this research has identified the most common user behavior patterns in the processes of navigation, as an inseparable part of the electronic purchasing process. A behavioral-based model that provides profound knowledge about the processes of navigation through information networks illustrated through the example of an electronic bookstore is proposed. The developed model is based on stochastic modelling using Petri Nets, which solution is based on Continuous Time Markov Chain, used for model evaluation and few performance measures calculation, such as: the expected time spent in a transient tangible marking, cumulative sojourn time spent in a transient tangible marking, total number of visits in a transient tangible marking etc.

I. Introduction

Recently, the popularity of electronic stores of different types is very increased, which leads to an increased number of users (buyers) and more frequent online purchasing. Also new standards are established and user expectations are changed and grown. This implies a need to retrieve more precise results in the process of information retrieval, accurate recommendations, better design oriented to the user (user experience design), as well as a need for better customization (personalization), both in the process of searching and navigation in various spheres, including the sphere of electronic commerce. All this, requires a profound understanding of the interaction, i.e., the interface on one hand, and the behavior of users in such electronic environment, on the other hand, which is

extremely important to create new strategies and appropriate marketing.

There are plenty of scientific papers that are focused on this problem. Despite this fact, we came across difficulties to identify a research work which considers user navigation behavior (i.e. actions) as transitions. This is the main idea of our work: to show how Petri Nets (PN), as transition based models, can be applied in modelling user navigation behavior. In this work, we want to outline some intrinsic details of Generalized Stochastic Petri Nets (GSPN) application for describing user navigation patterns, which actually take some time to execute (perform).

The rest of the paper is organized as follows. In Section 2 we present related work in this field. Section 3 represents an overview of the Petri Net formalism and our contribution. A case study is presented in Section 4. In the last section, we give some conclusions and steps for future work.

II. Related Work

To build an effective user navigation behavior model means to develop an accurate predictive mathematical model of the user behavior. Usually, the models are based on log data collected in a period of time [16], [20], and their structure is complex, but it carries an important source of information about user behavior. In order to study log data and to gain knowledge of how users navigate, statistical analysis and application of data mining techniques need to be performed. Usually, the emphasis is placed on developing models for: discovering user search or navigation patterns [24], predicting and proposing future user actions [7] and personalization based on user behavior [2], [12], [21].

[19] use a data mining approach in order to discover common user navigation behavior patterns and also common sequences of transitions, based on a particular case of log data, taking into account the duration of the website visits. Also, a data mining approach, but in combination with semi-Markov process in discrete time, is applied in [10], in order to understand and describe the user behavior. They propose an algorithm for obtaining a transition probability matrix. The developed model is used to improve the design of the website and also for

performance evaluation. In the study of [18] a new approach for predicting user behavior in order to improve website performance is proposed, based on both log data and website structure. They apply Petri Nets in order to reveal the structure of the website and to predict next user action (path completition). Model based on Colored Petri Nets (CPN) [11] for predicting next user action is proposed by [12]. The approach is based on former user profiles and the current user session. Another application of Petri Nets formalism is found in the research of [22], but this time the emphasis is placed on modelling and analyzing the structure of the web site, so web pages are presented as states and transitions as arcs. Solving this model helps in predicting subsequent user actions in the navigation process (path complete). This research evolved, so in [17] the concept of Stochastic Time Petri Nets (STPN) [4] is implemented for modelling the website structure and predicting future user behavior. [14] suggests application of Stochastic Petri Nets [1] for modelling electronic store costumers behavior in order to improve the quality of web services, their reliability, performance and availability. What is the user online search and navigation behavior in large enclosed spaces (ie. shopping centers), is investigated by [25] in order to improve customer satisfaction when using the Internet and doing online shopping.

There are numerous studies related to the user behavior clustering process. For example, [23] illustrates a new approach for clustering patterns of interests to the users, based on registered navigational data from Chinese electronic store. Specifically, except navigational paths in consideration is taken the frequency of web page visits and retention on a web page or a category. Also, some researches in this area are directed to the construction and implementation of algorithms for sequences clustering where not only transitions, but their order is important and carries useful information about the user behavior. One such approach is shown in the survey of [13]. They present a combination of standard clustering methods and techniques to analyze sequences based on Markov Chain, which is used to group user behavior according to the similarity of the user actions order.

III. USING PETRI NETS TO CAPTURE NAVIGATION BEHAVIOUR PATTERNS

The focus in our research is placed on discovering and modelling the navigation behavior of bookstore users (buyers), specifically examined in the case of first Macedonian electronic bookstore (www.kupikniga.mk), but easily generalized and applicable on other very known services, which structure is similar to the selected scenario.

A. Petri Nets – System Dynamics

The basic elements of PN are: places, transitions, tokens and arcs. Usually, places are presented as circles, transitions as rectangular boxes and tokens as black dots. Places are related to states, transitions are related to actions that can change the states and arcs determine directed relation between places and transitions (Murata, 1989). The marking of PN is closely related to tokens and it is used to describe the dynamic behaviour of the

system. In that context, a transition is enabled if all its input places contain at least one token. An enabled transition can fire by removing one (more) token from all its input places, and adding one (more) token in all its output places, following the arcs.

The behaviour in a standard PN is discrete only. It means all the transitions are instantaneous or fire instantly. An extension of this concept is GSPN [1], where immediate and timed transitions are introduced. Here, the firing delays of timed transition are stochastic, usually exponentially distributed random variables. It means a timer is associated to each enabled timed transition, in such way that the timer value is sampled from (negative) exponential distribution with appropriate rate parameter. The timer constantly decreases, and when its value will become zero, the timed transition will fire. Usually, immediate transitions are presented as black rectangular boxes or bars, and timed transitions as white rectangular boxes. The immediate transition fire with priority over timed transitions. The markings could be tangible and vanishing. A tangible marking is a marking where only timed transitions are enabled. Contrary to this, a vanishing marking is a marking where immediate transitions are enabled (or combination of immediate and timed transitions are enabled).

B. Suggested models

The dynamic nature of PN, especially GSPN, indicates that they can be accommodated for modelling real user navigation behaviour. In this direction, we employ a model in order to capture navigation behaviour patterns. In GSPN notation, according to the web site topology, shown in Figure 1. our net comprises 10 places, and 44 timed transitions. Detailed specification is given in TABLE I. and TABLE II. respectively.
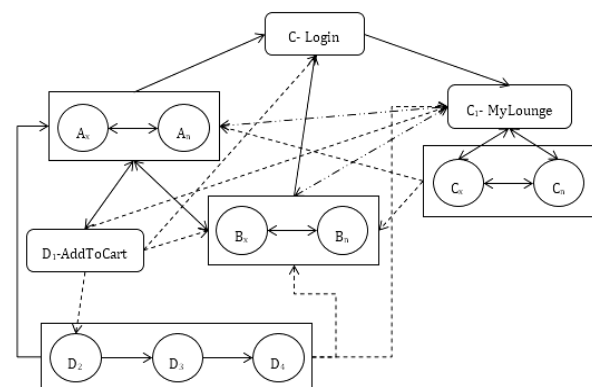
Figure 1.   Graphical model presentation

TABLE I.   PLACES IN THE GSPN MODEL

Place name	Place description	Initial marking
A	A category page	1
B	B category page	0
E	Ended user session	0
L	Login	0
ML	MyLounge (MyBookStore)	0
C	C category page	0
D1	AddToCart	0

D2	AddressEntry	0
D3	LastCartPreview	0
D4	PayingCasys	0

TABLE II.   TRANSITIONS IN THE GSPN MODEL

Transition name	Transition description	Rate
tA_cont, tA1, tA2, tA3, tA4, tA5, tA6	Visit an A category page	α
tB, tB_cont, tB1, tB2, tB3, tB4, tB5	Visit a B category page	λ
tE_A, tE_B, tE_L, tE_ML, tE_C, tE_D1, tE_D2, tE_D3, tE_D4	End the session	μ
tL, tL1, tL2, tL_cont	Login	κ
tML, tML1, tML2, tML3, tML4, tML5, tML_cont	Visit MyLounge page	ν
tC, tC_cont	Visit a C category page	θ
tD1, tD1_cont	Visit AddToCart page	ε
tD2, tD2_cont	Visit AddressEntry page	γ
tD3, tD3_cont	Visit LastCartPreview page	δ
tD4, tD4_cont	Visit PayingCasys page	β

Graphical model representation is depicted in Figure 2. The GSPN dynamics of the model can be described using the terminology of CTMC [1], [15]. In this regard, for understanding the stochastic process that underlies this GSPN model and evaluation of appropriate performance measures, we use efficient time and space algorithm for computing steady state solutions of deterministic (DSPN) and stochastic (SPN) Petri Nets, proposed by [6].
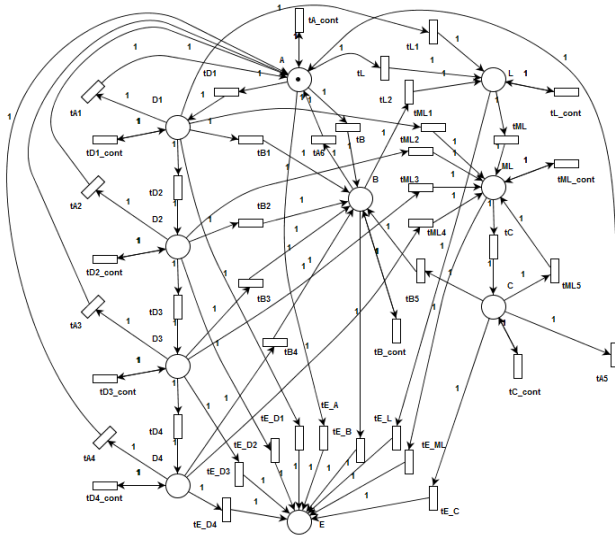

Figure 2.   Graphical model presentation

IV.   CASE STUDY

The navigation data used for this study is collected server side in a certain time frame and it is in a standard W3C format. The log file contains about 415000 records so that each record contains data belonging to several categories (attributes), but for this research particularly important categories are: userID, Date and Time and URL visited. In order to transform the data into easily interpretable format for further usage, it was necessary to

do pre-processing and data cleaning tasks. It means removal of all incomplete records or records that lack any of the key attributes or they are inconsistent. Using a script we dynamically identify users, visits, visits duration and page views, per user under per visit. Also, the script is used for statistical analysis and general user behavior patterns detection. After the pre-processing step and data cleaning, the total number of records is 322000, so 1984 unique users and 15433 unique visits were identified.

To cluster the users based on their navigation sequences, we apply sequence clustering the algorithm proposed by [13]. According to the set input parameters and the data set, the users are automatically grouped into two clusters, as an optimal solution for this problem. As illustrated in Figure 3. the number of users in each cluster is approximately equal.
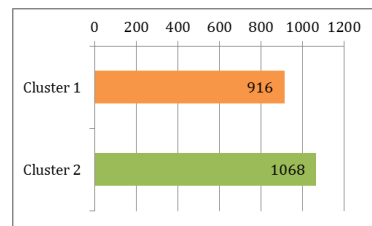
Figure 3.   Number of users in the two clusters

The visual cluster profiling is given in Figure 4. thus each column represents a cluster, each row represents a sequential attribute and each cell contains a histogram of user actions sequence.
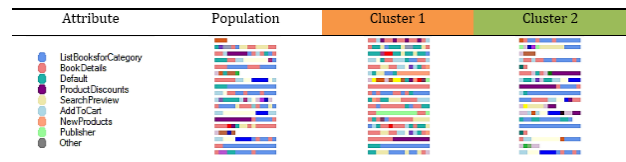
Figure 4.   Cluster profiles

According to the analysis and quantitative data obtained, the model is solved, validated and several performance measures are calculated. In that direction, the rates calculated of our timed transitions, for the first and the second cluster are shown in TABLE III.

TABLE III.   FIRING RATES OF THE TIMED TRANSITIONS

	Cluster 1	Cluster 2
α	0.000009	0.000033
λ	0.000059	0.008621
μ	0.000003	0.000003
κ	0.000004	0.000003
ν	0.000107	0.000080
θ	0.000882	0.001027
ε	0.000073	0.000208
γ	0.083333	0.050000
β	0.047619	0.055556

Because the last state (E) is absorbing it means that computing steady state probability distribution is meaningless in this case. All the others measures of

interests are computed and described in the remainder of this section.

The average sojourn times for our tangible states for both of the clusters are shown in TABLE IV.

TABLE IV.   AVERAGE SOJOURN TIME SPENT IN A TRANSIENT TANGIBLE MARKING

	Cluster 1		Cluster 2	
Marking	Time [s]	Time [min]	Time [s]	Time [min]
M_A	6796.70	113.28	112.76	1.88
M_B	13451.82	224.20	115.47	1.92
M_E	∞	∞	∞	∞
M_L	8820.74	147.01	11582.01	193.03
M_{ML}	1008.46	16.81	901.15	15.02
M_C	943.99	15.73	102.42	1.71
M_{D1}	11.96	0.20	16.96	0.28
M_{D2}	7.63	0.13	8.75	0.15
M_{D3}	9.38	0.16	13.44	0.22
M_{D4}	16.95	0.28	53.08	0.88

Also, the total time spent in the transient states is given in TABLE V.

TABLE V.   TOTAL TIME SPENT IN A TRANSIENT TANGIBLE MARKING

	Cluster 1		Cluster 2	
Marking	Time [s]	Time [min]	Time [s]	Time [min]
M_A	32577.45	542.96	645.74	10.76
M_B	338538	5642.3	142562.3	2376.04
M_L	13496.14	224.94	23.42	0.39
M_{ML}	8099.07	134.98	3.04	0.05
M_C	40131.37	668.86	0.36	0.01
M_{D1}	28.48	0.47	2.29	0.04
M_{D2}	49.65	0.83	1.78	0.03
M_{D3}	40.07	0.67	5.24	0.09
M_{D4}	13241.97	220.7	6.06	0.1

The average number of visits in the transient states is presented in TABLE VI.

TABLE VI.   AVERAGE NUMBER OF VISITS IN A TRANSIENT TANGIBLE MARKING

	Cluster 1	Cluster 2
M_A	3.501551	11.593189
M_B	3.828545	12.600198
M_L	0.996941	1.062461
M_{ML}	5.182163	1.035813
M_C	5.164502	1.032780
M_{D1}	1.839687	0.273193
M_{D2}	1.835698	0.232543
M_{D3}	1.828880	0.200941
M_{D4}	1.823379	0.107744

In our model, cumulative sojourn times for all transient markings are shown in TABLE VII.

TABLE VII.   CUMULATIVE SOJOURN TIME IN A TRANSIENT TANGIBLE MARKING

	Cluster 1		Cluster 2	
Marking	Time [s]	Time [min]	Time [s]	Time [min]
M_A	23798.99	396.65	1307.2	21.79
M_B	51500.88	858.35	1454.9	24.25
M_L	8793.76	146.56	12305.43	205.09
M_{ML}	5226.02	87.1	933.43	15.56
M_C	4875.23	81.25	105.78	1.76
M_{D1}	22.01	0.37	4.63	0.08
M_{D2}	14	0.23	2.03	0.03
M_{D3}	17.15	0.29	2.7	0.05
M_{D4}	30.9	0.52	5.72	0.1

Thus, we can conclude that the average duration of a single session in the first cluster is 94278.95 [s] or 1571.32 [min], and 16121.82 [s] or 268.70 [min] in the second cluster.

V.   CONCLUSION

We have proposed a Generalized Stochastic Petri Nets (GSPN) modelling approach for describing user navigation behavior. In this class of Petri Nets (PN), immediate transitions have firing weights, timed transitions have exponentially distributed firing times, and the underlying stochastic process is a Continuous Time Markov Chain (CTMC). In order to evaluate several performance measures, we have employed an efficient algorithm for computing steady state solutions of deterministic and stochastic Petri Nets (DSPN), proposed by [6]. The obtained results include the average sojourn time in each of the transient states, the total time spent in these transient states, the average number of visits, as well as the cumulative sojourn time.

Under the assumption that users' arrival can be described as a stochastic process with exponentially distributed interarrival times, and users' sessions have exponentially distributed duration with mean equal to the cumulative sojourn time, one can easily extend the GSPN model in order to describe the "operational environment", i.e. to partition the "input space" of the client-side by grouping users that exhibit as nearly as possible homogenous online navigation behavior, as well as to evaluate service reliability, system availability, performance and performability. Moreover, during a session, all those multiple requests/tasks consume system resources, possibly reducing service accessibility (load levels saturate the system). An understanding of the motives underlying user actions can help designers to better accommodate to what appears to be chaos: make available those capabilities that best support the range of known behavior patterns.

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Identifying user interface design guidelines for touch interfaces for children

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Abstract – The research was aimed at establishing and verifying best design guidelines for creating a touch-based interface for tablet applications for children. The children were divided in three age groups categories: 0-3 years, 3-5 years and 5+ years according to different usage approach and cognitive level of the children as well as their previous exposure and experience with devices with touch interfaces. A set of UI design guidelines were verified and identified.

I. INTRODUCTION

Child Computer Interaction as part of the overall HCI is defined as discipline concerning design of interactive applications where primary users are children [1].

With the overwhelming and increasing presence of more and more tablet and smartphone based devices the children are experiencing computers for the first time via the tablet devices and their touch interfaces, thus the importance of good user interface design aimed towards touch and gesture usage by children. Furthermore apps intended for usage by children need to be age-and-gesture appropriate to be effective, easy and fun to use.

The overwhelming presence of touch interfaces makes new usability challenges mainly because of missing tactile feedback (i.e. buttons on a keyboard or a mouse) and with introduction of new interaction gestures like swipe, pinch, three finger swipe and touch etc. All of these gestures need to be presented to the end users so they know them how and when they can use such interactions. This is especially important in case where end users are children. Besides learning and knowing the new gestures children struggle with their motor skills and their current cognition level.

There are many studies that have children in their main focus along with touch-screen devices such as [2, 3, 5, 6, 8]. In similar studies UI design has been studied related to children's interaction [4] with the possibility of the children using non-standard gestures. Interactions by an older children (aged 7-10) were studied in [7]. Some of the guidelines proposed there are: children need large buttons/images to touch, stylus can and should be used as an alternative for better accuracy of touches, accuracy can and needs to be increased by software, tablets need non-touch sensitive edges in order for the children to be able to hold the devices, visual feedback should be always present, usability testing with children should be repeated for accurate results.

TABLE I.   CHILDREN BY AGE GROUPS

Number of tested children by age group				
		total	*m*	*f*
1	0 to 3 year olds	**5**	**3**	**2**
2	3 to 5 year olds	**25**	**10**	**15**
3	Older than 5 years	**20**	**12**	**8**

Other studies have investigated children interaction with touch screen, tablet, computer and pointing devices [9, 10, 11, 12].

In this particular study, we aimed at identifying and verifying best UI design approaches for most common and rather simple touch interfaces. We excluded testing complex interfaces like 2D and 3D games.

The apps scenarios used in the study were more-or-less standard story telling apps (find the correct picture sequence to tell the appropriate story), picture memory apps (find two same pictures in a set) and Audio memory and repetition of sounds section. The application used in the test was developed by the researchers. The application also included a "parent and teacher" section which enabled the end users of the app to be able to change and manage the content of the stories, pictures and sounds in order the app to be interesting and the usage of the app prolonged well after the study ends. For application and device platform we used Android based tablets primarily because they are more present and significantly cheaper than any other tablet platform. For size we used smaller tablet size of 7" (18cm) in order to be able to be grasped by the smaller children.

II. METHODOLOGY

A. Experiment setup

The research was done in three phases.

In the first phase we decided which user interface elements and usage procedures we wanted to test. The user elements were primarily buttons, windows text boxes and labels, images and animations. The procedures involved using touch gestures and actions in order to navigate through the application (several navigation threads were possible: with and without pop-up windows) and use touch and drag interaction and gestures to finish the main application activities like picture sorting, image

Figure 1. Initial welcome page of the test app

recognition, image drag and placement. These activities were primarily present in the main activities of the app.

In the second phase we developed the application with the target user interface elements that was to be used in the testing by the children.

In the third phase we made the main experiment with the children using the app where we tested 50 children aged between 0-7 years in Bitola, Macedonia.

B. Application and device familiarity

The children were not in any contact with the test app before the experiment. Some of the children have had previous experience with tablet and smartphone devices thus their exposure to touch interfaces. All children used the same tablet device in order not to have any variations in the device size and speed of processing the testing application.

C. Procedure

The study was made in a comfortable and known environment for the children to use the tablet (daily care center). The camera/video was setup for recording images and video. The younger children were allowed to be helped by their caretakers, parents or the researchers in order to be able to complete the tasks within the app and avoid frustration.

As suggested by [5] the researchers need to observe children closely and teach them at least once on how to use gestures in applications to avoid unintended contacts in any experiment.

D. Information gathered

We noted the time needed for the children to understand and move between app menus and content groups, the gestures used, problems faced, where the children needed help and/or clarification by an adult, and we noted the perceived level of child's excitement (sentiment) throughout the whole process.

III.   RESULT AND DISCUSSION

From the overall observation, children love tablet touch devices especially games. Children who interact with the tablets have different abilities depending on their age, cognitive level and previous experience with such devices.

The children's ability by age level was identified early in the experiment and three age groups emerged: 0-3 years, 3-5 years and 5+ years. There was possibility for another age group segment only for 2 year olds but the number of such children was small in this experiment so the validity of the results for that group could be compromised and such age group was not formed.

A. Children aged up to three years

- They liked and used primarily the controls located at the edges of the screen UI
- Some standard conventions are known and understood. They know what is and what does the X button (app close)
- They need help in using the app and the controls. For this age group the app should have brief usage tutorial preferably with audio and video.

B. Children aged between three and five years

- The pop-up windows process is confusing. They like linear processes organized with "Next" and "Back" buttons or arrow-shaped images.
- The text is not read so there should be less or no text labels in the UI. Voice/audio guidance is a plus.
- Also for this age group the app should have brief usage tutorial and explanation of the purpose of the game.
- The number of clickable (actionable) buttons and other controls should be lowered to minimum. The needed essential buttons need to be larger in order for the smaller children (three years) to be able to successfully press them.
- Children from this age group cannot effectively do drag-and-drop functions and such should be avoided.

C. Children older than 5 years

- Children from this age group can easily understand and follow UI made of more windows. Older children know how to navigate forward and backward in this type of interaction with multiple pop-up windows.
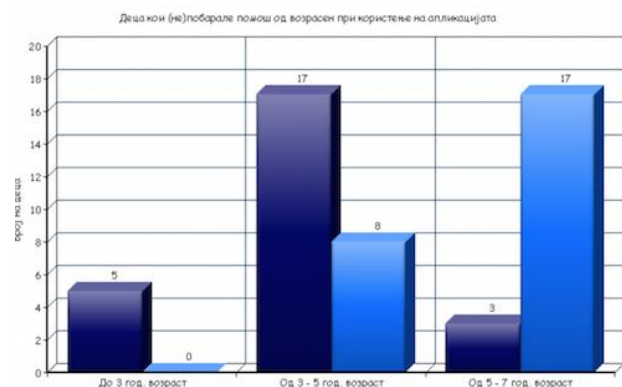

Figure 2. Number of children that needed help (by age group), and children that did not need assistance
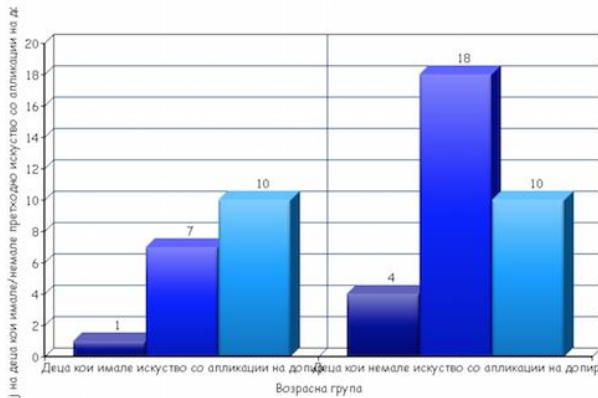
Figure 3. Number of children who had or had not previous experience with touch interfaces (by age group)

- They want to be able to skip certain parts of the usage instructions especially the audio introduction.
- They know and successfully use drag-and-drop types of interaction.

D. Conclusions valid for all age groups

- Their primary usage goal of the children for the applications and computers always is for amusement and fun.
- They are quick to judge and are keen on closing/exiting the application if the first impressions are not good enough for them in that moment.
- They are not ready to wait for anything. They want prompt and fast UI.
- When they get familiar and accustomed to UI interaction conventions they like them, follow and use them.
- The same goes for individual and particular UI visual controls. When they are familiar with such controls they prefer to use them.
- They will try all the buttons and UI elements on the page/UI window. In random order.
- The smaller children don't even bother in reading.
- They are typing (entering text) very slow and need help.
- Scrollbars are confusing to all age groups. Both horizontal and vertical scrollbars should be avoided and not present.
- They will go through all animations and listen to all sounds. At least for the first time.
- They respond vastly better if the overall UI design is appropriate to their age group.

IV. CONCLUSION

The results show that children can learn and use applications with touch interfaces very fast. Depending on the target children age group of the app the user interface needs more visual and audio guidelines (if the children are younger), but if the app is used by an older child (over 5 year old) those A/V guidelines need to be skipped. The children learn fast and utilize UI standards and conventions. An application that uses UI conventions is more likely to be used enough in order for the children to find out the main usage purpose of the app. In this particular study there were small number of children aged 2 to 3 years so there was no possibility of creating such age group cluster and exploring UI guidelines for toddlers. Children older than 5 years have enough previous exposure to touch devices and UI conventions that there was no need to create any other age group for older children.

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A Model of Adaptive E-Learning Recommendation System

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Abstract - E-learning recommendation system helps learners to make choices without sufficient personal experience of the alternatives, and it is considerably requisite in this information explosion age. The majority of current web-based learning systems are closed learning environments where courses and learning materials are fixed and the only dynamic aspect is the organization of the material that can be adapted to allow a relatively individualized learning environment. Normally, learners have different learning styles, cognitive traits, learning goals and varying progress of their learning over period of time, which affects the learner's performance while providing the same bundle of course to all learners. Hence, there is a need to create adaptive e-learning environment to offer appropriate learning content to all individuals. In general, the adaptation can be done based on learners' characteristics. In this paper, we propose a model of a course in an e-learning system, which gives recommendations to students on what type of material to learn, in order to increase their level of knowledge, learning styles and results achieved in tests.

I. INTRODUCTION

One of the objectives of e-learning is to offer educational content that is more adequate to the specific learning style of each student. In most cases this educational content is called learning objectives - LOs. Object for a learning can be defined as an entity that is used in the process of learning-teaching. Within e-learning, the goal is to create content in a digital format that can be reused in different learning goals, and even be used in the construction of other facilities for learning [1].

In general, the enormous and different kinds of learning materials clatter users mind and demotivates them from achieving their learning goals. To overcome such aversion towards the learning materials, learner is provided with the preferred LOs. Here by the kind of material we mean whether the learner prefers concept, detailed concept, examples, flow diagram, case study, exercise etc. Preferences can be identified from the learners' behavior patterns. Few learners prefer the overviewof concepts rather than detailed contents. Othersmay like to learn facts according to the context while others like to read in a sequential manner. Some might also like to understand the concept using the flow diagram of the entire content while others might like to learn practically like working out examples or doing

activities. Moreover, each learner has a preference for a teaching style that allows him to learn better. Some one likes to listen and talk, others prefer to analyze a text, or simply using a visual medium. Therefore, all types of contexts are considered before forming the Los [11].

By means of interviews, or during monitored interaction, the students produce evidence about their learning styles. These learning styles involve the strategies that a student tends to frequently apply while in learning situations [2]. Different students fit different styles, what makes them adopt attitudes and behaviours that repeat in different moments and configurations [3],[4].

Learning styles are cognitive, affective and psychological traits that determine how a student interacts and reacts in a learning environment [2]. The idea is to identify the outstanding characteristics that define the learning process of a given learner. To satisfy a given learning style, the teacher must use teaching strategies that will meet the needs of different learning perspectives. The learning style is a component that aids the e-learning system so that it can adapt itself to reflect the features of the student learning profile [5].

Recommender systems, with educational focus, follow the ratings that the students confer on learning strategies, or on learning contents. These systems track such ratings by structured profile delineation questionnaires, or by monitoring the explicit and implicit actions of the students over the system. These data are then analysed in order to automatically suggest the content during the learning process. The user tracking process may occur in many ways, for example, by the use of the Soloman and Felder (2008)[6] questionnaire, or by the observation of the content pages accessed by the student in specific moments [7],[8]. The characterisation of the dialogue between the student and the system is crucial to analyse the learner preferences. In this sense, the modelling of the observation process is fundamental to avoid the lacking of relevant information about the student interaction.

This dialogue should provide both the user and the system with high-quality information improving the recommendation methods [9]. Atif et al. (2003) provide a flexible framework for modelling object-based e-learning environments; authors depart found their argumentation on the premise from the premise that the general learner's modelling is an intractable problem and, as such, they use

learning routes as a heuristic in order to maximise the benefits of modeling [10]. In another work, Stoilescu investigates how intelligent agents can be used in order to adapt learning objects to the students' characteristics[12]. In the same line, Baldiris et al. present ADAPTAPlan, a system that aids on design by means of user modelling, planning, machine learning, and pervasive use of educational specifications and standards. Finally, Popescu surveys latest trends on learning styles technology along with a related case study[13].

E-learning recommendation system their resources to draw of the big amount of learning material that is available on-line and off-line. The purpose of these software tools is that they have offer the choice of suitable material, by recommending the most useful learning materials that suit the student the most.

In Chapter 2, a model course in the e-learning which gives recommendations to students depending on their time spent in the learning material and points achieved by testing.

Chapter 3 presents clustering of students by type of material that they learn and makes comparison on the basis of achieved level of knowledge.

Chapter 4 describes the operation of the software makes recommendations, level of knowledge and achieved results of testing.

While Chapter 5 describes the validation and verification of the model.

The main idea behind the adaptive model in the e-learning is to perform division of the students by type of learning material positioned in the course and to determine the best type of learning for obtaining the best results to students. The second important idea behind the adaptive model of the course is to recommend techniques and advise the student about the results achieved in the case and provide a recommendation regarding his/her areas of weakness so that they can pay more attention to achieve better results.

II. THE PRPOSED MODEL

The behavior of the learner might not always be the same. Therefore learner behavior should be logged every time he/she enters e-learning system. Hence learner behaviors have been observed dynamically based on the various browsing actions like Time spent on materials, Time spent on tests, type of LOs preferred, learning objects skipped, count of various LOs used, Performance in tests, Navigational patterns etc.

The model we propose consists of several dimensions that need to be evaluated. They include: time spent on students in each type of material placed in the course, the achieved points test, the achieved level of knowledge and send recommendations to the student.

The model aims to cover technical, and pedagogical aspects of e-learning and the test is carried out with different methods of evaluation of usefulness. It

is divided into three time phases are executed one after another as follows:

1. Clustering of the students by type of learning
2. Comparison of the achieved success from testing of the students in terms of the type of learning
3. Software for recommendations of students in order to improve the level of knowledge of students

A course has been created on the subject "Theory of information." The aim is to analyze the behavior and the students' first colloquium in the e-learning in the relevant case. For this purpose 3 lectures online were set online, and each lesson consists of 3 online content / segments:

- ppt. presentation (theory only);
- pdf .lesson (theory + problems);
- solved problems

The course forbids downloading material positioned and allows just watching in real time while students are informed that the first colloquium will receive 2 theoretical questions and 2 tasks that are also ranked.

In this section, we suggest Petri-Network models for transition of students in the course of the system for e-learning. First implemented Petri-Network using a simulator HiPS_1.02 (Hierarchical Petri net Simulator), which describes the progress of the student through the course in learning the system. The research is necessary to create 3 different Petri-Network models depending on what resources were used for student learning.

First Petri-Network model is modeled on the type of students that used all materials extensively for the three types that are set, see fig 1.

The second model shows the transition of the student through the course in the e-learning when it uses only two segments of the lessons (ppt-pdf, or pdf-tasks), see fig.2.

The third model is shown in fig.3 represents Petri-Network model for the transition to the student through the course in the e-learning when the student uses only one segment of the lessons (usually only ppt-slides).
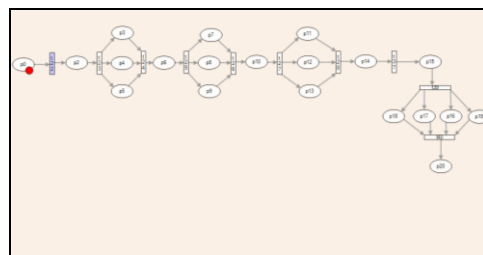

Figure 1 . Transition to the student through the course in the e-learning when the student uses all 3 segments of the lessons
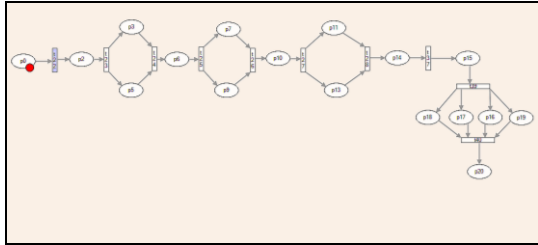
Figure 2 .Transition to the student through the course in the e-learning when the student uses only 2 segments lectures (ppt-pdf, or pdf-tasks)
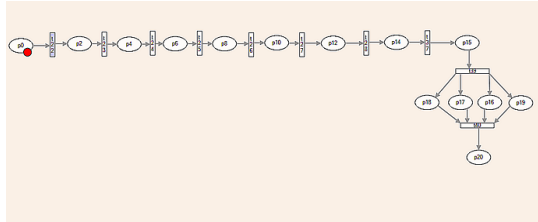

Figure 3 . Petri network model for the transition to the student through the course in the e-learning when the student uses only one segment of the lessons
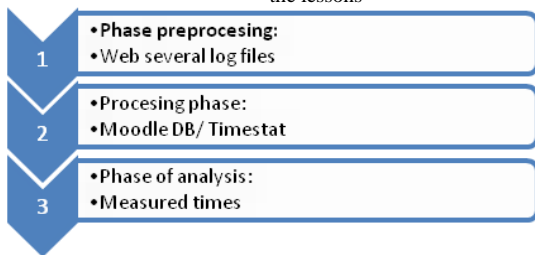

Figure 4. Process of monitoring the student activities

III. CLUSTERING AND COMPARING THE RESULTS

To perform the clustering of the students are two most important factors such as: First determine the time a student spends in the course in each of the lectures and the second type most teaches material.

To follow the student activities - in system Moodle e-learning module is installed (plug-in) Timestat [11].

Process of monitoring the student activities are conducted according to the following fig.4.

Phase of pre-processing: involves selecting and recording of data. During this step, the data is cleared from the empty and useless Web server log entries. These information on student entry is stored in a relational database and matched with records provided by the e-learning. As criteria for merger are taken into account - the time of entry, IP-address and access a Moodle module, ie type of action performed (examination of a specific material, etc.).

Processing phase: Unless the system time from the web server - we used tables that Timestat module generates for each student individually. The times that the student has passed every part of the lesson (Power point lesson, .pdf lesson, file solved problems) gathered cumulatively, and rounded 30 minutes. (half hour).

Phase of analysis: There were 3 lectures online, and each of the lessons consisted of 3 online content /

segments: 1. ppt-presentation (just a theory); 2. pdf lesson (theory + problems); 3. solved problems. We measured the time the students spent in each of the segments of all three lectures. Timestat module automatically record data in the table with the following format (see table I).

From the results we got from e-learning system Moodle, received is that the type of material used by students to learn they can cluster as (fig.5).

TABLE I. DISPLAY VIEW THE RECORDER DATA TABLE

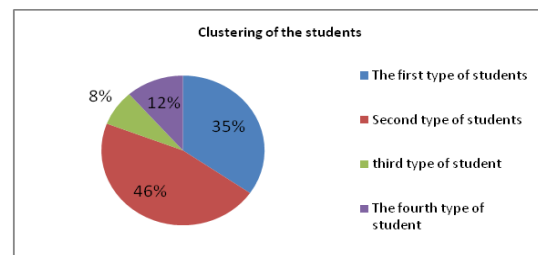| Student login ID	Student name	Lesson	Activity type	Time spent
		Name of lesson	(.ppt, .pdf, tasks)	(in minute)

Figure 5.Clustering of the students

After a period of on-line learning course is being tested on students to determine their level of knowledge achieved. The results from the e-learning are divided into three categories (fig.6):

• **Type A** (low level knowledge)
Students who have earned less than 40 points
• **Type B** (intermediate level of knowledge)
Students who have earned between 40 and 80 points
• **Type C** (a high level of knowledge)
Students who have earned more than 80 points

IV. SOFTWARE FOR SUBMITTING RECOMMENDATIONS

In the field of electronic education, the recommendation of contents with higher levels of relevance may potentially attract the students' attention.

Adabtability model is made by developing three applications in Matlab : learn.m, learn1.m and novo.m. In learn.m imported times students have spent in the e-learning. The second application is learn1.m visual - ie It is implemented through the GUI interface. The application provides information on student test results and the number of points they won for each task and theoretical question individually, the achieved level of knowledge and advice to student see Figure 7. The application is made learn1.m correlation as the time passes student in each of the three types of material that is placed in the course and the results of testing. Depending on these two factors, the application recommends the student to the proper use of materials and material types

that pay more attention to increase the level of knowledge of the student.
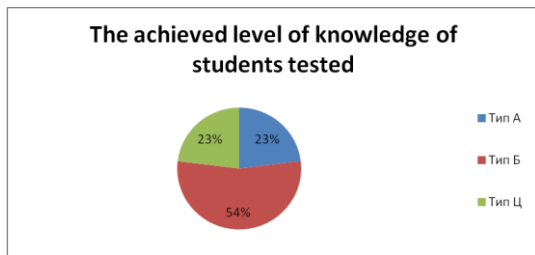

Figure 6. Achieved the level of knowledge of students tested
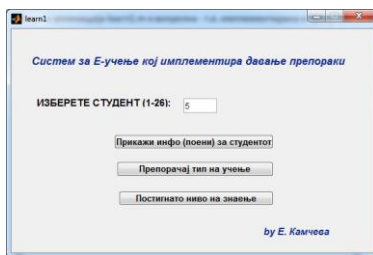

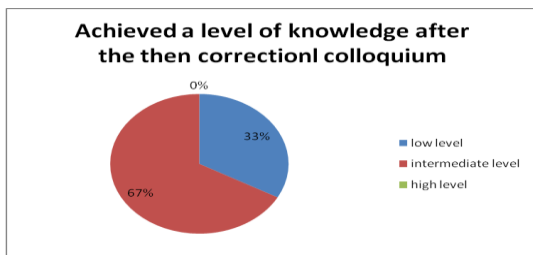Figure 7. The e-learning system that implements submitting recommendations

Figure 8. Achieved a level of knowledge after the then Correctional Colloquium

V.   VERIFICATION AND VALIDATION OF THE MODEL

To show that the model is adaptive and recommendations that positively affect recommendations for increasing the level of knowledge of the student; a corrective colloquium.

The main aim is for students to be given an additional opportunity to use the e-learning, i.e. to change the style and intensity of use of the system.

Some of the key results of this research is the achieved level of knowledge of students of correctional colloquium. The obtained results shown in Figure 8 to verify our model.

Of great importance are the recommendations made after the first test, they direct the student to teach that material which has been measured at least time spent in the system and shown a low level of knowledge in testing. After the second test significant progress could be seen in the level of knowledge of students who in the first test showed a low level of knowledge. It also has shown a considerable difference among students whose first test had been gained with high level of knowledge, and then the recommendation level of knowledge has increased to high. Our opinion is that this kind of recommendations will direct students towards the correct choice of material for learning and achieving the desired level of knowledge.

Validation of the model is demonstrated by comparisons of the statistical tests of students achieved level of knowledge before and after sending a recommendation using: test for the difference of mathematical expectations with unknown dispersions and small samples, Vilkoksonov test of the rank of signs and χ^2 - criterion uniformity.

In this paper statistically proven criteria test for the difference of mathematical expectations with unknown dispersions and small samples. E hypothesis defined as follows: H_0 - fails difference in the level of knowledge of the student with or without recommending vs. the alternative hypothesis H_1 - by recommending students their level of knowledge is higher. $H_0 : m_1 - m_2 \leq 0$ vs. the alternative hypothesis $H_1 : m_1 - m_2 > 0$. According to our research because it is testing the same students who repeated after the first colloquium will compare their achieved points from the first test and testing correctional colloquium, results are are shown in Table 2. We use Equation 1 and is compared with the Equation 2.

$$\bar{t}_{n_1+n_2-2} = \frac{\bar{x}_{n_1} - \bar{y}_{n_2} - m_0}{\sqrt{n_1 s_{m_1}^2 + n_2 s_{n_2}^2}} \sqrt{\frac{n_1 n_2}{n_1 + n_2}(n_1 + n_2 - 2)} \qquad (1)$$

$$t_\alpha(n_1 + n_2 - 2) \qquad (2)$$

$$t_{1-\alpha}(n_1 + n_2 - 2) = t_{0,9}(16) = 0,128$$
$$< 3,018561 = \left| \bar{t}_{n_1+n_2-2} \right| \qquad (3)$$

The results clearly show that should be ruled null hypothesis H_0 and and to accept the alternative hypothesis H_1 for level of reliability $\alpha = 0,1$.

All the tests conducted proved that submitting recommendations to the students affects the increase in the achieved level of knowledge of students.

TABLE2. TEST FOR THE DIFERENCE OF MATEMATICAL EXCPECTATION WITH UNKNOWN DISPERSIONS AND SMALL SAMPLES

ID-student	Points scored without sending recommendations	Points scored after sent recommendation	$(x_i - \overline{x})^2$	$(x_i - \overline{x})^2$
2	45	60	73,19753	97,79012
7	30	45	41,53086	26,12346
10	21	38	238,5309	146,679
14	33	43	11,8642	50,5679
15	39	58	6,530864	62,23457
19	33	59	11,8642	79,01235
20	36	32	0,197531	328,0123
21	48	60	133,5309	97,79012
24	43	56	42,97531	34,67901
arithmetic average	36,44444444	50,11111111		
standard deviation			62,24691	102,5432

VI. CONCLUSION

Providing an adaptive and interactive environment tailored to the learner's needs is one of the most important areas of research in e-learning environments.

The offering of educational materials matching the students' learning profiles supports the learning-teaching process by aiding the students with content that suits their learning styles. In this context, this paper proposed a methodological systematisation, model with preference categories, a configuration that is able to suggest learning objects concerning the students' learning styles.

Further works include: Frequency / rarity attendance system is a key issue in personalized recommendations. In order to get good recommendations, the proposed framework requires improving the accuracy of two aspects: precise identification of student needs, and accuracy of finding recommended learning materials. To achieve the first improvement, the proposed framework focuses on a comprehensive analysis of student requirements. The system will be designed to receive and analyze information on several aspects of student. To improve the latter, this proposed framework design - in order to find which type of learning materials students would like to receive; create a list of the top-N recommended learning materials for each of them. By developing and using both technologies, the frame can accurately identify the necessary materials. By choosing the right materials for the learning needs of each student, the system can provide quality recommendations.

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Development of the University's Library Information System Model as an asset of the e-Society

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Abstract -Information society (e-Society) as new society base on networks, computer and communication capabilities, transforms the way that information is viewed and managed, and change the way the organizations manage their business processes. In this society the need for data integration in one place has been present more than ever. The key of success lies in creating appropriate information system based on new technology and network capabilities that will support the processes of the organization. The universities represent specific organizations with the highest priority of accessing to scientific knowledge. As academic institutions which produce knowledge, universities use and manage information from both: internal and external sources. e-Society offer a new dimension for communication between the students, professors and administrative staff by allowing quick access to information from an unlimited number of users from different locations at any time, with the possibility of further processing and use thereof. The existence of library information system (LIS) is a predisposition for quality assurance in universities. The purpose of this paper is to propose a model for University's Library Information System (ULIS) that integrates information in a simple way, and allows quick access to books, electronic materials (internal books, lectures, manuals, presentations etc.), articles or research results from each member (unit) of the university.

I. INTRODUCTION

It is an era of social transformation where information and knowledge are the most important resource in the economy, and their security, processing and distribution are the fastest growing sector. The development of information and communication technologies (ICT) and the occurrence of the Internet and wireless devices, contributed to the emergence of the new society so-called Information Society (e-Society). The potential of this new society was described many years before its emergency: Lancaster [1] argued that the effects of technology occur in three stages: first, it enables us to do what we do now, but faster and cheaper; second, it enables us to do what we cannot do now; and third, it transforms our lives. e-Society refers to a system where cultural, social and political centre of existence revolves around the production and distribution of information through the use of ICT. The need for quick transmission, reception and global exchange of information with digital assets, regardless of the distance, is the dominant feature of e-Society. Hence, the key to success in this society lies in creating additional appropriate information systems (IS).

Information systems represent a set of integrated components for collection, storage and processing of data and delivery of information, knowledge and digital products. IS is a system composed of people, organization and ICT whose main task is collecting, processing and/or interpretation of information for the sole purpose to provide effective and efficient services [2]. The existence of IS is associated with mutual activity of six major components: hardware, software, network, data, procedures and people. The concept of an integrated information system based on new ICT and network capabilities has been adopted in all sectors in the society, including libraries.

The place where information is stored, kept, issued and used traditionally is called library. Braude [3] recommended six functional responsibilities for the library; one is that the library should serve as a broker of information from both internal and external sources. The term library most commonly associated with intellectual activity so in the world of education (especially at the universities) it is perceived as a centre of networked information necessary in the process of lifelong learning, researching and creating new knowledge. According to Braude [3], library is already viewed as an institutional resource that seeks support not for itself, but for its users.

As "information agency" in terms of e-Society, library is facing with dramatic change in the way of it works [4]. Observed as place of collecting, storing and publishing, but also researching and creating of new knowledge, the library is directly related to the need for adequate Library Information System (LIS). Matheson and Cooper [5] mention two types of libraries: the academic information resource services (AIRS) library, and the academic information management (AIM) library. Both are stage-I libraries in the evolution of an integrated academic information management system. The AIRS library will have fully developed library-to-library and library-to-user capability. ICT in relation with the possibilities offered by the Internet enables the creation of effective LIS, which modern libraries transform into virtual organizations – digital libraries.

Although the university libraries do not always play a direct role in the creation of on-line resources, they offer access to resources and have responsibility to made available to users. The use of LIS provides integration of classical and electronic libraries, offering access to

resources and services to support learning (e-learning), teaching, and research in the classroom and at a distance. In this way both students and teachers can learn and explore databases without being physically in the library and its satisfaction often depends on the functionality, effectiveness and efficiency of LIS.

According to Kokorceny and Bodnarova [6] some of the typical disadvantages of digital library system are: not enough flexible architecture, tight coupling of application components (instead of loose coupling architecture), higher costs of customization of a digital library system, digital libraries usually cannot share application components with other information systems, difficult integration of a digital library system with other information systems and applications in an institution, higher costs of this integration, usually there is not process based approach.

Good planning is necessary in the process of creating system architecture for an IS to be effective. Hence, a key factor for the success or failure of an IS, is the architecture of the system that provides the necessary functionality and its quality attributes.

In this paper we propose a model of information system for University library that integrates information from individual libraries placed in different locations. This ULIS will allow the users (students and staff) to use the resources in the process of teaching and research in a simple and fast manner, regardless of their location.

Next section gives a theoretical view of digital libraries. The proposed ULIS model is through diagrams, explained in the third section, while the fourth section concludes the paper.

II.   DIGITAL LIBRARY

The term "Digital Library" is currently used to refer to systems that are heterogeneous in scope and yield very different functionality. These systems range from digital object and metadata repositories, reference linking systems, archives, and content administration systems (mainly developed by industry) to complex systems that integrate advanced digital library services (mainly developed in research environments) [7].

As an integrated set of services for capturing, cataloguing, storing, searching, protecting, and retrieving information, which provide coherent organization and convenient access to typically large amounts of digital information. Digital libraries are realizations of architecture in a specific hardware, networking, and software situation, which emphasize organization, acquisition, preservation, and utilization of information [8].

Digital libraries provide information based on technology and services at any time in any place, and encouraging innovative learning throughout life. According to Dhiman [9], the digital library (e-Library) serves mainly as a facilitator in organizing and providing knowledge and resources to its users. Krishnamurthy [10] defines digital libraries as electronic libraries in which large number of geographically distributed users can access the contents of large and diverse repositories of

electronic objects. Unlike of traditional (classical) libraries that collect, store and manage information in hard copy, digital libraries content can include "virtually any kind of electronic material, such as various kinds of electronic media (images, video, etc.), licensed databases of journals, articles and abstracts, and descriptions of physical collections' [11]. Electronic resources include online catalogues, databases, multimedia, online journals, digital repositories, electronic books, electronic archives, and online/electronic services [12].

III.   UNIVERSITY'S LIBRARY INFORMATION SYSTEMS

Library Management as a sub-discipline of institutional management, focus on specific problems faced by libraries and the professionals who manage libraries. Library Information System (LIS) are used to track items that the library owns, rental of books and its' users. Basic tasks in library management are: planning and gathering materials, renting books, documents and other e-content, membership and human resources management.

Primarily, LIS incorporates basic concepts typical for public libraries. In fact, most public libraries that own printed books and articles use decimal classification system, based on unique identifiers, as their method of marking, preserving and collecting artefacts. The use of such systems contributes in the development of common structures that function as tools for librarians and library users. These structures include: Master catalogues, Indexes, Unique identifiers, Tokens of unique identifiers, Artefacts.

Universities as complex institutions composed of multiple units (faculties and associate members) need information systems to easily share information, coordination and decision making. The implementation of information systems in university libraries, improves communication between all stakeholders and the speed with which users come to certain data. One type of information system that can be used by the university's library is the information system ULIS presented in this paper.

The purpose of the proposed model is managing the university library, i.e. libraries within different units and their integration into a single system. The implementation of such a LIS will integrate all faculty libraries in one, and students, teachers and all other staff will be able to access, search and rent books, download and/or use electronic materials (internal books, lectures, manuals, presentations) etc. One of the main challenges in the creation of the proposed library information system is to overcome the problems associated with the functioning of the faculty libraries.

IV.   ARCHITECTURE OF THE LIBRARY INFORMATION SYSTEM MODEL (ULIS)

A library information system usually contains relational database, software and graphical interface. Mostly, these systems divide software functions into modules, where each module is integrated with a single interface. Taking into account all the specifics and needs of a LIS, the architecture and functionality of the

proposed model ULIS will be presented by a few different types of diagrams.

A. Deployment Diagram

A deployment diagram (Fig.1) shows the physical organization of ULIS, which explains how the individual parts of the system are distributed. Client through communication link (http/Internet) access the client application - Library Information System, which is a node (basic element) of the diagram. Client application via a communication link (a local computer network) is associated with the web server. Web server contains web application for the distribution of a collection of Java Servlets and classes, xml files, static web pages (HTML) and other resources which together compose the web application. Web application is located on the web server and via http/LAN communications link connects the server (containing the database) in order to facilitate the operation of all functions of the application.

B. Class Diagram

In the class diagram of ULIS shown in Fig.2, the types of objects and relationships between them are described. Overall the system consist seven classes. Composition *Database* contains three main classes, of which four more classes are derived.

C. Activity diagram

We use activity diagram in order to show the functionality and to describe the logical procedures and flows in ULIS.

Activity diagram of students. When a student accesses the application he/she has two options: to register or log in the system. Once the user successfully registers/announces several options are available: browse books, choose professor (in order to review and download materials) or review all current reserved/rented books. After the student completes all activities should log out. Activity diagram for students is shown in Fig.3.

Activity diagram for teachers. Activity diagram for teachers is shown in Fig.4. The initial actions for entry and registration in the system are the same as for students, but teachers could also upload documents (scripts, lectures, exercises, results). The teacher can attach a new document, modify or delete a document previously upload in the system.
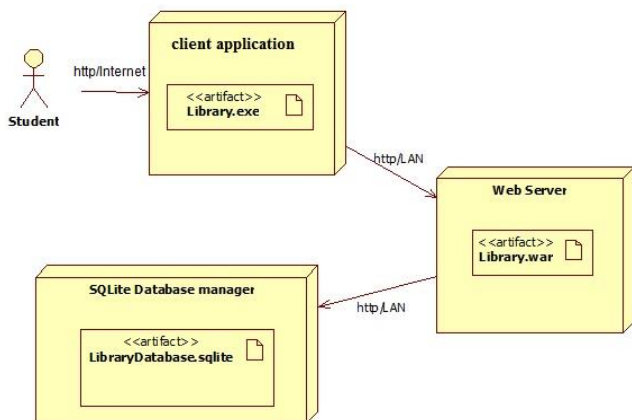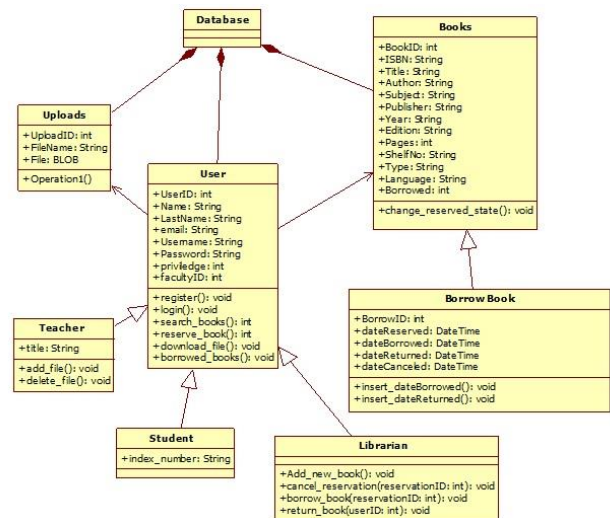

Figure 2. ULIS class diagram

Activity diagram for librarians. The activities in ULIS, that can perform librarian, fully contain the activities of the student and partly of the teacher (librarian cannot upload and delete documents). Additionally librarian can add a new book to the system, update data related to the rental of books, and make the changes to the book status (rented/available). The activity diagram of the librarian is shown in Fig.5.

V. CONCLUSION

In the last decades digital libraries play an important role in knowledge sharing. The application of LIS at universities provides an integrated platform for students and teachers on which they could easier and faster exchange information and materials.
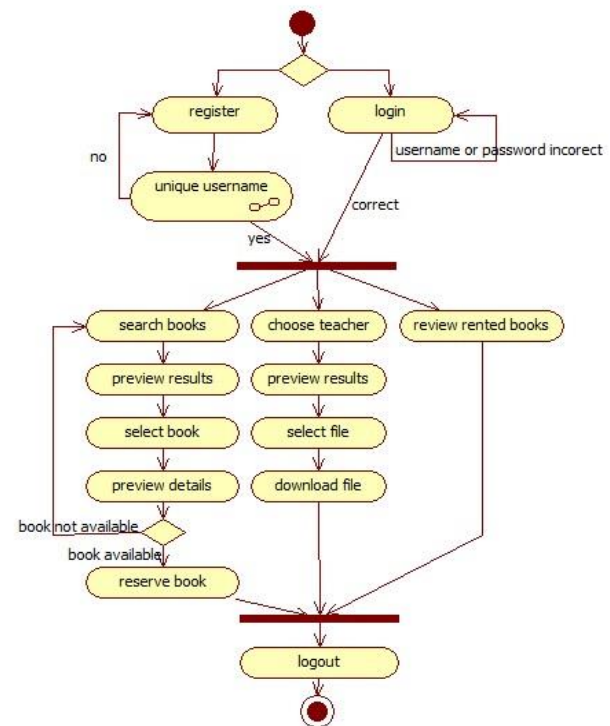

Figure 1. ULIS deployment diagram

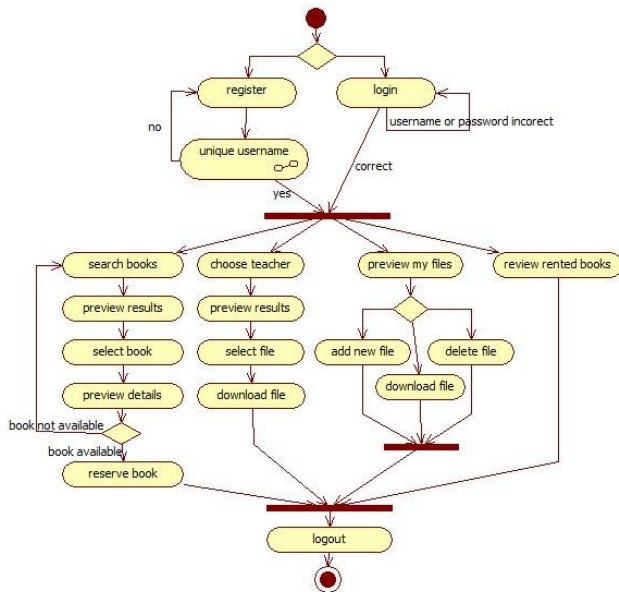Figure 3. ULIS activity diagram for students

Figure 4. ULIS activity diagram for teachers

The purpose of the proposed ULIS model is to integrate the various university libraries of the units in a system that will allow all users to be able to search and rent books as well as to access and upload e-contents. Proposed model reduces the time required to search literature and also facilitates access to it. Additionally, facilitates the coordination of the overall work of the university in terms of manipulation with integrated fund of information and e-materials, and meeting the needs of users (students and teachers) for quicker and easier access to the desired information.
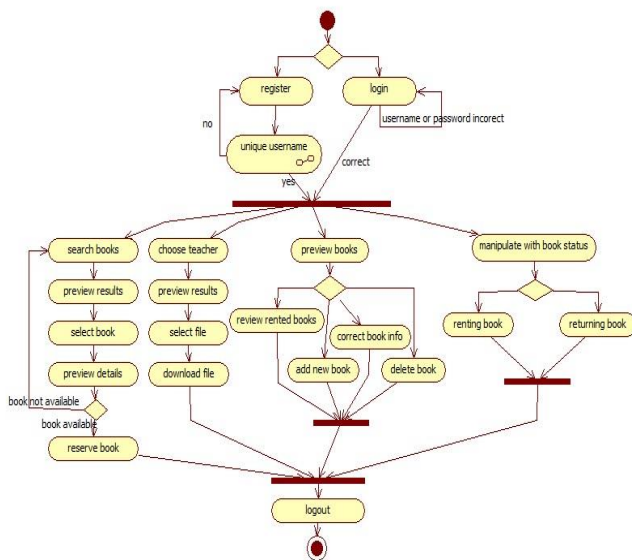

Figure 5. ULIS activity diagram for librarians

Overall, the proposed model gives equal access to all users without any administrative supervision which would control the categories of users. Categorizing the users as well as providing other benefits to different categories of users is one of the possible upgrades of the system. Software solution, based on the model presented in this paper is developed, but its implementation and testing with real users remain to be the done as further work.

The usage of the suggested information system will enable quicker access to the required materials for students, easier management of the book storage and the electronic materials for the administrative staff, but before all, it increases the level of communication between the different sides at the University.

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Ranking Projects using multi-criteria method

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Abstract - Making decision is complex solution with influence of economic and financial indicators such as investment, the price of irrigation water, springs, financing conditions and many others. Some of the indicators, such as, social impact, rural development, and environment protection can only be expressed qualitatively. Investments in local irrigation systems which belong to agricultural ownerships are considerably low. The hydrological risk is presented using precipitation during long term period. Economic risk is presented using water price. Evaluation of risk and uncertainty was conducted on several irrigation systems in Republic of Serbia. In terms of evaluation of the price of water and water services for different purposes of the hydro system there were used several methods of calculation (cost-benefit principle, the marginal principle, the price of complete coverage of the expenses etc.).

To objectively solving these problems it is necessary to use methods of multi-criteria analysis as a decision making support.

I. INTRODUCTION

Potkonjak and colleagues [1] examined various cases of calculating the price of water for irrigation in Serbia from the local system to the multi-purpose regional hydro-systems. Depending on the type of ownership of the system authors had suggested several principles of calculating the cost of water for irrigation: cost principle, benefit principle and marginal benefit principle.

Mesa Jurado et al. [2] have presented in their investigation the valuation of water under different scenarios. Aggregated basin value is given as the function relating water value (price) and irrigation consumption.

The economic value of water in agriculture has been considered in research Kasnakoglu and Cakmak [3]. They developed a model in which the economic value of water is determined according to several limitations: different soil types, regions, crops, irrigated land. The model is applied to Anatolia Project in Turkey.

The implementation of the WFD (Water Framework Directive) is thoroughly described in WATECO Guide [4]. EU countries have developed the concept of complete coverage of the cost of water (full cost recovery).

Selection of the best candidate for evaluate project is not simple, and the wrong choice may have great negative financial consequences. It is clear that the decision made in the process of deciding, must be based on multi-criteria analytic methods, according to the model offering the group of favourable and unfavourable features. This decision support system (DSS) can include tools which help in solving operational problems. DSS is the instrument for processing, analysis and presentation of the information based on use of computers.

If we calculate that average water consumption equals $2500 \text{ m}^3/\text{ha}$ per year, the amount of irrigation water that needs to be made available is 2 billion m^3 per year. Natural watercourses in Vojvodina area, as well as the already build regional systems and reservoirs, do not provide the necessary amount.

The main and concept designs, as well as the studies of the justifiability of the planned undertakings have been taken as the basis for the research. With the goal of collecting data on the amount of needed investments, the costs of building regional systems and subsystems have been considered in both large and small irrigation systems.

In case of risk situations it is possible to account the probability of each random variable to calculate the degree of risk and determine a compromise. If it is a precarious situation due to lack of available data, the law of probability cannot be used and, in this case, the numerical results are displayed along with their expected value.

When assessing plans for irrigation systems, risk and uncertainty must be taken into account, because unexpected events can increase the cost of the proposed technical solution.

The significant attention is given to a research of quality and water protection of Danube in Serbia [5]. Nine hydrological stations control the quality of the river (which varies from III/IV at the entrance to the III category at the exit of Serbia) which is a significant figure in the planning and using irrigation systems and the use of the Danube water for other research purposes. According to researches [6] in Republic of Serbia, especially in Autonomous Province of Voivodina, water as a resource is still not sufficiently used to increase a food production. Regard to its quality (II to IV category), on most streams in the country water can be considered as a safe factor in producing the healthy food. However, according to the reports [7], Serbia is classified into one of the biggest polluters of the Danube with nitrogen (N) and phosphorus (P).

Looking at the present situation and development of water infrastructure for irrigation purposes in the Republic of Serbia, study in this case is focused on the selection of the appropriate method for calculating the best project solution.

II. Method and Data Sources

The methods that would be the most appropriate in this case for use in irrigation systems are binomial tariff water system to the users and the economic cost of water in the long term management of the system (ILRIC).

When binomial tariff is used, irrigation costs consist of two parts: 1) a fixed costs (amortization, maintenance, and gross wages of full-time employees, insurance, interest) and 2) variable costs (energy, seasonal labor, maintenance). Under this method, the fixed costs are distributed on the entire irrigated area (U.S. $ / ha, € / ha). On the other hand, the variable costs are allocated by the level of the water consumption (m3/ha * din/m3, m3/ha * € / m3). In this way, the crops that consume more water will have higher costs per unit of irrigation surface. Principle based on customer's willingness to pay can be used so that crops such as wheat, forage crops pay a lower cost of irrigation in relation to intensive crops (fruits, vegetables).

In the case of irrigation problems that are commonly studied are:

a) Evaluating the construction of irrigation projects under risk and uncertainty.

Bendeković [8] proposes few methods of estimating the uncertainty of investment projects and to the threshold of profitability, sensitivity and probability analysis. Potkonjak [9] examines on several regional irrigation system in Serbia the feasibility of construction thereof, including risk and uncertainty. Break point method, sensitivity analysis and risk programming were used. Mergos [10] gives the treatment of economic uncertainty in irrigation projects and then demonstrates how uncertainty may inhibit adoption of high value crops and result in lower project benefit.

b) The effect of irrigation on overcoming the problems of drought, which becomes more pronounced.

Jones [11] described a method of risk analysis for calculating the conditional probabilities of exceeding an impact threshold under climate change. Gil [12] developed econometric model and the same used for the economic evaluation of drought risk. Manocchi [13] proposes a new methodology that studies agricultural drought not only in terms of deficit of soil water content but also in term of net benefit. The methodology called the risk analysis and economic impact assessment of agricultural drought (ADERA model).

c) The demand for water and water markets.

Taylor [14] investigated the ability of water markets to allocate water to the highest valued use and applied deterministic and discrete stochastic sequential programming models (DSSP). Limon – Gomez [15] introduces methodology for deriving water-demand functions. This methodology utilizes weighted-goal programming approach. The results showed that the estimated water-demand curve is different when a multi-criteria utility function rather than the classical profit maximization is employed. Millan [16] use of multi-criteria techniques to study the tradeoffs and conflicts between profitability and risk subject to different

probabilistic resource availabilities. Shaw (2005) investigated risk and the various types of models that allow for behavior under uncertainty

d) The selection of crops that will best utilize the water.

Carey [17] developed a stochastic dynamic model of irrigation technology adoption. He used a simulated stochastic price process and analyzed the diffusion pattern associated with a distribution of farms. Alvarez [18] developed MOPECO model as a tool for identifying optimal production plans and water irrigation management strategies. Genetic algorithms used to identify optimal strategies. MOPECO model content three computing modules: (1) estimation of net water requirements; (2) derivation of the relationship between gross margin and irrigation depth; and (3) identification of the crop planning and the water volumes to be applied. Junior [19] carries out the risk analysis by risk simulation using techniques as the Monte Carlo method. Its developed a computer program "P-risco" and compared to the RISK program and used by construction of scenario analysis. Scenario analysis indicated in this case that the selling price for passion fruit farming has expressive influence over the development financial performance.

e) Selection of the optimal system capacity for irrigation including economic criteria.

Gogić [20] determined the limits of economic justification for irrigation system capacity use. He compared income with cost and detected the point of capacity use at which incomes equal costs.

f) Integrated water management.

Barzzani [21] developed integrated decision support system for irrigation (DSIRR). Solution is found by applying multi-criteria mathematical programming. Kensal [22] developed the concept of integrated risk management in Way Jepara irrigated area (Indonesia) and purposed the five steps in risk management: 1. risk identification, 2. risk assessment, 3. decision making under risk and uncertainty, 4. implementation of the method of risk management and 5. monitoring.

III. Results

The system chosen was a regional subsystem "Srem" of 1700 ha and the water source is the River Danube. Following the proposed technical solution of a subsystem using the binomial tariffs and ILRIC method the price of water was calculated. Irrigation costs is 550 to 690 Euro/ha during investment and 350eur/ha after repayment period.

According to previous studies that had been done [23], [24] water that will be delivered to the regional systems users (farms) should have an economic price. Calculation of economic price of distributed water (economic long run prices) in this case is adapted to the infrastructure character of the analyzed regional sub-irrigation system. Economic costs are calculated for different discount rates represent the basis for the established selling prices.

HS "Danube-Tisa-Danube" still have great potential. Belong to the Danube region a total water demand is 164.11 m³/s. Some of the already built areas should be rehabilitated.

It can be concluded that land and water are the most important resources for irrigation and food production.

BUILT AND POTENTIAL IRRIGATION AREAS WITHIN THE DANUBE REGION IN SERBIA

No.	Regional hydro system	Capacity m³/s	Irrigation area ha
1.	HS "Danube-Tisa-Danube"	84.00	210,000.00
2.	HS "Srem"	26.00	121,000.00
3.	HS "Negotin's depression"	10.31	12.000,00
4.	HS "Grocka"	1.80	5,000.00
5.	HS "North Backa"	42.00	87,500.00
	Total	164.11	435,500.00

Decisions about the construction of this subsystem depend on the economic criteria, which is used to assess the validity of the planned venture. Since the investments in building this system are long-termed is not enough to have information concerning only annual financial effects. Operational period of these facilities is over 30 years and for all that time the cost should be covered.

We analyzed the five projects and the criteria were investments, total costs, maturation period, repayment period, and the area to be irrigated, the impact on the environment.

TABLE II.   CRITERIA AND GOALS

No.	Characteristic	Goal
1.	Investment	Min
2.	Total Cost	Min
3.	Repayment Period	Min
4.	Irrigated Area	Max
5.	Ecology	Max

Based on the obtained data, ranking projects is carried out and recommendation was sent to the investor which one project is the best. It was also analyzed how the changes affect the materiality of certain criteria in selecting the best project. Favoring certain criteria (ecology, total costs) can significantly change the order of projects.

IV. CONCLUSION

The research in this paper is based on the selection of appropriate methods that would be used to determine the price of water. There were two methods (binomial rates and economic sales price of water), which would correspond with the budget price of irrigation water in the Republic of Serbia

Using research in this field, in the example of regional subsystem for the irrigation which will be located in Srem, Vojvodina, methodologies for the assessment of risks and uncertainties has been developed and applied.

Areas that are suitable for irrigation in this region compared to factor of soil amount to over 430 thousand ha of arable land. Most part belong to HS "Danube-Tisa-Danube" which has yet unbuilt land (210,000.00 ha, particularly in private farms). A significant areas exist within the future HS "Srem" (121,000.00 ha) as well as HS "North Backa" (87,000.00 ha).

Irrigation can significantly influence the sustaiable development of agriculture and water management because an intensive usage of soil and water is at hand.

A twenty-year plan predicts the enabling of around 475.000 ha of arable land. When looked at from a macroaspet, this could considerably influence the development of the food industry, as well as the agri-foods market.

According to the collected data and the project documentation, it is necessary to decide which hydro-system will be constructed.

Multi-criteria analysis allows ranking projects based on objective criteria.

Evaluator can easily favor the particular desired characteristics and to determine whether the order of quality projects remains the same or changes.

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Ancient Sundial 3D Reconstruction from Multiple Images

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Abstract - The digitization of cultural heritage represents a process that includes a large range of activities. It is largely dependent on the subject being digitized, as well as the purpose for which the process is done. 3D digitization of cultural heritage consists of multiple processes and can be changed depending on the specific demands. In this paper we presented a method for creating 3D models based on the large number of different images that cover entire object from different angles. Modeled object is an ancient sundial which represents object of medium size and complexity and is therefore entirely appropriate to assess the capabilities of the proposed solutions. The solution involves applying SIFT algorithm to extract the key points and obtain their matching, implementation of sparse and dense reconstruction to obtain a points cloud. Obtained model is converted into the surface using Poisson surface reconstruction algorithm. Application of texture over created shape produces the 3D model. Created model in a satisfactory manner represents subject of modeling, which shows that presented method can be successfully applied in order to create cultural heritage.

I. INTRODUCTION

The digitization of cultural heritage is a process that includes a large range of activities. It is largely dependent on the subject being digitized, as well as the purpose for which the process is done. The entire process involves three-dimensional (3D) digitization, creating a system for managing digital content, presentation and reproduction. In other words, entire life cycle of digital cultural content is included.

3D digitization of cultural heritage is the first step in preserving objects and monuments. It consists of multiple processes and can change depending on the specific demands of certain applications for digital cultural heritage. In accordance with the complexity of digitizing demands, which comes from the object being digitized, there are number of different methods and technologies. The goal of each method is that it can be successfully applied to a particular type of objects or monuments, or to meet specific project requirements. There are techniques that yield appropriate results for objects that are of microscopic size, other techniques are used for small, medium or large objects, and special techniques are used for monuments.

A large number of available 3D digitization systems is the result of three main factors that affect the applicability of a particular method [1]:

- complexity in size and shape
- morphological complexity (level of details)
- diversity of materials from which the object is created

3D digitizing is a complex process consisting of three phases [1]:

- preparation, during which are performed some preliminary activities that involve making decisions about which technologies and methods will be applied
- digital recording, which represents the main process
- data processing, which includes modeling of digitized objects through the incorporation of parts that are scanned separately, geometric data processing, texture creating, etc.

In this paper is presented a method for creating 3D models based on the number of images that cover the entire object from different angles. We applied process of digitization over marble sundial. It is medium size object with medium complexity and is therefore entirely appropriate it order to assess capabilities of open source solutions in 3D reconstruction.

II. RELATED RESEARCHES

Mapping of cultural heritage in digital 3D objects can be classified based on the size of digitized object. Due to technical constraints and demands of the specific application, there is significant difference between object and monument digitization.

A. Object digitization

Laser scanning techniques: This system consists of the device with a laser source and an optical detector. Emitted laser can be in form of line or pattern. Advantages of this technique is that laser light is very bright and stays focused even for long distances. This brings high accuracy in geometry measurements [1-3].

Shape from structured light: This method is based on projecting a specific pattern on the surface of the objects and trying to extract geometry information from the pattern deformations. Pattern can be projected on whole object, or some part of its surface. This techniques can

lead to impressive results and can also obtain information about surface [4-6].

Shape from images: this technique is based on photographic capturing of objects from different angles. Object digitization by images has high productivity and relatively low price. It can obtain shape and texture of observed object [7-10].

B. B. Digitization of monuments

Topographic techniques: this method implements a 3D orthogonal coordinate system by using complicated and high accuracy measuring devices. Mainly, this method using a Geodesic Station, a system for measuring angles and distances of characteristic points on the surface of the monument, which are further transformed to coordinates in reference to the initial orthogonal coordinate system. Main advantage of the method is its high accuracy [1].

Laser scanning techniques: Laser scanners can actually be considered as advanced geodesic stations and can be used to measure topographic quantities. They can measure the direction of a fictional optical line joining the characteristic points on the surface of the monument to a reference point on the measuring device [11].

III. EXPERIMENTAL WORK

In this research we have shown an example of 3D object digitization from multiple images. During digitization process we used a free open-source software, so research can be easily verified. Digitization object was marble sundial from the end of I century and beginning of II century A.D. It was found in the ruins of ancient city Sirmium. Sirmium was a city in Pannonia, an ancient province of the Roman Empire. In 294 A.D. it was pronounced one of the four capitals of the Roman Empire. Observed sundial consists of the sun scale and three figures. The elements of a sundial were carried by the figure of Atlas, and under the sun scale are figures of Hercules and his half-brother Ifiklo. This symbolizes divine and earth time. Horizontal line on the upper part of the sundial represents exact latitude of the Sirmium for which the sundial was made. Sundial from Sirmium represents unique part of the world cultural heritage. By digitizing valuable ancient artifacts, we create digital

cultural heritage and preserve them from oblivion. Sundial that is subject of this research is shown in Fig.1.

In order to create 3D model from images, it is necessary to provide large number of images covering each part of the object being modeled. In this research, we used images from different angles and distance relative to observed object. This causing observed object to change its size and appearance.

A. A. Key point extraction

The first step is to link images. Since we used large number of images, they should be taken in order to capture entire object that we want to convert into 3D model. However, a large number of images are overlapping. Images are captured from different angles and positions, but they still show the same object. In order to link the images and determine overlapping, we used SIFT algorithm [12]. This algorithm allocates the key points on the observed images, whereby the difference in the size of objects that arises as a result of zooming, has no effect on the key point detection accuracy. On the observed images, we apply Laplacian of Gaussian (LoG) algorithm. LoG represents object detector that recognizes objects in variety of sizes, due to change of the parameter σ.

Key point extraction and sparse reconstruction of observed object is obtained by Structure from Motion (SfM) algorithm [13]. This algorithm is implemented as a part of VisualSFM software. During the image processing, algorithm performs camera recalibration and determines its position in relation to the observed object. The object is represented by dots that are obtained as the intersection of the identified key points from the processed images.

During the research, we noticed that image resolution has significant impact on the number of key points in sparse reconstruction. We took an experiment on 80 images that contain observed object and resize them to different resolution. Number of key points in relevance to image resolution is shown in Fig. 2. From Fig.2 we can see that highest number of key points is recognized from images whose resolution was 1472x1104 pixels. Images with lower resolution do not contain sufficient amount of details in order to recognize key points. As the resolution of images increases, we come to another problem that is well known in artificial intelligence and machine learning. Too many details in images (training set) can produce poor results, because feature detection algorithm extracts

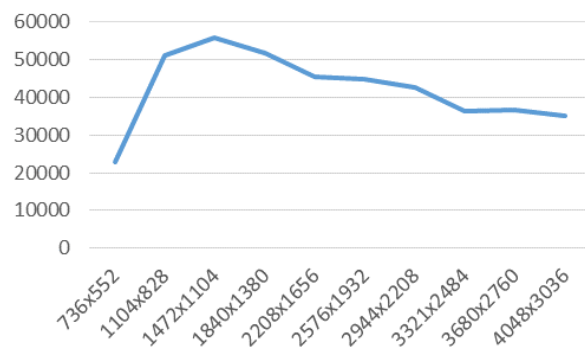Figure 1.   Sundial from ancient Sirmium

Figure 2.   Number of key points in relevance to image resolution

false key points (local minimum).

We were also interested in the optimal number of images in key point extraction process and their impact in sparse object reconstruction. Number of key points in relevance to number of images used in training process is shown in Fig.3. All images in this experiment have the same resolution of 1472x1104 pixels. We took ten measurements and concluded that number of key points increases linearly with the number of images. In other words, every new image brings some new features and gives higher quality in sparse point reconstruction.

B. B. 3D model creation

After sparse point reconstruction, we create dense reconstruction. In dense reconstruction we used Clustering Views for Multi-view Stereo (CMVS) algorithm and create point cloud. Many multi-view stereo (MVS) algorithms do not scale well to a large number of input images (lack of computational and memory resources). CMVS takes the output of a SfM as input, then decomposes the input images into a set of image clusters of manageable size. An MVS can be used to process each cluster independently and in parallel, where the union of reconstructions from all the clusters should not miss any details that can be otherwise obtained from the whole image set [13].

During the dense reconstruction, beside the modeled object, we also reconstruct large number of other objects. Those are objects that are captured by images, because they are placed nearby the subject of modeling. In the modeling process they represent noise, and should be removed. For that purpose we use MashLab software. It allows us to remove all unwanted points and to obtain pruned model.

Next step is to convert points into surface. For that purpose, we used Poisson Surface Reconstruction algorithm. Reconstructing 3D surfaces allows fitting of scanned data, filling of surface holes, and remeshing of existing models. Key insight is that there is an integral relationship between oriented points sampled from the surface of a model and the indicator function of the model. Specifically, the gradient of the indicator function is a vector field that is zero almost everywhere (since the indicator function is constant almost everywhere), except at points near the surface, where it is equal to the inward surface normal. Thus, the oriented point samples can be viewed as samples of the gradient of the model's indicator
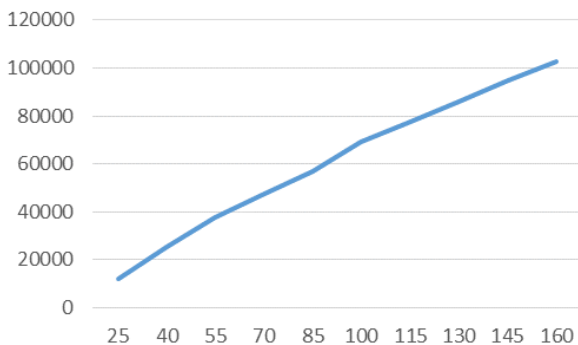
function. The problem of computing the indicator function thus reduces to inverting the gradient operator. When divergence operator is applied, this variation problem transforms into a standard Poisson problem [14]. Appliance of Poisson Surface Reconstruction algorithm over pruned point cloud is shown in Fig.4.

C. C. Textures creation and rendering

For 3D model of observed object, we determine texture. We build a UV map by figuring out which image have the best view of each part of the modeling object. For each part, we use exactly one image. By using this approach, we end up with clean textures.

Last step is to create 3D model with applied texture. For this purpose, we used Blander, a free 3D modeling tool. It allows us to manually fix the model by creating and modifying parts that are not correctly modeled. Once we are done with the model changes, we apply a texture over it and get the final appearance of the reconstructed object. 3D model with applied texture is shown in Fig.5. Reconstructed model can be moved, rotated, zoomed, etc. in order to enable its complete presentation. This concludes creation of 3D model from a set of images.

IV.   CONCLUSION

Digital heritage allows ancient artifacts to be converted into 3D form and to be preserved for future generations. Today, there are large number of specialized devices and techniques for 3D reconstruction. Selection of the appropriate methodology depends on the object being digitized, as well as the requirements of the project within which the digitization is performed.
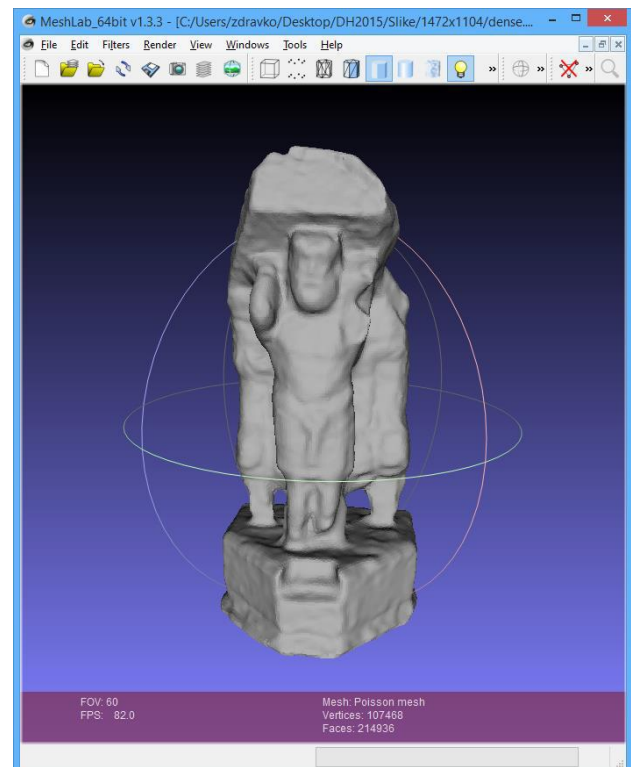
This paper shows an example of creating a model

Figure 4.   Appliance of Poisson Surface Reconstruction algorithm

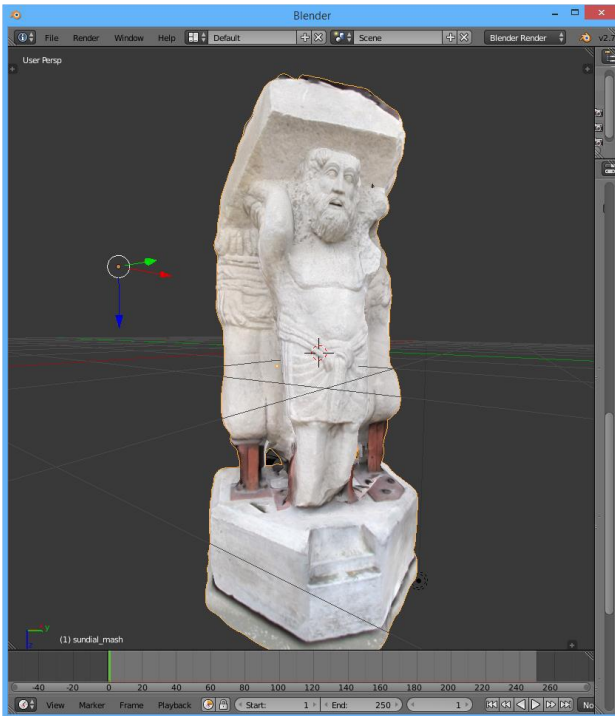Figure 3.   Number of key points in relevance to number of images

Figure 5.   Reconstructed 3D model with applied texture

based on a large number of images that are created to represent each part of ancient Sundial, which is the subject of modeling. We were also examined the influence of image resolution and the number of images in reconstruction process. The results indicate that the technique based on the multiple images and their analysis through presented algorithms can be successfully applied in creation of digital heritage.

The following research will aim to examine the possibilities of other algorithms. In addition, we will analyze the impact of additional factors, such as brightness, contrast and the presence of surrounding objects on the result of modeling.

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UML Modeling of Kindergarten Information Systems

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Abstract - This paper describes the process of software modeling applied to Kindergarten information systems. It is an application that should allow child care businesses, to easily and effectively meet ever-changing needs, challenges and opportunities. In this paper we present basic concepts in designing such systems without concrete implementation in particular programming language. For that purpose we use UML modeling language, and especially use case and activity diagrams. Those diagrams allow us to clearly see all basic functionalities that must be fulfilled in one such system.

I. INTRODUCTION

Modeling is used in many aspects of life. It was first encountered in ancient civilizations such as Egypt, Greece and Rome. Ancient civilizations used modeling for art and architecture. Today, modeling is widely used in many aspects of science and engineering. By using it, we could provide abstraction of the system at a certain level of accuracy and with a certain degree of detail. Primal benefit is better understanding of system that is being developed. According to the OMG (Object Modeling Group), "modeling is the development of software applications before coding."

In software design and development, modeling is used as a basic part of the software development process. Models are created and analyzed before implementation of the system, and serve to direct the implementation that will follow. Any enterprise level software system must be based on well created and tested models.

Better understanding of the system can be achieved if development is viewed from multiple perspectives (different views) [1] [2]. Most commonly used are requirements modeling, static modeling and dynamic modeling of software systems. Graphical modeling languages like UML, assist in the development, understanding and communication between different views.

Principles of object-oriented programming (OOP), play a crucial role in the software analysis and design. OOP focuses on key questions about the possibility of changing the software, its adaptation and evolution. OOP methods are based on the concepts of information hiding, classes and inheritance. Information hiding may lead to

the creation of systems that are more independent and it is therefore easier to modify and maintain.

Increasing number of notations and methods for software applications object-oriented analysis and design created a request for a common modeling language. As a result, there is a UML (Unified Modeling Language). It represents a standardized language and graphical notation for describing object-oriented models. However, since UML is independent of the methodology, it must be used together with one of the methods for object-oriented analysis and design.

Modern methods for object-oriented analysis and design are based on the model and use a combination of use case modeling, static modeling, modeling of state machines and interactions between objects. Almost all modern object-oriented methods use UML notation to describe software requirements, analysis and design models [3] [4].

Use case modeling of systems functional requirements defines software system in terms of usage and participants who use or interact with a given system. Use cases are created to show the interaction between objects which participate in it. Interaction diagrams are created to show how objects interact with each other in order to realize the use cases. The classes are defined according to their attributes and relations with other classes [5].

Kindergarten represents an important place in every man's growing up. In order to become better from the standpoint of growing up and maturing, kindergartens shell analyze their activities and constantly adapt. Before information systems, all data recording was done manually. Staff need to record data in books and keep them in the rack. Those data were very difficult for searching and retrieval. Kindergarten information systems allow teaches to manage student records and achievement more easily.

II. SOFTWARE ARCHITECTURE

Software architecture goal is to overview entire system structure, in terms of components and their interconnection. It is also responsible for internal implementation details of individual components [6]. Emphasis on the components and their interrelations are sometimes called programming-in-large, while detailed

design of individual components is called programming-in-miniature [5].

Software architecture can be described at different levels of details. At higher levels it can describe the decomposition of system into subsystems. At the lower level, it can describe the decomposition of subsystems into modules or components. In both cases, the emphasis is on an external view of the subsystem / component - that is, the interfaces provided and required, and their interconnection with other subsystems / components [1][2].

Software architecture is sometimes viewed as a high-level design. It can be described using different views. It is important to ensure that the architecture meets the software requirements, both functional (what the software should do) and nonfunctional (how well it should do). It is also the starting point for detailed design and implementation, particularly in cases where development team becomes quite large [5].

III. UML DIAGRAMS

UML notation has evolved since it was first adopted as a standard in 1997. The highest revision was made in 2003. Current version is UML standard 2. UML notation has consistently grown over the years and today supports a large number of diagrams. The application development is usually based on following diagrams:

- Use case diagram
- Class diagram
- Object diagram
- Communication diagram
- Sequence diagram

- State machine diagram
- Activity diagram
- Deployment diagram

A. Use-case diagrams

Use Case Modeling is an approach to describe the functional requirements of the system. Inputs and outputs of the system are given by first describing by the use case model, and then using static modeling.

In approach of modeled using use cases, functional requirements are described by the participants, who are users of the system, and use cases. Use case defines a sequence of interactions between one or more participants and systems. At the stage of processing requirements, use case model looks like a black box system and describe the interaction between participants (one or more) and system in the descriptive form that consists of inputs that are entered by users and answers provided by the system.

Use case typically consists of a series of interactions between actors and systems. Every interaction consists of entrance which provides the actor, followed by the response received from the system. Thus, the actor provides input to the system, and system gives an answer to the actor. While simple use cases consist of only one interaction between actors and systems, in most systems consist on several interactions. More complex cases may involve using more than one participant [5].

In this paper we present UML modeling of kindergarten information systems. Those softwares are designed to reduce the administrative and reporting requirements. Some of basic functionalities that every such system has to fulfill are shown in Fig. 1. Those functionalities are:

- Parent account – parents create their individual accounts which allow them to see all topics related to kindergarten information system. Those informations are general informations about parent and child, notifications about any planed events, promotions, …

- Online courses – children could learn reading, colors, shapes, mathematics and other topics from their homes

- Check-in/Check-out – parents could see when their child arrived in the kindergarten, and who pick them up

- Health management – this part of application stores special information if some child has special medical needs (allergies, etc.)

- Payment processor – allows easy payment through some of well-known payment providers. It also displays all payments and any previous debts

- Reporting – displays all informations about child's activities, interests and progress. Parents could see their child's drawings,

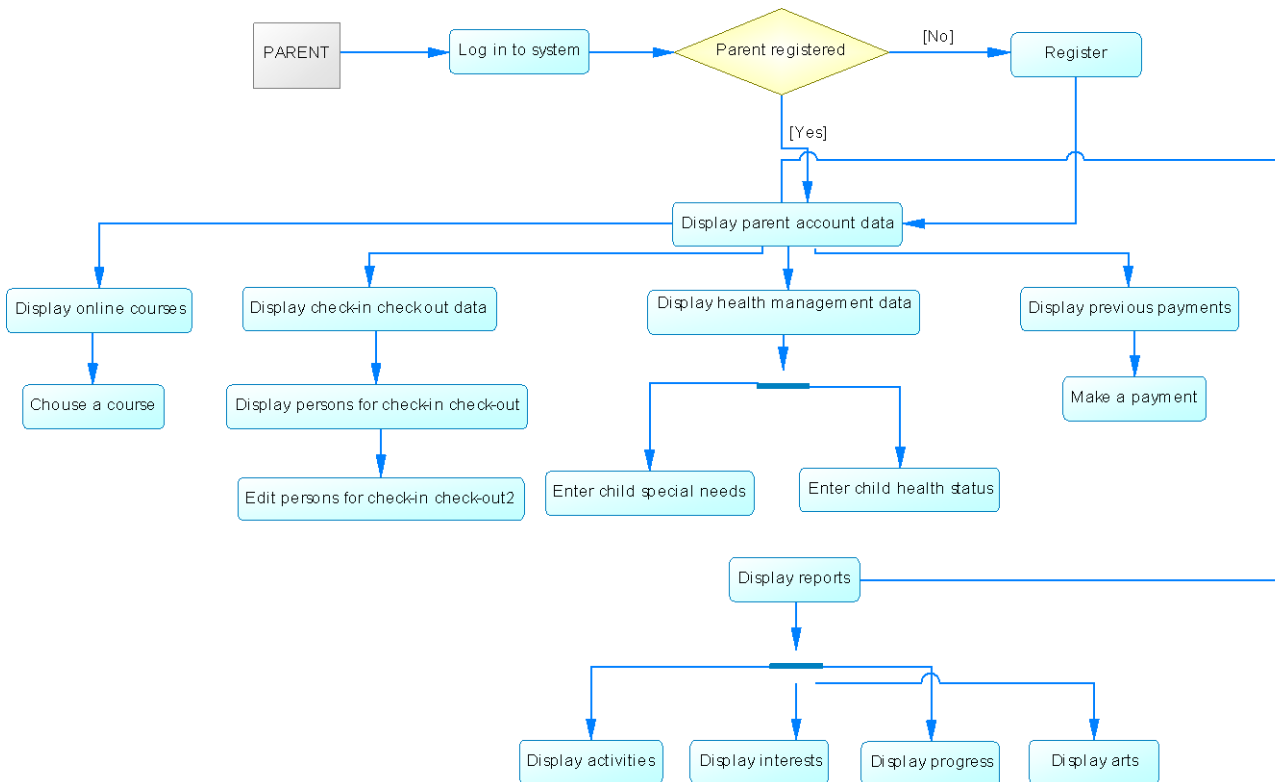Figure 1. Use case diagram of basic kindergarten information system functionalities

Figure 2.   Activity diagram of basic kindergarten information system functionalities

videos of its musical or acting performances, etc.

Use-case diagram in Fig. 1 displays only activities that are intent for parents. Use-case diagram of all actors in kindergarten information system are left from this paper.

B.   Activity diagrams

UML activity diagrams represent type of application diagrams that displays flow of activities in some information system, as well as control sequences that occur during software activities. Activity diagram shows the sequence of activities, decision nodes, jumps, etc.

Use case model can be described using activity diagrams. However, to show the use case, it is required only a subset of what activity diagrams can offer. More precisely, it is not necessary to model the competitive activities of the use cases [7].

Activity diagram can be used to represent the sequence of steps in use case, including the main sequence and all the alternative sequences. In other words, the activity diagram can be used in more precise description of the use case because it shows the exact location and conditions in the sequences that are required for alternative execution. Activity node can be used to display one or more steps in the use case. High level activity node can be used to display whole use case, where it can later be decomposed into a separate activity diagram.

Activity nodes could be aggregated nodes that could be hierarchically decomposed to give lower level activity diagram. This concept can be used to indicate the use cases with the inclusion and expansion. Therefore, node activity in the base use case can be used to represent a

connection with the case of use which represents inclusion (or extension), which is then displayed on a separate lower-level activity diagram [5].

Activity diagram shown in Fig. 2 gives us a closer look on a system that is globally represented by use case diagram in Fig. 1. From Fig. 2 we could see that first part of every activity is logging to the application. This is because only logged users can access system, and all data are confidential and are intend only for parents. In other words, no one can see other children's data.

From the start page to which we get redirected after successful logging, we could access all other parts of the application. Subsystem for online courses allows users to display all various online coursed, and to choose one according to child's wishes and needs.

Check-in and check-out part displays information about who bring the child to the kindergarten that morning, and who pick it up later. From this page parent could define who has authorities to bring or pick up the child (mother, father, grandparents, etc.). Parents are also allowed to make changes on daily bases if, for example, someone else parents are going to pick up the child.

Health management information are very important for every parent and child. If child has some special needs, for example it is allergic for some kind of food, or material, those information must be available to teachers. Parents could also inform teaches that child is suffering from a cold and that it won't be coming to kindergarten form next couple of days.

Payment information is intended to help parents track the made payments. It also includes some of well-known payment processors.

Reporting part of application allows parents to track child's progress, interests and activities. It also displays all children's drawings, acting and singing, which could be stored.

IV. CONCLUSION

This paper presents a model of kindergarten information system software. The software is modeled using different types of diagrams that represent the required modeling and analysis process. In this way, we obtained a better overview of the process of creating software and the functionality it provides, and the execution and implementation of these functionalities. An additional advantage is the possibility of modeling the distribution and organization of the process of creating the software between multiple teams working on its implementation. Thanks to UML modeling and technology, this process is carried out in precisely defined steps that have enabled rapid and efficient integration process.

ACKNOWLEDGMENT

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The spreading of non-formal information in the human networks of organizations

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Abstract— **Internal communication network of the organizations constitutes a multilevel and complex network. Professional formal information of operational processes flow in this complex communication network but also the non-formal communication that does not belongs directly to the operation run there. Performance and operational safety of the organization are influenced not only by professional information but they are directly affected also by the features of non-formal communication network. The non-formal communication network represent an important role in the organisational human network, because in the view of it the flowing of some parts of information is more effective and controlled organizational changes can be realized faster, furthermore safety of information handling can be improved. Through the research the internal informal network of a 144 employee's Hungarian company was examined. The structure of the informal network and their features that are determinative from network theoretical point of view were mapped and based on it the information spreading model of the examined informal network was completed. By the help of the model dynamic features of the information spreading became revealable and based on it information spreading effectiveness of the different managerial communication strategies could be examined.**

Keywords— **Organizational human network, information spreading, operational safety.**

I. INTRODUCTION

A complex connection network evolves between the organization's members through the operation of the organization. People have also non-formal communication connections along their daily professional relations. Every people are also members of each connection networks therefore internal connections of the organization form a complex network (human network) which is built up from several different sub-networks. The organizational human network is such a multiplex network wherein particular network layers [1] visualize the different connection system of people in a graph in the way that peaks symbolize the organization members and the edges the among them realizing connections. The different network layers explore special connection networks e.g. dependent connections or professional connections, but a particular network layer shows who chats to whom about non professional topics on a daily basis. As long as the networks that belongs to professional connections are determined by operational processes, the communication network that does not belongs to professional activities is based on emotional relations of employees and it is structured on the base of sympathy. Although this informal connection network is dominated by emotions it

plays an extremely serious role in the internal communication system in terms of the information spreading in the organization and it has an indirect effect on the operation of the organization. Knowing the non-formal communication network it is possible to evolve such internal communication strategies that are conductive to spread positive information more quickly and widely and at the same time balk spreading of negative information.

II. THE INVESTIGATED ORGANIZATION AND DATA COLLECTION

A. The organization

The research was made at a 144 active employee's Hungarian company which has a parent company with a European network. It was a service company and most of its processes consisted of administrative activities. It manoeuvred a countrywide branch network, has been present in Hungary for 20 years as one of the market leaders on its field. Its operational processes were evolved and audited according to the ISO 9001 Quality Standards.

B. The software platform of the survay

The organizational network was mapped using web-based software. The software was essentially made for corporate management systems, but because of its modular structure it was possible to use it for other functions as well. The needed surface for the survey was configured in this software. As first step of the survey all of the active employees of the organization received an individual access code to the software, which enabled them to entry on the filling surface. Because of using personal data it was voluntary to join the survey. For this reason participants had to declare that they wanted to join the survey and allowed to handle their personal data within the frame of the survey. These statements were formulated according to Hungarian data protection law. All the employees of the company assumed the participation in the survey and they also declared it committed it in writing.

C. The methode of data collection

The whole organizational network was mapped through 45 different relationship networks, called network-layers. The data of the particular network-layers has reached due to the answers received for the questions about the relationships. The participants could choose the answer names of their colleagues from a roll down menu for the

questions. It was possible to choose one or more names, and the responders could choose also themselves depending on the nature of questions. The software that used for the data collection threw up all the 45 questions randomly at every access, the filling could be interrupted at any time and previous answers were stored. This possibility enabled for participants not to spend too much time at once to fill the questionnaire and minimised the risk of aligned responds.

III. MAPPING THE NON-FORMAL COMMUNICATION NETWORK

Answers given to the following question were used to map the non-formal communication network: *"Who do you usually talk to about non professional topics on a daily basis?"* The responders could choose the organization members unlimitedly and it was possible to choose only one person or not to choose anyone but self-marking was impossible.

The non-formal communication network is based on emotional relations of employees, therefore daily informal contacts map also sympathy links and for this reason is structured on sympathy and antipathy basis. On the one hand it is although a slightly narrower connection system than the sociometric network of Mérei [2], but at the same time it shows a verier picture in terms of organizational operation in practice, because it is based on daily communication connections. Namely the fact that somebody is likeable to someone does not implicate the daily sharing of information. It can be said that sympathy is a necessary but not sufficient condition of a non-formal communication connection between two people.

Processing of the answers can be started only after that all of the participants gave the responses. The responses that were given to the questions about non-formal communication habits constitute a data set that is consists of pairs of names. The first name in the particular pair of names belongs to the responder and the second name belongs to the person who was marked in the answer. By converting these pairs of names the adjacency matrix concerning to all of the organization members can be recorded [3]. The rows and the columns of the adjacency matrix include the members of the organization, and the rate of the cells is 0 or 1 depending on which colleague was marked by the responders according to the question. In the case if the person whose name is in the row of the matrix marked a colleague whose name is in the column the rate of the cell is 1, in other case the rate is 0. In this manner matrix *A* can be configured that reveals the system of informal connections. (1)

$$A := (a_{ij})_{n \times n} \quad i = 1,2,...,n \quad j = 1,2,...,n \quad n = 144$$

$$a_{ij} = \begin{cases} 0 \ if \ the \ person \ i \ don't \ signed \ the \ person \ j \\ 1 \ if \ the \ person \ i \ signed \ the \ person \ j \end{cases}$$

(1)

This way received adjacency matrix forms a controlled graph. But since informal connections are sympathy based and non-formal communication is bi-directional because of its verbal character, the received adjacency matrix has to be transformed to get a symmetric matrix. In the course

of the transformation the original adjacency matrix *A* has to be add to the transposed matrix A^T, and the result will be a symmetric relationship matrix *K*, that represent the undirected version of the original informal relationship graph. (2)

$$K = A + A^T \qquad (2)$$

IV. CHARACTERISTICS OF THE NON-FORMAL COMMUNICATION NETWORK

The graph of the informal connection network can be visualized on the grounds of the relationship matrix *K*, that include people in its intersections and the undirected edges are the non-formal communication contacts that were realised between them (Figure 1).
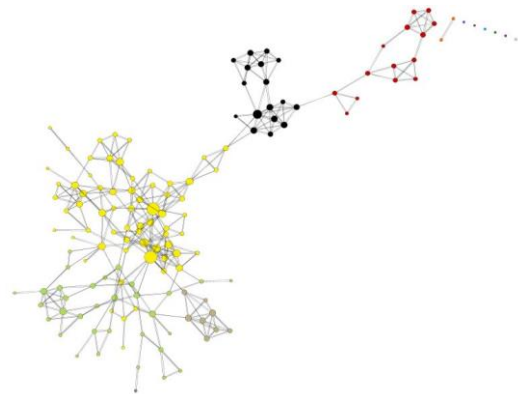

Figure 1. The non-formal network layer of the organization

The structure of the non-formal communication network does not conform to the regional structuring. Although the non-formal communication between people is influenced by the regional configuration of the organization, but it is not the same extent as in the case of the substitution network. The substitution network replicates almost completely the regional structure of the company since substitutions can be solved at regional level because of the distances (Figure 2).
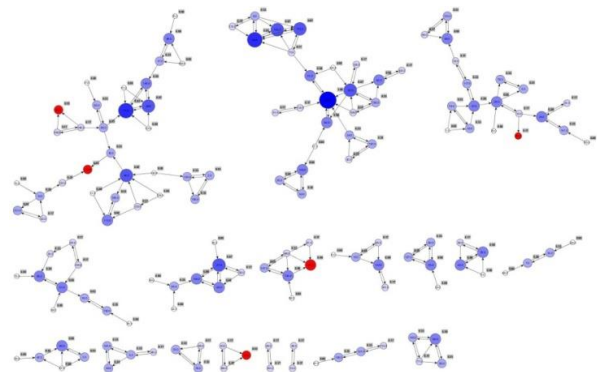

Figure 2. The substitution network layer of the organization

Nowadays the regional fragmentation of the organization set less and less bar against the non-formal communication between people. The mobile phones and

the internet communication provide people the opportunity to maintain their sympathy based connections independently of regional fragmentation, and it has a significant impact to the non-formal communication network of the organization.

Analysing the topological characteristics of the non-formal communication network it can be seen that two smaller chain switched clusters are connected to the central part of the non-formal communication network as bines. [4] Even two persons can be identified in the connection of the central part and the two smaller clusters whose absence causes the loss of non-formal communication contact between the central part and the two smaller clusters. In the case of the absence of these two people more than the 20% of the whole manpower split off from the non-formal communication with the central part. The 20/80 ratio in the network refers to the power function character of the degree distribution in general [5] and it can be said that the informal network has small-world character.

It can be seen from the quantitative results of the informal network that it consist of relative numerous connections, thus it forms a mighty connected network (Table I.).

TABLE I.
QUANTITATIVE RESULTS OF INFORMAL NETWORK LAYER

	informal network	central cluster of informal network
nodes	144	102
connections	330	243
average connection	2,29	2,38
average distance	5,45	3,98

The average length of the access path has a relatively high value. It arise from the topological character that the two smaller clusters are attached to the central part by few edges. At the same time if the central part would be analyzed separately the average length of the access pass shows a lower value.

V. THE INFORMATION SPREADING MODEL

The information spreading model was prepared by using the above defined relationship matrix K. The values in the relationship matrix show the persons with whom the particular people keep daily non-formal communication. To model the spreading it is required to submit the relationship matrix to a further transformation. It is necessary because in the main diagonal of matrix K all the values are 0, since self-marking was impossible through the responding. In order to have value 1 in all the cells of the main diagonal of the matrix it is necessary to multiply it with an identity matrix E that has the value 1 in all the cells of its main diagonal. In this way transition matrix P will be received that is one of the needed elements to the spreading model. (3)

$$K \times E = P$$

$$
\begin{pmatrix}
k_{11} & k_{12} & . & . & k_{1j} \\
k_{21} & k_{22} & . & . & . \\
. & . & . & . & . \\
. & . & . & . & . \\
k_{j1} & . & . & . & k_{ij}
\end{pmatrix}
\times E =
\begin{pmatrix}
p_{11} & p_{12} & . & . & p_{1j} \\
p_{21} & p_{22} & . & . & . \\
. & . & . & . & . \\
. & . & . & . & . \\
p_{j1} & . & . & . & p_{ij}
\end{pmatrix}
\tag{3}
$$

$$i = 1,2,3,...,n \quad j = 1,2,3,...,n \quad n = 144$$

The other element of the spreading model is the state vector S shows at a given moment those people who received the in terms of spreading new information (news) through the non-formal communication and there through are infected by the new information (news). Next step is the introducing of a new state vector S_t whose elements are the particular members of the organization and whose values are 1or 0 depending on if they are infected by the new information (news) or not. (4)

$$
S_t :=
\begin{pmatrix}
s_1 \\
s_2 \\
. \\
. \\
s_n
\end{pmatrix}
\qquad t = 1 \qquad n = 144
\tag{4}
$$

$$
s_n =
\begin{cases}
1 \; \textit{if the person } n \textit{ got the news} \\
0 \; \textit{if the person } n \textit{ didn't got the news}
\end{cases}
$$

In the model the product of transition matrix P and state vector S_t shows who are infected by the new information in the non-formal communication network in the first step. The result is a modified state vector S_t+1, and it shows who receives the information in the communication network in the first step. (5) Iterating the multiplication operation the information spreading in the network can be modelled. The iteration operation has to be kept on until the quantity of contamination by the new information saturates in the network, and new multiplications does not change the values of the state vector Sm and at the end $S_t = S_t + 1$.

$$P \times S_t \to S_{t+1}$$

$$
\begin{pmatrix}
p_{11} & p_{12} & . & . & p_{1j} \\
p_{21} & p_{22} & . & . & . \\
. & . & . & . & . \\
. & . & . & . & . \\
p_{j1} & . & . & . & p_{ij}
\end{pmatrix}
\times
\begin{pmatrix}
s_1 \\
s_2 \\
. \\
. \\
s_n
\end{pmatrix}_t
=
\begin{pmatrix}
s_1 \\
s_2 \\
. \\
. \\
s_n
\end{pmatrix}_{t+1}
\tag{5}
$$

$$i = 1,2,3,...,n \quad j = 1,2,3,...,n \quad n = 144$$

It is necessary to interpret also the iteration steps in the spreading model. It is evident that the transmission of the information does not happen scheduled and all at once, but there are relevant simplifications in the model. In the case of the information spreading model iteration steps can be defined as time intervals. It is assumed that the

transmission of the information can be surely realized during such a time interval. As a matter of course there is no guarantee on it in the reality, but this approximation can be used in the modelling of spreading.

VI. DYNAMICS OF THE INFORMATION SPREADING IN THE NON-FORMAL COMMUNICATION NETWORK

Knowing the topological and quantitative features of the non-formal communication network it is possible to model the dynamic features of the information spreading in the organization. The relevant index numbers in terms of the information spreading are the number of people who received the new information (contamination) and the number of iteration steps (iteration number) as well as the number of the repeated interactions of the information transfer that befall the particular people (contamination redundancy). The last means how many times receives a person the intent of information transfer. Namely people tend to evaluate the new information more authentic if they are confirmed by several persons. Contamination redundancy was handled on maximum credibility level in the present spreading model, it means that all participants of the model are evaluated perfectly authentic by everybody else and the recipient of the communication accepts the information already through the first interaction.

Spreading dynamic was examined in the case of six different initial state vectors. The initial state vectors included only one zero-client in every case, it means only one person was infected by the new information. The model includes the state vectors of the two zero-clients with the highest degree of centrality (S1 and S2). These own the most informal contacts (C=17). Furthermore it include the state vector of the person with the lowest degree of centrality (S6), who has only one informal contact (C=1). In addition it includes three further people with 11, 10 and 5 degree. The degree of centrality indicates that with how many other people has one person contacts in the network.

TABLE II.
INFORMATION SPREADING OF DIFFERENT STATE VECTORS

iterations	Different state vectors					
	S1 (C=17)	S2 (C=17)	S3 (C=10)	S4 (C=11)	S5 (C=5)	S6 (C=1)
1	1	1	1	1	1	1
2	18	18	11	12	6	2
3	53	47	30	34	22	3
4	83	78	67	65	65	4
5	104	108	95	95	95	7
6	117	124	107	108	107	34
7	124	127	117	117	117	65
8	127	130	124	124	124	91
9	130	133	127	127	127	112
10	133	137	130	130	130	124
11	137	137	133	133	133	127
12	137	137	137	137	137	130
13	137	137	137	137	137	133
14	137	137	137	137	137	137

In the Table II. can be seen the contamination spreading that belongs to the different zero-client. It can be seen that although there is correlation between the degree and the number of iterations that are necessary to reach the needed saturation level, all the same time might occur different spreading dynamic in the case of the same degree and very similar spreading dynamic in the case of different degree.
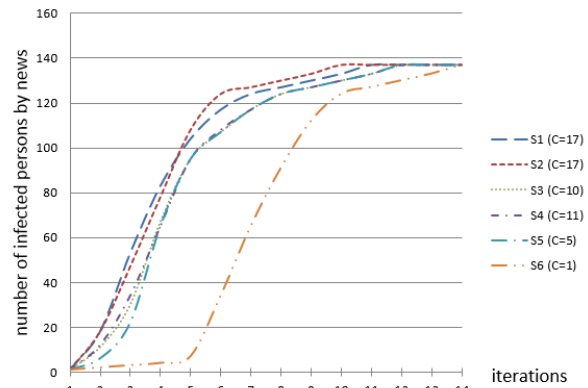

Figure 3. The spreading dynamics of different degrees

The Figure 3. shows the different spreading dynamics (Figure 3). It can be seen that there are different but similar growth function in the model. The growth curve that belongs to the zero-clients with higher degree is typically Mitscherlich-type, while it shows logistic nature in the case if the degree is lower. [6] It distinct on the graph that the higher degree of the zero-client results faster spreading in the first iteration steps, but after a contamination of 124 persons all of the spreading dynamics are the same. It can be seen that the growth curve saturates after the 14th step in the case of the lowest degree zero-client. In the case if the unit of the iteration steps in the model is considered one day and assuming that there is only one non-formal communication between people per day, non-professional information spread in two weeks at the longest in the entire organization according to the model. It can be said that a non-professional information spread in a short time in the entire organization independently of the source of it.

VII. SUMMARY

The organizational human network - where the contacts of the organization members are realized through their activity - is a complex multilevel connection network, which includes as well the non-formal communication network as the power structure, the substitution, the knowledge transfer and any other connection sub networks. Through the daily operation of the organization not only professional but also non-formal communication take place between the employees. The non-formal communication network of the organization can be mapped using network theory methods, and knowing the nature of the network it is possible to specify the weak points of the network, to measure the calibre of the particular members in the network and to model the information spreading from different initial state. The knowing of the internal non-formal communication network of the organization provides an opportunity for

the management to use different communication strategies. Knowing the features of the network it is possible to speed up or slow up but even block the spreading of information in the organization. In crisis situation or in the case of change management it provides a great help for the executives if they can influence the spreading of non-formal information in the organization. [7] It is possible to make change faster and easier acceptable for the organization members or rather the wide range spreading of incorrect or negative impact information can be balked. Knowing of the non-formal communication network of the organization can be used also on the field of security, namely in the case of handling confidential information it worth to take in consideration the features of the network.

It is important to draw the attention to the fact, that non-formal communication network is sympathy based; therefore this relationship system can change in time with the transformation of human relations. Accordingly informal network has to be considered a dynamic structure that has to be mapped from time to time, because it is the only way to get a true picture.

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General audit of the infrastructure, improvements in network security features, fixing potential security holes in a company

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Abstract - Nowadays, viruses spread from computers to computers very fast through the Internet. They can attack anywhere at any time if the system's network has holes, errors and weak security. Moreover, they can damage the system seriously. Thus, finding the holes and the problems of the system is very important before applying the solutions to protect the network from external or internal attacks.

This article reports a general and systematic review of a small company called PhoneMessage (a VOIP company in Paris, France). Although it is a small firm, managing the network of the company is essential to ensure safety and security. Therefore, the mission includes three parts: a. General analysis of the company system's network to find the holes and potential weaknesses; b. Discovery of the existing security issues and corresponding possible solutions; c. Testing and deployment of the solutions to improve the system reliability.

Keywords: general audit; improvement network security features; potential security; security holes; fixing potential security; network security

I. INTRODUCTION

Protecting the computers from hackers and viruses is an increasingly unending concern for the administrators. The main task of system administrator is to operate the system in a stable and secure status.

Therefore, the system administrator must know the current status of the system and find the vulnerabilities of the system such as reliability before putting forward the solutions to fix the fault of the system.

II. METHODS

This paper presents the systematic and general review of the network system at a company; especially in PhoneMessage company. Systematic reviews uses some methods such as figuring out the software and hardware function, specific issues and treatment, proposing measures to prevent the system from potential technical errors and proposing a new solution for this organization.

III. FIGURING OUT THE SOFTWARE AND HARDWARE

A. Sketching the present network diagram

First of all, we need to analyze the company network system by sketching the network diagram. This firm has workstations, handsets, ADSL, Main Server, Secondary server, Backup server, Database server, IT providers: Orange Telecom and so on.

After having a network system diagram, it is easy for the administrator to have a deep look inside and know the device function.[1,2] For example: the Primary Server (server 4) undertakes the management functions such as database, web server 2, ABM server and CTI link (Computer Telephony Integration link) – allowing the interactions on a telephone and a computer to be integrated or coordinated.

It includes the integration of all customer contact channels (voice, email, web, fax, etc) with computer systems. This server is responsible for converting the digital signal into analog signal from the clients who call our company through CTI link and vice versa. [3] Moreover, this server plays an important role in the system in managing the all workstations.

Besides, the secondary server (server 3) has some functions; for instance, email sender, web server 2, printer server, SMS services, fax and file server. Furthermore, this server includes a special function that is back up server.[4] This service allows backing up the whole system and database storage in case of emergency.

It is an important and indispensable tool for every system. In addition to designing and making the system function well, analyzing the potential risks or damage is indispensable to figure out the solutions of each device. [5,6,7]
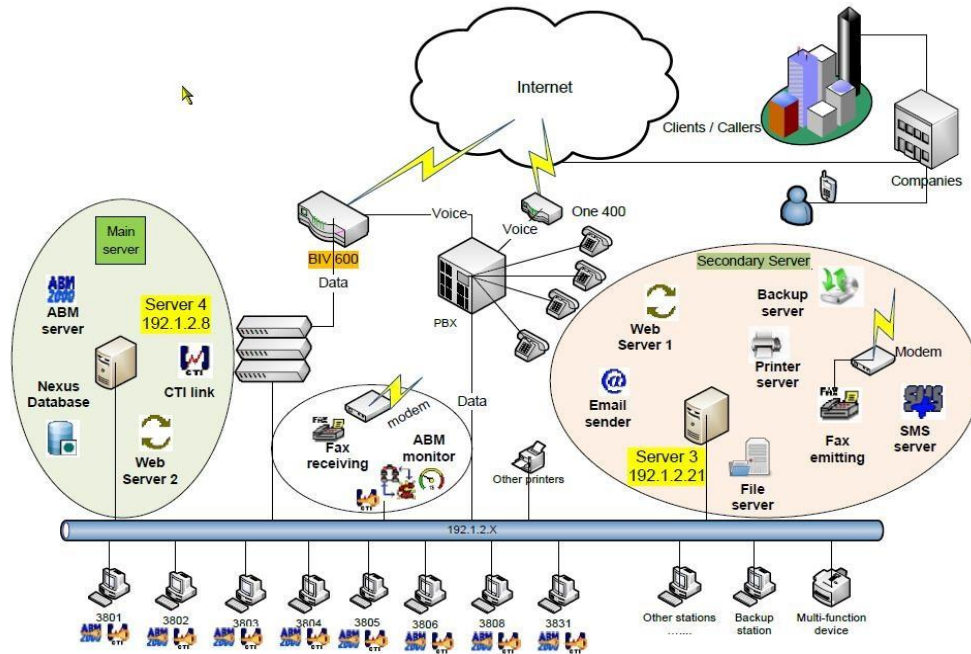
Figure 1: PhoneMessage's network system

B.   Analyzing risks [8] and solutions for some important device

Device	Function, support	Risk	Damage	Solutions
BIV 600	Connect outside and inside company	virus attack, overload, IPv6 not compliant	High	Choose the appropriate IP Providers
Nexus DB	Manage database	Data corruption, hard disk malfunction, lost data	High	Test data frequently Replace new hard disk
Work station	Operator	Virus attack expired OS version, problem, LAN problem, hard disk problem, software malfunction, dumping physical memory, software conflict, fan problem, file system errors, registry problem, speed slow down	High	- Use antivirus software - Purchase new license. - Replace new fan - Test LAN card or replace a new one. - Buy new equipment - Read instructions carefully before installing new software - Re-install OS to fix file systems. - Update service pack to fix errors for OS. - Re-install OS. - Use software to defragment hard disk, clean garbage files.
Backup server	Backup database	Hardware problem, out of electricity, network connection, out of space, hard disk malfunction.	Medium	Upload backup files to Amazon S3 to save space. Burn all backup files to DVD disks. Replace battery or provide UPS. Fix or buy new hard disk.
ABM server	Program action and execute on workstation Manage functions likes	Internet connection, software and RAM, main board malfunction, expired OS version, overload, call drop, NTLDR's missing, SQL errors, log errors, Service overloaded, out of battery, Runtime errors, DNS server error, domain controller Net frame work error [8]	High	- Test the connection. - Purchase a new license for OS. - Replace RAM or main board. - Check and replace new server. - Hiring more employee -Restart system, check hard disk/BIOS configuration. Restore NTLDR and file ntdetect.com from OS disk. - Test the request - Restart system. -Process to buy new UPS or battery. - Contact to the technician, IP provider - Re- install net frame work

C. *Proposing the security solutions*

Why did we need IPv6 [9] anyway? Millions of new computers, printers and other devices are connected to the Internet every year, and the network is getting closer and closer to new machines that are inaccessible. It is evident that each apparatus that is connected to the Internet needs its own Internet Protocol address, which is currently being provided by a suite of protocols called IPv4.

Internet Protocol (IP) addresses are used to identify devices on the Internet so that they can communicate effectively with each other. Each IP address must be unique. If two or more devices share the same address, they will not be able to access the Internet. The same is true for devices that do not have IP addresses. IPv4 can no longer support this need for unique addresses because of the increasing growth of Internet. Another reason for upgrading to IPv6 is the need for better security.
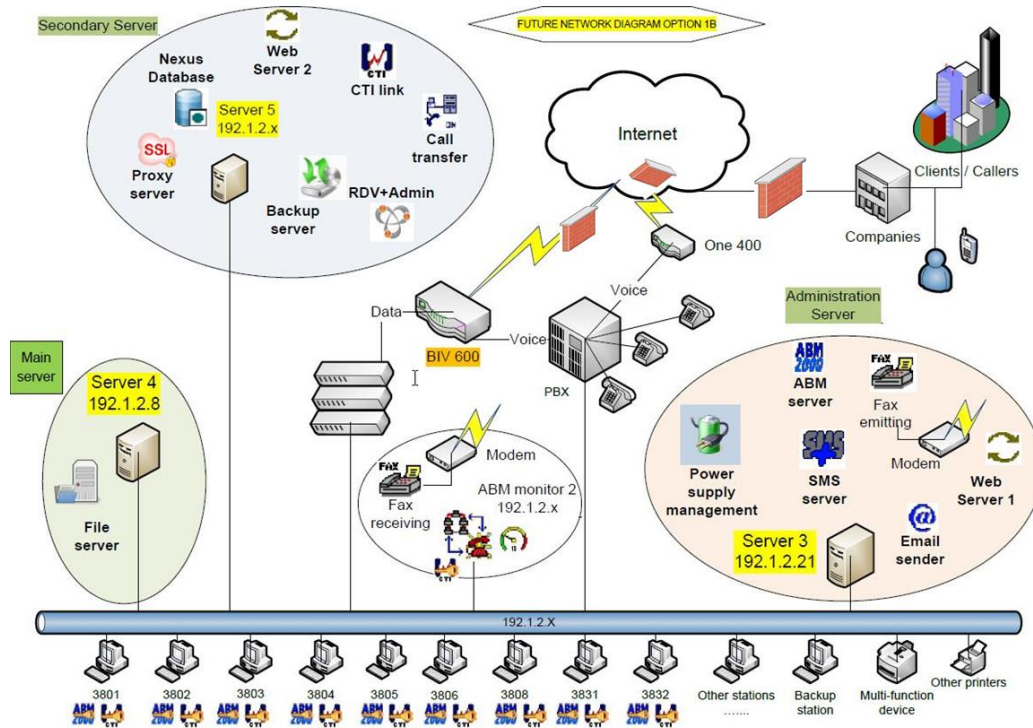
Figure 2: PhoneMessage network system in the future

The critics and scientists have predicted that the world would no longer use IPv4 because all IP address will have been used by the end of 2010. Therefore, the changing the system using IPv6 instead is very essential and urgent at this time. Moreover, for the small businesses, the transition to new technologies can improve the security, reliability and performance of applications.

We supposed that if Main Server had had some problems in some functions, the Secondary server and Administration server would have replaced it and kept the system works more efficiently.

We suggested this solution with the purpose of preventing the system from breaking down or failure to connect between our clients and us. Moreover, it can reduce to the minimal damage for the company because every single minute there are countless calls from the clients to our company while we find the reasons and the solutions to fix Main server.

IV. CONCLUSION AND DISCUSSION: MAKING THE SYSTEM MORE SECURE

With this option will help the company work better, safer, faster and meet the diverse demands of our clients.

On the other hand, we wanted to set up a new extra Server – Server 5 and work with the using of the NAS (Network Attached Storage) [10] technology for storing files to make our network system more secure.

Drawing on the impact and constrains of IPv6, IPv6 is defined to be one of the factors that make the company more secure and safer in the future. It should be noted that it is very indispensable to put that project and the proposal for a new organization into actual operation to meet the increasingly diverse demands of the clients. By doing so, the company can maintain its position, enhance recognition, and ultimately keep up with other competitors in the same line of business.

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Creation of VPN laboratory exercises for industrial Ethernet communication

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Abstract – The establishment of secure connection over the Internet in industrial and commercial environments is very important. Considering that IT professionals are in charge for these tasks, the efficient IT security training inclusion in the university courses has the crucial role. The creation of VPN laboratory exercises for industrial Ethernet communication is presented in this paper. The focus in this VPN exercises is made on Allen-Bradley® communication equipment in combination with other hardware and software components.

I. Introduction

The industrial and companies networks, its functionally and above all its security have the impact to the company business, production capabilities and profit. The security of these networks is very important, not only in the sense of protecting the network from the intruders, preventing network crushes, but in the sense of data security and confidentiality.

Considering all this, in this paper is presented approach of implementing industrial communication security in university curricula. This approach includes industrial Allen-Bradley® Stratix5900 Service Router produced by Rockwell Automation, Inc [1]. Together with router, one Cisco Catalyst 2950 24 switch and Wireshark network analyzing tool are included in the laboratory equipment. This lab set is used for one pilot lesson in building the secure Site-to-site VPN connection. Before, establishing the secure site-to-site VPN connection the unencrypted connection between two computers is established in order to show students the vulnerability of their information.

II. The platform for the course

The platform for this lab exercise consists of seven components. Those components are presented in the table I.

TABLE I. THE COMPONENTS OF THE INDUSTRIAL SECURITY LAB

No.	Item	Description	Role
1	Allen-Bradley® Stratix 5900	Service router	Router A in the scenario
2	Allen-Bradley® Stratix 5900	Service router	Router B in the scenario
3	Cisco Catalyst 2950 24 Switch	L2 switch	Public network
4	Computer A	Win 7 OS	PC and network on the side of Router A
5	Computer B	Win 7 OS	PC and network on the side of Router
			B. Network analyses station and configuration station for both routers.
6	Quick 'n Easy FTP Server 3.2	Software on computer B	Service provided to the users in order to demonstrate secure and unsecure connections
7	Wireshark	Network analyzing tool	Software tool for simulating network
8	Router configurator tool	Stratix 5900 Configuration tool	Installed on Computer A for configuring routers.

The network components are deployed as it was presented on figure 1. The two first items are router Allen-Bradley® Stratix 5900 representing one router connected to the core network of a company and one router connected to the far branch of a company. Stratix 5900 has fully integrated with Cisco IOS. It has one wide area network (WAN) port and four additional Ethernet-ports. It supports: firewall capabilities, Virtual Private Network (VPN), intrusion protection capabilities, Network Address Translation (NAT), NBAR protocol filtering, Access Control Lists (ACL) and Quality of Service (QoS). [2]

Cisco Catalyst 2590 24 Switch is L2 switch (item 3 in Table I) playing the role of the WAN or Internet public network with IP addresses from the pool 192.168.100.0/24. This router capability of monitoring network traffic is crucial in this scenario. [3]

Using the Cisco Catalyst 2950 SPAN (Switched Port Analyzer) feature, the switched segment and direct communication between two Stratix 5900 routers is forwarded to the port 22 of the switch – the monitoring port of the network, allowing all packets to be forwarded to the Computer A (USB Ethernet adapter) in order to be analyzed with the Wireshark network analyses tool.

Wireshark [4, 5] is the world's most widely used network protocol analyzer. It lets IT experts to what is happening on the network at a microscopic level. It is the de facto (and often de jure) standard across many industries and educational institutions.

Wireshark (item no. 7 in Table I) has a rich feature set which includes the following: deep inspection of hundreds of protocols, live capture and offline packet analysis, standard three-pane packet browser, multi-platform support (runs on Windows, Linux, OS X, Solaris, FreeBSD, NetBSD, and many others), captured network data can be browsed via a GUI, or via the TTY-mode

TShark utility, rich VoIP analysis, etc. The Wireshark read/write many different capture file formats: tcpdump (libpcap), Pcap NG, Microsoft Network Monitor, and many others. Output can be exported to XML, PostScript®, CSV, or plain text.

The Computer A (item no. 4 in Table I) is presented with the two images. The computer with IP address 172.16.200.2 and the computer with the IP address 10.10.10.2.
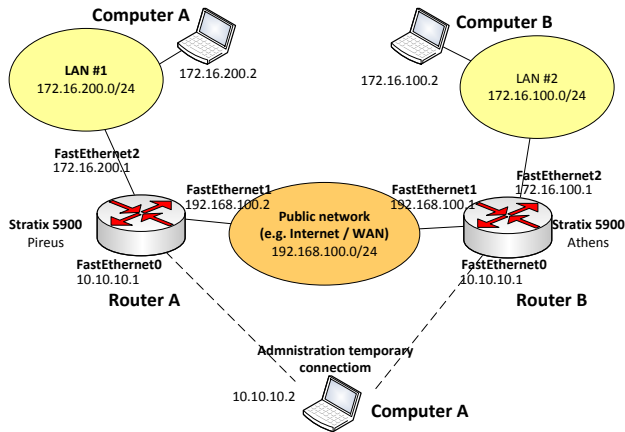

Fig. 1 Laboratory components for industrial communication VPN

Basically, this is the same physical machine - laptop with one network interface and one additional USB adapter network interface. This configuration allows two LAN Ethernet connections at the same time. One interface is used for playing the role of Computer A in the scenario with IP address 172.16.200.2. Other interface is used to configure either Stratix 5900 router A or Stratix 5900 router B. This network interface is with the network address 10.10.10.2 or any other address from the pool 10.10.10.0/24 except 10.10.10.1.

Computer B (item no. 5) plays the role of the computer placed in the branch office, on the far side of the network. It has installed FTP server in order to provide connectivity and data transfer and to demonstrate the students difference between encrypted and unencrypted traffic. The installed version of the FTP server is Quick 'n Easy FTP Server 3.2 (item no. 6). It has only purpose to enable lecturer to open one user account in order to provide access to FTP server on Computer B from Computer A and to provide data transfer.

The Stratix Configurator is program provided by the Allen-Bradley® for the configuration of the Stratix routers. It is desktop program developed in Java. It requires Java runtime machine to run. It allows easy and menu guided installation. This program will be used in the lab exercise for setting up and establishing VPN connection.

III.   VPN SCENARIO

VNP scenario used in this lab exercises is simple site-to-site VPN (Fig. 2). It should represent the simple way to securely connect two sites [6]. On one side is company HQ and on the other side is remote branch office.
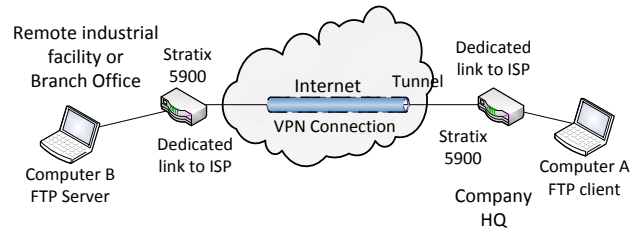

Fig. 2 Simple site-to-site VPN scenario

The first part of the scenario includes establishment of simple network connectivity without encrypted tunnel. The simple IP addressing and static routing is configured on Stratix 5900 service routers. It was made with web configuration interface and web browser. The exact steps for this configuration will be shows in next section. The non-encrypted scenario is presented in Fig. 3.
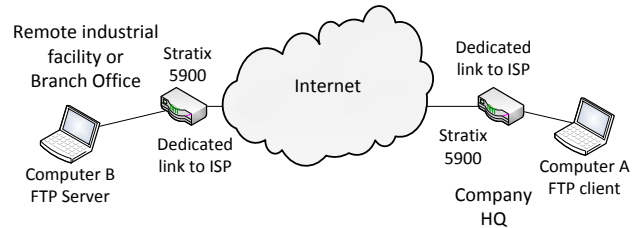

Fig. 3 Network connectivity without encryption

IV.   SETTING THE ROUTER IN THE SCENARIO

A.   IP addressing and static routing

As it was told before, the first step in configuration of the non-encrypted connection is accessing the routers and configuring their IP addresses. In order to configure routers, the interface card on the Computer A should have assigned IP address 10.10.10.2. The connection to the router can be made with the browser using IP address 10.10.10.1. The access to the router's web interface and its options are presented in Fig. 4.
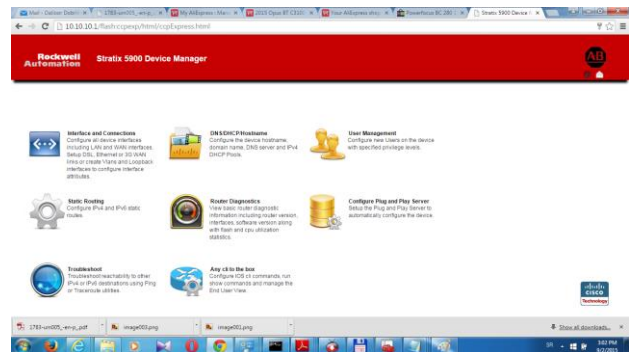

Fig. 4 Web interface of Stratix 5900 service router

The IP address interface setting for Router B is made by creation of two additional VLAN's - VLAN2 and VLAN3 besides existing VLAN3. The VLAN1 with address 10.10.10.1 stays associated with FastEthernet0 interface of Stratix 5900, VLAN2 with IP address 192.168.100.1/24 should be associated with FastEthernet1 interface, and VLAN3 interface (172.16.100.1/24) with FastEthernet2.

The similar settings are for the second router (Router A). VLAN1 has IP address 10.10.10.1 and it is associated

to FastEtherent0 interface, VLAN2 (192.168.100.2/24) to FastEthernet2 and VLAN3 (172.16.200.1/24) to FastEthernet3 interface. The listing of interfaces is given on the figure 5 after successful configuration.

The next step in configuring router is addition of one static route to each router. This route may be added as a default route (0.0.0.0/0) to the gateway - FastEthernet1 interface on the router of the opposite side, or the route to the network on the opposite side of connection – e.g. route to the network 172.16.100.0/24 on the Stratix 5900 router A via FastEthernet1 interface of Stratix 5900 router B with IP address 192.168.100.1. On the router B the added route can be route 172.16.200.0/24 via gateway 192/168/100.2.
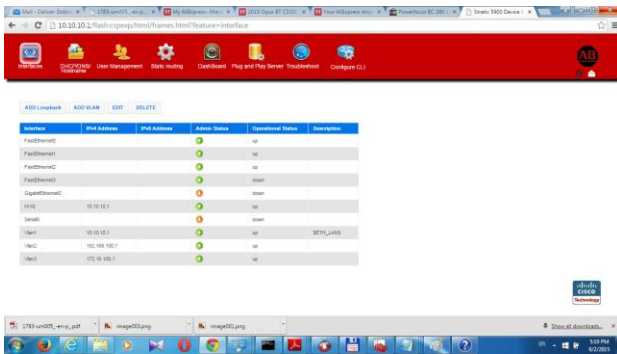
Fig. 5 Interface configuration of Stratix 5900 service router A

B. Establishing site-to-site VPN connection

The establishment of secure VPN connection for this purpose is made with Stratix Configurator. The configuration details are presented in figure 6. The set of menu options which lead to the screen on Fig. 6 are *VPN > Site-to-site VPN > Create site-to-site VPN > Quick setup*.
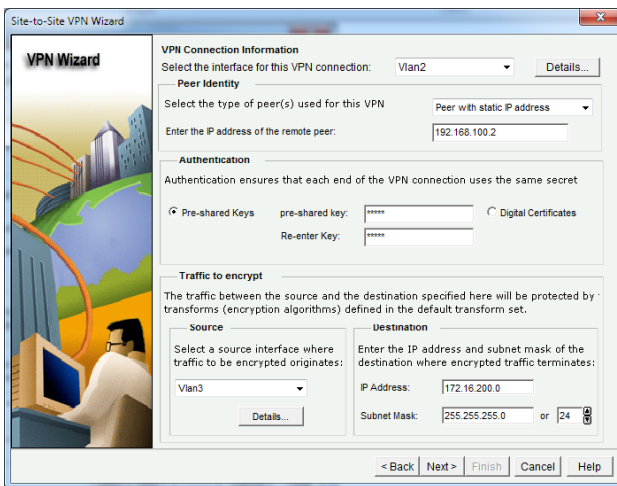

Fig. 6 Creation of site-to-site VPN on Stratix 5900 service router A

The major parameters which should be taken into account are as follows. The selected interface should be *VLAN2* for both routers. Select type of peers should be *Peer with static IP addresses* for both routers. Address of the remote peer should be *192.168.100.1* on router A, and *192.168.100.2* on router B. Pre shared key should be made by choice and to be the same for each router. The traffic to encrypt parameters should be *VLAN3* for source, and

172.16.100.0/255.255.255.0 for destination on router A, and *VLAN3* for source, and *172.16.200.0/255.255.255.0* for destination on router B.

V. THE LAB EXECISE

This section is divided in three subsections. In the first subsection is described the flow of the lab exercise in non-encrypted network. In the second part is described flow of the lab exercise in the encrypted network with established VPN tunnel. The benefits of the tunneling the traffic over the public networks are presented with the usage of Wireshark tool for network traffic analyses.

A. Using the non-encrypted network scenario

After finishing the first phase of configuration, with IP addressing and static routing, the simple access to the Computer B FTP server is made from Computer A using any FTP client. The network traffic between the Computer A and B is monitored by the Wireshark installed on computer A.

Analyzing the network traffic, captured packets and using option *Follow TCP Stream* in Wireshark the students are able to see that the username and password are visible to the user of the Wireshark program or to the potential intruder.

B. Using the encrypted network scenario

The same set of steps is repeated again with the encrypted network scenario. In this case, the network traffic was visible, but the packet content is not. It is shown on figure 7.
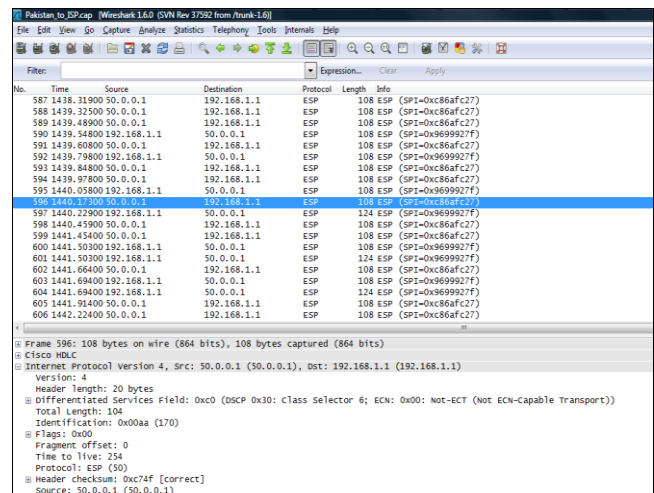

Fig. 7 The Wireshark listing the captured encrypted packets without its content

C. The experiment and the experience

The experiment with analyses of presented lab exercise usability is made with two students working as a group. The main reason for including only two students in the exercise is limited equipment, because in this phase only one set of the presented lab equipment is available. Two students successfully finished the lecture and lab exercise.

After the completed exercise the interview is made with both students involved. They stated that the lesson is well structured, with the easily understandable steps and that

they didn't have trouble to complete the exercise. They also stated that the lesson gave them deep insight in difference of encrypted and un-encrypted communication and helped them to understand VPN and VPN tunnel communication principles.

Both students agreed that they will gladly work with more labs in this environment and that will use the same platform with different scenarios.

VI. CONCLUSION

In this paper is presented the model of building the laboratory environment for the VPN topics and networks security courses. This research is motivated with the big importance of network communication security and secure data transfer for all sorts of networks and especially in industrial environments.

The laboratory equipment is based on Allen-Bradley® Stratix 5900 service router and their implementation of VPN tunneling. The laboratory set and associated exercise were tested with two students. The both students successfully completed the exercises, proving that the set is functional and efficient to be used in laboratory courses. Both students stated that this environment provided them deep insight in VPN principles and its benefits. The environment provided them deep technical knowledge as well.

The possible extension of this lab exercise can be made towards the extension of exercises with different lab scenarios, and also with inclusion of the more industrial equipment, such as education PLC controller kit or similar features in order to make stronger connection to industrial environments.

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Implementation of a Distance Scanner using Arduino Robot

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Abstract - In this paper we will present how to map an area of about 2 meters in diameter using Arduino Robot and HC – SR04 ultrasonic sensor. Since Arduino Robot is based on Arduino Robot Control Board, we will also present difficulties we had to overcome in order to make a working prototype of a Distance Scanner. In general, Arduino Robot revolves around itself, tracks angle rotations based on readings from an internal compass and notes measured distances that are obtained from HC – SR04 ultrasonic sensor. During reading, those values are stored within EEPROM, and later transferred trough serial port to C# application in order to draw measured distances on a picture of a scanned area from a bird's eye perspective. Also, in this paper we present test results of a scanned area and discuss quality of HC – SR04 ultrasonic sensor readings and applicability of a developed Distance Scanner.

Key words : Arduino Robot, HC – SR04, Distance Scanner

I. INTRODUCTION

There are similar solutions to one that we are about to present. They are mostly based on one of the smaller Arduino boards such as Arduino UNO R3 or Arduino Leonardo and utilize HC – SR04 ultrasonic sensor or Parallax Ping ultrasonic sensor in combination with a servo motor in order to rotate the ultrasonic sensor around some base, thus making a radar that outputs scanned data to serial port in real time and acts like a mini radar. Aforementioned similar solutions are described in papers of Tarulescu [1], Hariansyah et al. [2] and Haitham et al [3]. Our solution does not incorporate real time component due to the limitations of hardware that we used.

There are various solutions that utilize HC – SR04 ultrasonic sensor or a similar ultrasonic sensors in real time Some of them are presented as parts of a solution in papers by Arunababu et al [4] for implementation of ultrasonic spectacles and belt for blind people, Taniguchi et al [5] for monitoring road surface condition on a bicycle, Kalelkar et al [6] for autonomous vehicle obstacle detection and Reem Alattas [7] for bad posture detection. Aforementioned solutions are intended for solving problems that are not similar to the one we are about to present mostly from hardware aspect, yet regarding software aspect they share some features..

The Arduino Robot is the first official Arduino on wheels. The robot has two processors, one on each of its two boards. The Motor Board controls the motors, and the Control Board reads sensors and decides how to operate. [8] Both Motor and Control boards are microcontroller boards based on the ATmega32u4. [8] The ATmega32u4 has 32 KB with 4 KB that are used for the bootloader. It also has 2.5 KB of SRAM and 1 KB of EEPROM which can be read and written with the EEPROM library. [8] There is an external SD card reader attached to the GTFT screen that can be accessed by the Control Board's processor for additional storage. [8] Arduino Robot is shown in Fig. 1.

Ultrasonic ranging module HC - SR04 provides 2 - 400cm non-contact measurement function and the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. [9] HC - SR04 is a 4 pin sensor that, per pin, incorporates power supply of 5V, Trigger Pulse Input, Echo Pulse Output and 0V Ground as seen in Fig. 2.

Figure 1. Arduino Robot [10]

Figure 2. HC - SR04 Ultrasonic sensor [11]

HC - SR04 emits ultrasonic waves based on schema that is presented in Fig 3. First a short 10uS pulse to the trigger input is sent to start the ranging, and then the module will send out an 8 cycle burst of ultrasound at 40 kHz and raise its echo. Range is calculated through the

time interval between sending trigger signal and receiving echo signal. [9] In our paper we converted measured values between HC - SR04 ultrasonic sensor and various objects to centimeters using formula: uS / 58.
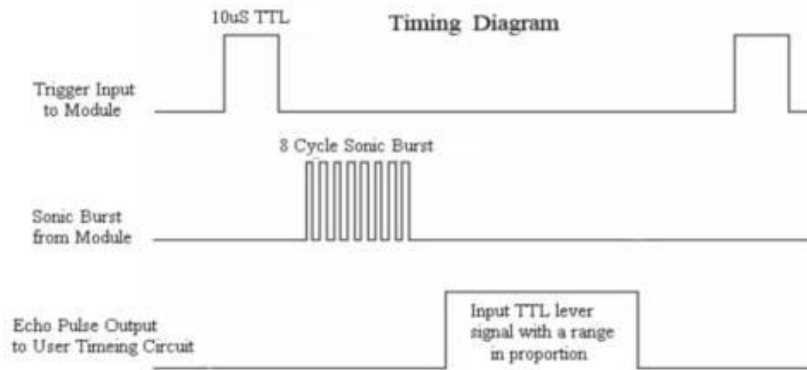

Figure 3.   HC - SR04 Timing diagram [9]

II.   BUILDING DISTANCE SCANNER

Since we had a fully functional Android Robot with open TK (Tinkering Kit) slots the first step toward building a Distance Area Scanner was to mount HC - SR04 Ultrasonic sensor to Android Robot in order to sensor reading. This was not a trivial task since Arduino Robot Control Board is like no other Arduino board where pins are marked out in a much simpler way.

On a circular board, based on the official schematics we had to locate appropriate slots and mark the correct pins. Once we established 4 slots for digital pins that HC - SR04 requires, two of them being VCC 5V and Ground, and TKD4 and TKD3 for Trigger and Echo pin respectively, we had to solder a 4 pin female connector to mapped out slots as seen in Fig 4. in order to connect HC - SR04 and Arduino Robot Control Board. We have chosen TKD4 and TKD3 pins in order to place HC - SR04 ultrasonic sensor in front of the robot. HC – SR04 was mounted on the Arduino Robot by using hot plastic gun and an empty 3 pin female connector to hold a 4 pin female connector that was soldered for Arduino Robot Control board as shown in Fig 5. Arduino Robot with HC - SR04 ultrasonic sensor is shown in Fig 6.

With Arduino Robot and HC - SR04 ultrasonic sensor connected, writing Arduino sketch that will read data from ultrasonic sensor had commenced. However, a problem soon arised, and presented itself as inability to move Arduino Robot while Arduino Robot Control Board connected to a serial port. Every time Arduino Robot is connected to a serial port, Motor Control board and Wheel Motors are disabled. This way, for transferring and storing data we had two options: one being and SD card, other being an EEPROM with limited size of 1024Kb.
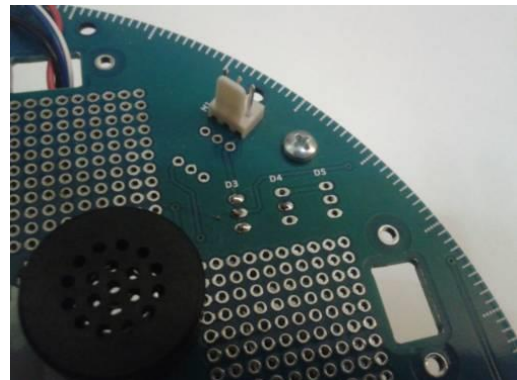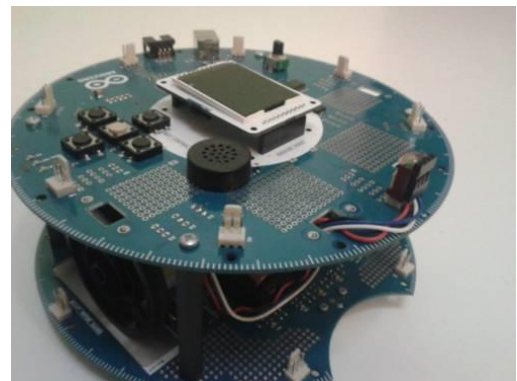

Figure 4.   Sodered 4 pin female connector

Figure 5.   Mounted 4 pin female connector for HC - SR04 ultrasonic sensor

Since EEPROM provided enough data to store data from scanning, we have chosen to write it to EEPROM. EEPROM also proved to be a better solution since reading

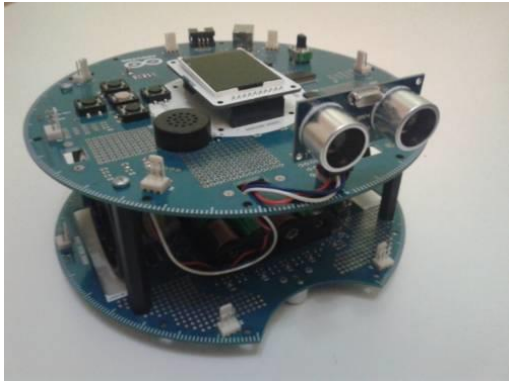and writing data to it is much easier and faster then its contender in this paper.

Figure 6.   Arduino Robot with HC - SR04 ultrasonic sensor

Next stepping stone in building a Distance Area Scanner is to make a Arduino Robot rotate around itself trigger HC - SR04 ultrasonic sensor, read and store collected data. At first we tried to rely on a method from ArduinoRobot.h file Robot.rotate(degrees); that would rotate an Arduino Robot by a certain amount of degrees. However this method proved ineffective since we needed to turn an Arduino Robot only by a couple of degrees, and the method simply did not provide enough power to the Wheel Motors. Therefore, we came up with an idea that incorporates reading from an onboard digital compass and manually rotating Arduino Robot around itself by issuing Robot.motorsWrite(power,power); command with negative integer value for the left motor, and positive integer value for the right motor. This way, Arduino Robot turns clockwise, which is considered as a desirable behavior, since onboard digital compass reads the current direction of an Arduino Robot as a degree of rotation in a clockwise direction from magnetic north. Compass readings are executed by issuing a statement Robot.compassRead(). This way, we give enough power to motors in order to slightly rotate Arduino Robot, get readings from an HC - SR04 ultrasonic sensor and read onboard compass value.

```
angles[numberOfScans] = Robot.compassRead();
distances[numberOfScans] = GetUltrasonicDistance();
Robot.motorsWrite(-85,85);
delay(100);
Robot.motorsWrite(0,0);
numberOfScans++;
delay(500);
```

Figure 7.   Core lines for Distance Scanner

During the process of scanning, a number of slight rotations is tracked in a form of a short integer, angle rotations are tracked as and array of short integers as well, while measured distances are stored as an array of words. Both arrays have a maximal length of 180 elements. This means that minimal difference between angles during reading is 2 degrees since full circle and therefore full rotation has 360 degrees. We had to use data types such as short and word since Arduino Control Board has only 2560 bytes of storage for local variables. By using a type of word for storing distance values, precision of distance measurement was rounded up to an error of 1cm, which is,

for tests we conducted, consider to be tolerable. If we had more memory available we would have used float as a data type which would enable us to perform more accurate readings. In Fig. 7 a piece of code that rotates the Arduino Robot and captures distances that are read from HC - SR04 ultrasonic sensor is shown.

There are two Arduino sketches written to facilitate scanning process. First one scans the area, and writes data to EEPROM, while other one reads data from EEPROM and outputs it to serial port, where an application written in C# waits for data to be received, and stores them in special *.usd (UltraSonic Data) files. Fig. 8 displays this feature. During the data transfer tracked angle values are converted by reducing them by the value of first marked angle. This way a first read will be marked as the one at 0 degrees stating the initial orientation of Android Robot, while other reading increase appropriately in clockwise direction.
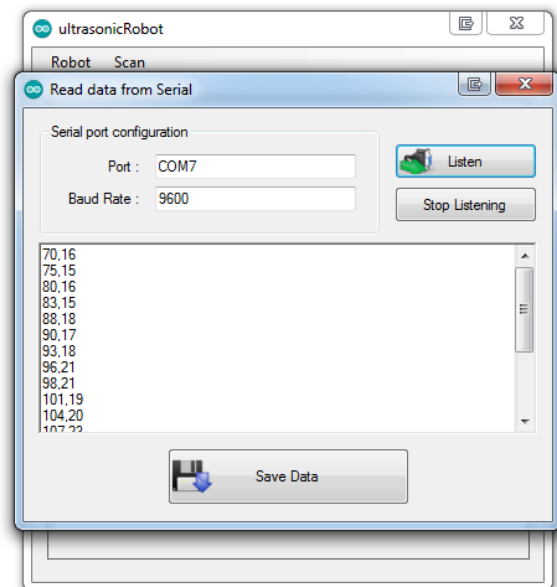

Figure 8.   Reading scan data from Serial port

III.   SCANNING RESULTS AND THEIR APPLICABILITY

Once we had completed all of the necessary modifications and auxiliary software in order to facilitate scanning process we made a small polygon with 5 cuboid objects that we marked with numbers from 1 to 5. We have placed those objects in a circular formation that are within 50 to 100 cm range from a center point. On center point we have placed Arduino Robot with HC-SR04 ultrasonic sensor as shown in Fig. 9.

Since accuracy of HC-SR04 ultrasonic sensor is ranked as low when compared to medical or industrial ultrasonic sensors and limitations of Arduino Robot Control board regarding available memory, accuracy of measured values are rounded up to whole numbers and they differ in 1 or more centimeters. One more limiting factor regarding accuracy of obtained readings is that we do not turn Arduino Robot in fixed angle steps, yet we nudge him in order to rotate clockwise, read compass to determine its orientation and record that data also.

Figure 9. Scanning course

It is known that any compass is sensitive towards magnetic fields and often require calibration. Having this in mind, it was decided to perform multiple scans of an area and objects that are presented in Fig. 9. Next several best scans that would produce readable and comparable results where selected since we knew that readings will come with a certain amount of noise and irregularities due to the aforementioned factors. Results of 4 iterations of scanning is presented in Fig 10.
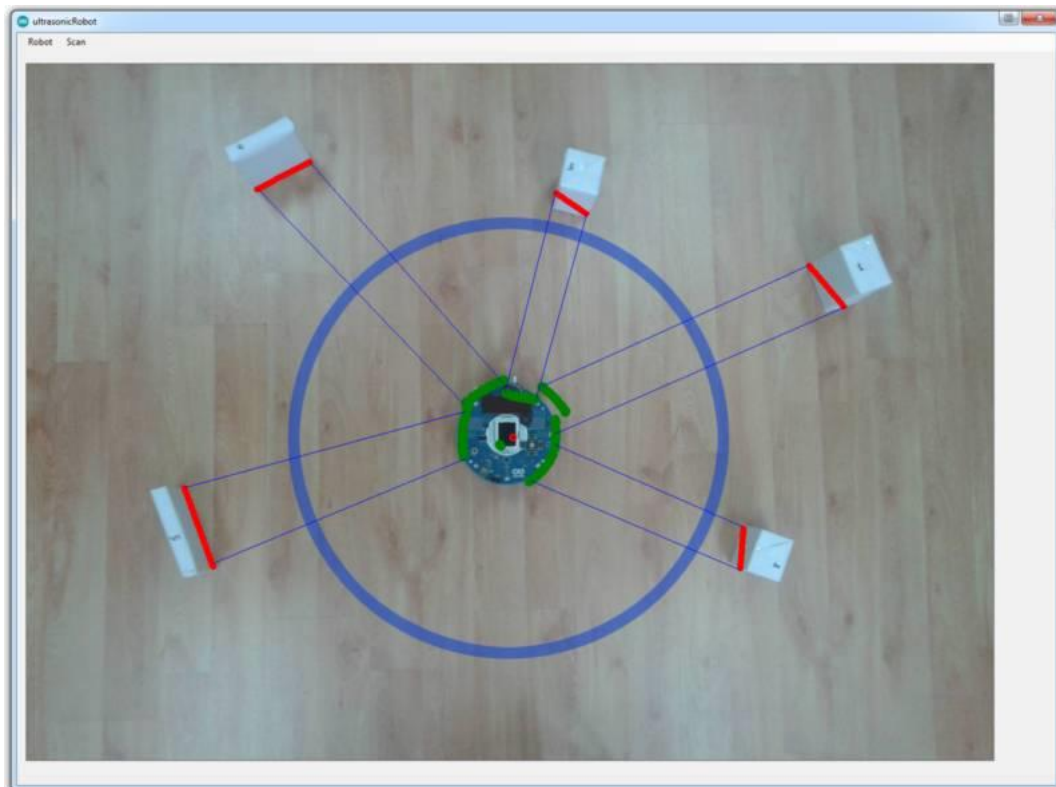

Figure 10. Rendered scanned data

In Fig. 10 dyed in deep green color are distances that have been read from the HC-SR04 ultrasonic sensor, scaled up, and aligned to approximately fit the scanned objects (red lines) with certain compensations due to fact that image shown in Fig 9. Is not completely parallel to the ground. Center of an image and Arduino Robot rotation point is marked with a red circle in Fig. 10.

IV. CONCLUSION

Presented idea, and developed solution present an alternative compared to already presented solutions. Key points of this solution are located within the fact that presented Distance Scanner is not a custom built contraption with careful consideration of both electrical and mechanical parts that are needed to perform previously described task. With components such as a servo motor and an Arduino UNO R3 Control Board presented idea would without a doubt produce better results, while outputting obtained data directly to a serial port in order be interpreted and rendered in real time.

Currently, developed solution does not posses large applicability due to its hardware limitations and implemented software compensations.

However, we have shown that a similar task can be done with equipment that can be considered unsatisfactory, while relying on programming skills, ingenuity and compensation methods. Also presented idea could be, to some extent, be developed in order to built a robot that navigates trough an obstacle course based on the data he obtains trough 360 degree environmental scanning and decides where to go based on the measured distances and calculated spacing between them.

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The Implementation of modern technologies in University information systems

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Abstract - Most of the todays universities have outdated information system that they are using. Students are having problems with gaining information or they have to visit multiple places in order to get enough study material. With this platform, security is enhanced, information and data flow is simple and everything is in one place. Mobile phones, Android wear, Cloud computing and many other modern technologies are available everywhere and they are poorly applied in university systems. Combination of these technologies can provide really efficient network and information delivery system. Platform that we are developing will provide all in one software that includes website, Android and iOS application, and Desktop PC application.

I. INTRODUCTION

Most common way of sharing information today is by using social networks, social media and cloud platforms. This platform which was made by combining these technologies can enable university students to use them all in one place.

This platform called "Velox Information System" will aim at helping students organize their time and improve their efficiency in studying. Features like online work stations, chat and cloud storage will vastly increase information availability and make it more approachable.

Every first two months, on start, students are forced to download schedule documents all over again. This is happening because it takes time for professors to establish stable class schedule. An idea came to us when we saw how perfect notification systems are used today in social networks, email applications, chat applications, etc. Idea is to combine and use best of all modern technologies that are available today.

II. DESIGN

Most crucial part of the application nowadays is the "Look&Feel". Our platform uses Google Material Design Standards for Mobile, Web and Desktop applications [1].

Why Material Design? We decided to use Material Design because of it's simplicity and elegance. Also, it enables us to implement easier navigation trough application features and content with no dependency on the platform where it's been run. Navigation Drawer widget can be seen in Figure 1.
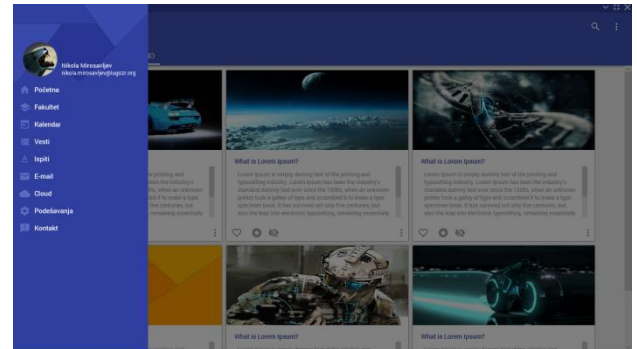

Figure 1. Navigation Drawer

III. TECHNOLOGIES

Combination of multiple technologies is a standard pattern today. Here are the technologies that we are using to deploy this platform:

- **LAMP (Linux/Apache/MySQL/PHP)** - Combination of these four technologies we can achieve great performance on our server side. Apache [2] is a Web Server that runs our website and back-end scripts for authentication, class schedule synchronization, etc. MySQL is the primary database server that will store 90% of the network data. Almost every feature of the platform will communicate with MySQL server using queries. PHP is Server-Side scripting language that will be used to establish basic scripts for protocols and data parsing, verification and validation. Most of the websites back-end is written in PHP. At last, but not least, GNU/Linux Operating System is the most stable operating system these days, and it's widely used for servers. In fact, 95% of the world is using GNU/Linux as their main server operating system. The reason behind this is that once you run Linux, you can keep the server up for long period of time. Another reason for that is FOSS (Free Open-Source Software) that allows developers to write custom system modules and implement them without any difficulties.

- **Cloud Server** – We are using "ownCloud" [3] platform as our Cloud server. This is a free open-source platform that is based on famous giant "Dropbox". ownCloud is a self-hosted file sync and share server. It provides access to your data through a web interface, sync clients or

WebDAV while providing a platform to view, sync and share across devices easily.

- **Node.js** – Node.js is an open-source, cross-platform runtime environment for developing server-side web applications. Node.js applications are written in JavaScript and can be run within Node.js runtime on any platform. Node.js provides an event-driven architecture and a non-blocking I/O API designed to optimize an application's throughput and scalability for real-time web applications. It uses Google V8 JavaScript engine to execute code, and a large percentage of the basic modules are written in JavaScript. Node.js contains a built-in library to allow applications to act as a web server without software such as Apache HTTP Server, Nginx or IIS.

- **Postfix Mail Server** – Postfix is a free and open-source mail transfer agent (MTA) that routes and delivers electronic mail, intended as an alternative to widely used Sendmail MTA. As an SMTP server, Postfix implements a first layer of defense against spambots and malware. Administrators can combine Postfix with other software that provides spam/virus filtering, message-store access or complex SMTP-level access-policies.

- **Java Programming Language** – Desktop application is developed using Java. Java is a cross-platform programming language that runs on top of the JVM (Java Virtual Machine) which makes it possible to implement "Write once, run everywhere" strategy. Java provides some of the most advanced Frameworks and APIs for business logic, front-end development and security. Front-end of the desktop application is developed using JavaFX API. JavaFX API is relatively young API and still lacks a lot of built in functionality so we developed multiple libraries for this project and implemented them. Libraries will be available on GitHub soon. Oracle Java Mail API presents the engine behind our email interface. It allows us to implement support for all email protocols and all email providers.

- **Maven Build Tool** – Maven is a build tool that has a goal to simplify the build process of Java Application. Maven's primary goal is to allow a developer to comprehend the complete state of a development effort in the shortest period of time. Maven is Apache Software foundation and references and documents about it can be found on the Apache website [2].

- **Android Application** – Android application is still in planning phase and none of the work has been started. For now, we have only concept for the application. It will be developed by using standard Google libraries and Spring Framework integration for Android.

- **Web Site** – Website front-end will be developed using Polymer library. Polymer source code example can be seen in Figure 2. Polymer isn't

web component or element. It's built on top of the web component standards and it helps build your own custom elements. Web components standards provide primitives, but it can be a lot of work. Not all browsers support these standards yet, so the web components polyfill library fills the gaps, implementing the APIs in JavaScript.

Figure 2.   Polymer source code example

The Polymer Library provides a declarative syntax that makes it simpler to define custom elements. It adds features like templating, two-way data binding and property observation to help you build powerful, reusable elements with less code. If you don't want to write your own elements, there are a number of elements built with Polymer that you can drop straight into your existing pages. These elements built with Polymer that you can drop straight into your existing pages. They depend on the Polymer library, but you can use the elements without using Polymer directly. Polymer custom element stucture can be seen in Figure 3. Website will provide some public features visible for people that are not part of the university but restrict them only to the public content (they will not be able to use chat, exams activity…) [4].
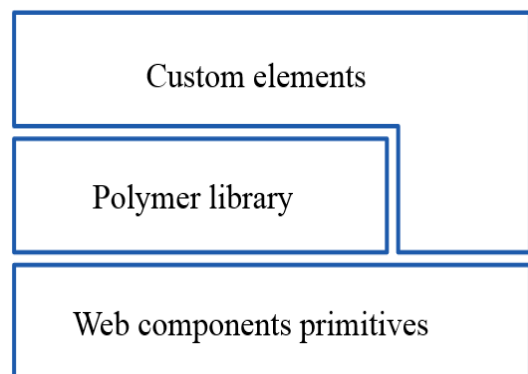

Figure 3.   Polymer custom element structure

IV.   FEATURES

Platform will contain many features. They will all be synchronized and work dependently on each other. Navigation Drawer will enable user to choose which Activity the application will display. Here are the features provided by this platform:

- **News –** News feed that will provide latest happenings on the university. Students will be able to filter and search for specific news, rate them depending on how important the news are and share them to a specific circle of students. Feature News can be seen in Figure 4.
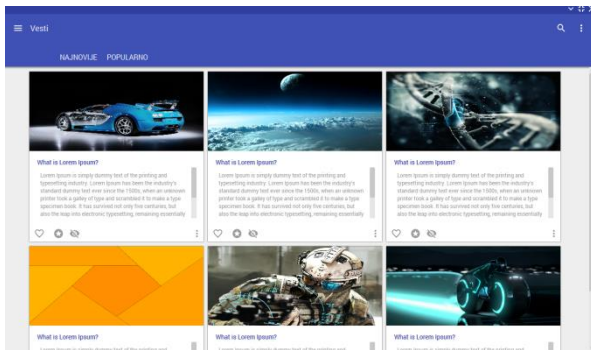

Figure 4.   Feature *News*

- **Exams –** Feature that will enable students to check their results for each exam, detailed preview of their tests and statistic charts that will provide the basic look on how are they progressing through the year. It will also enable students to apply for exams and pay for them. Back-end of the exams will be developed using Java Spring framework, Hibernate framework and Spring Transaction framework.

- **Cloud Storage –** Online storage that is accessible from anywhere and synchronized with all devices. Students can use cloud storage to keep study material and share them with others or keep project data and files. Powered by ownCloud, it provides a default user interface that we are currently using. Feature Cloud Storage can be seen in Figure 5.
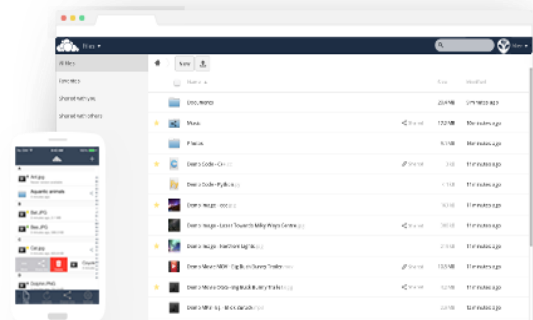

Figure 5.   Feature *Cloud Storage*

- **Email –** Emails are one of the oldest methods of communication using internet, but they are still widely used today. Each student will have his own email. Emails Interface and back-end are powered by Oracle Java Mail API. This email provides support for all protocols, implements security and provides great performance. Feature Email can be seen in Figure 6.
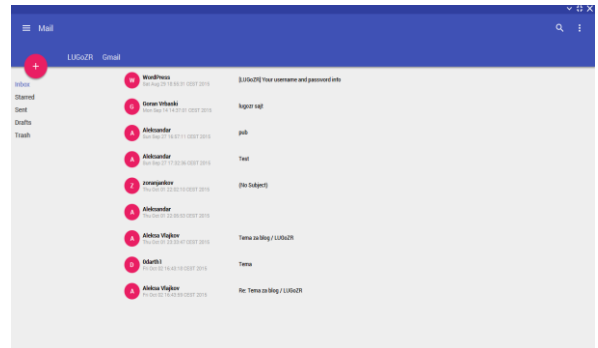

Figure 6.   Feature *Email*

- **Chat –** Powerful and swift integrated chat client powered by Node.js server. Real-time messaging is a standard today. It enables users to communicate with no difficulties. Using chat system can bring students close together and they can provide a support to each other.

- **Workbench –** Due to distance between towns, some students may not be able to attend project meetings or group work. Workbench feature will enable the group of students to work from their homes by Video/Voice communication and screen-sharing. It will contain many useful tools that will be used for simulation and development.

- **Users –** Interesting part of this system is user profile. They will be consisted of various information fields which can be confirmed by other students (i.e. LinkedIn profiles). Student profile will serve as a portfolio for their work on university, their skills and their hobbies. Feature Users can be seen in Figure 7.
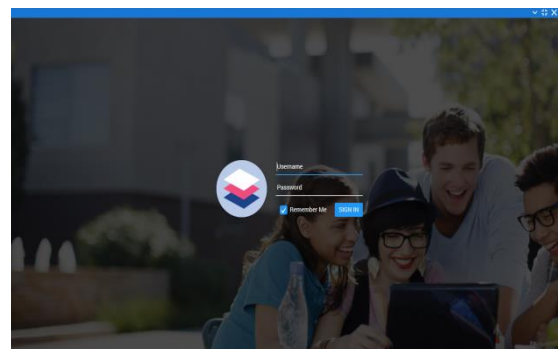

Figure 7.   Feature *Users*

- **Test and Crash Courses** – Feature that promotes and enables e-learning. Addition information will be posted that will link to the classes from university. Also, professors can enable and build small tests and exams for students to compete, check their knowledge and improve. This activity will be powered by Java Spring and Hibernate framework.

- **About University** – Section with multiple tabs containing information about university, its staff, classes, courses, conferences, etc. Content of this section will be managed by professors and university staff only.

- **Students Parlament** – Section for student parlament actions and events. Access to this section will be allowed only to students that are in the parlament.

V. CONCLUSION

Most of the young people use modern technologies every day in almost everything they do. Most of the time they spend on the social networks and their mobiles. If students spend some of that time on their University application or website, no matter if it is for study purposes or just fun and chat, that will make them more and more familiar with the whole system and keep them up to date with everything going on. Easily available data about classes and interesting way to make students research specific topics, professors guiding them through online tutorials and making workshops in the university can also help students be more active and significialy increase the quality of education. By using the tools provided with this platform, all of the above listed will become available and hopefully it will be properly used and applied. Aim is to point students attention toward university and projects, teamwork and interest in their field of study.

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Software tools for the reconstruction of traffic accidents: A preliminary review

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Abstract - Traffic accidents are one of the most serious problems in society, causing serious injuries to humans and damages to property. Therefore, appropriate and timely investigations of traffic accidents deserves attention of services and experts from various fields, such as traffic engineers and experts, judicial authorities, insurance experts, and health services experts. Software tools provide valuable assistance to experts in reconstructing and analyzing traffic accidents. This paper presents a preliminary review of the most commonly used software tools for the reconstruction of the traffic accidents, and outlines some benefits of using these software tools.

I. INTRODUCTION

The first traffic accidents were recorded over 100 years ago, and since then the number of accidents has been continually growing. Prentkovskis et al. [1] reported that the increased number of traffic accidents has become the object of attention and research around the world. Yang et al. [2] stated that road traffic accidents are one of the major social problems worldwide, causing serious disaster to humans and property. According to the most recent estimates, road traffic accidents kill 1.24 million victims worldwide and injure 20-50 million each year. Ninety percent of them occur in developing countries, and more than half of all victims globally are between the ages of 15 and 44 (see Fig. 1) [3] [4]. The main causes of traffic accidents are human factors, vehicle factors and environment factors. In addition, traffic accidents causes serious financial burden on society [5].
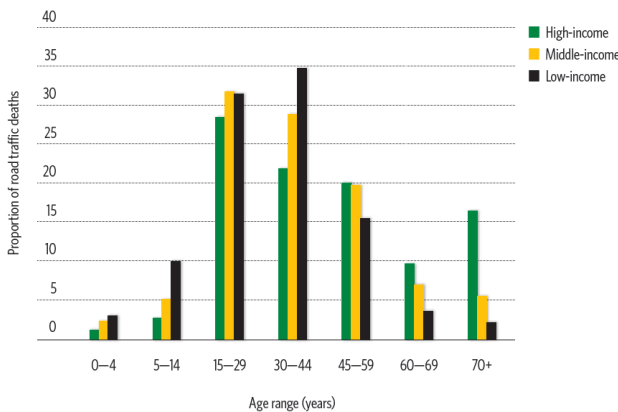

Figure 1. Proportion of road traffic deaths by the age range and country income status [4]

For many years in the past, the reconstruction of the traffic accidents were the subject for research by the various agencies. Different agencies have reconstructed crashes for different reasons [6]. The federal government reconstructs crashes in order to obtain statistical data, to develop safety standards and laws, or to perform or fund appropriate researches. Vehicle manufacturers analyze crashes in order to improve design and to produce safer vehicles and restraint systems. Insurance companies use experts for reconstructing crashes in order to determine liability. Law enforcement personnel investigate violation of laws through analysis of crashes. Due to the variety and complexity of the traffic accidents, manual analyses of accidents are practically impossible or with the fairly low precision [7], which emphasizes the use of computer programs for this purpose.

Computer programs have been used to analyze traffic accidents since the early seventies [8]. Large research institutes developed these programs, and the first users were the engineers and scientists engaged in the development. With the worldwide use of personal computers in the eighties, these programs have become available to large community interested in investigating traffic accidents. In that context, the accident investigators become the major expert users with the working knowledge related to the accident investigation and reconstruction. It is important to note here, that computers and software tools do not replace the expert knowledge, but they allow experts to analyze traffic accidents more quickly and more thoroughly and, therefore, more accurately. For proper functioning of these software tools, reliable input data is necessary.

Tomasch [9] presented *Accident Reconstruction Guidelines*, as a deliverable of the project *Pan-European Co-ordinated Accident and Injury Databases*, funded by European Community under the 'Competitive and Sustainable Growth' Programme (1998-2002). The following approaches to the reconstruction of the traffic accidents exist:

- **Impact Theories**. They are based on the theory of elastic bodies and Hook's laws of deformation, which are suitable for calculating the maximum forces of the impact and the impact duration. The Newton's theory of impact (the Newton's classical laws) provides the basis for accident reconstruction.

- **Backward Simulation**. The initial points for the calculation are the final positions of the involved vehicles. This positions serve as the basis for

calculating the point of collision, based on the available and measurable traces of the accidents.

- **Forward simulation**. This method starts from the running-in of the vehicles into the first collision, and from this, it calculates the run-out to the final position as well as the impact process.

Brian G. McHenry [10] argued that collecting reliable data about a traffic accidents, followed with the use of computer programs for reconstructing the accident, will produce the most reliable reconstruction of the accident. This is illustrated with the following quotation:

"As scientists, engineers and accident reconstructionists, we should not let the unlimited possibilities of making anything look real (with animation) obscure our duty to perform a careful and detailed engineering analysis while also continually testing and evaluating the applied techniques, including computer programs, to achieve the most accurate reconstruction possible."

II. BENEFITS OF USING SOFTWARE TOOLS

In order to accelerate and standardize the process of investigation of the traffic accidents computers, digital devices and a wide range of software tools are used. As a result of the standardization and the introduction of software in the process of conducting the investigation of a traffic accident, an experts task in the reconstruction and simulation of a crash is greatly facilitated, and the possibility of creating errors is minimized.

At present, the road accident reconstructions are increasingly based on specific computer software for simulating driving and collision dynamics, and for simulating a set of trial runs, from which a model that best describes a real event can be selected. Besides being time-saving, when properly used, such computer software can provide more authentic and more trustworthy accident reconstruction [11].

A detailed analysis of traffic accidents require determining all causes and the related factors, where software tools can provide assistance for humans investigating these accidents. However, the most popular software systems, such as Msmac3D [12] or PC-CRASH [13] have a lot of parameters which make them difficult to use, as well as too high prices especially for the experts from developing countries. In addition, each country have different circumstances, which requires considering specific parameters. Therefore development of specific software tools for reconstructing and analyzing traffic accidents is challenging, but demanding endeavor.

III. REVIEW OF SOFTWARE TOOLS USE

The first software for accident reconstruction were in 1974 [14]. According to Yang [2], many countries have more developed and theories on the road traffic simulation and accident reconstruction, and successively have developed some application systems for accident reconstruction and analysis. Typical large accident reconstruction software systems are SMAC, CRASH and IMPACT, which are developed with the financial help of National Highway Traffic Safety Administration (NHTSA). The three directions in software development, as well as in their historical evolution, have been implemented in different forms and by different software companies. Therefore, today we have variety of software in use, such as: EDCRASH, EDSMAC, EDVDB, EDVTS, EDSVS, HVE-3D, HVOSM, PC-Crash (2D Version and 3D Version), PC-Rect, WinCRASH, WinSMAC, AITools-Equations, AITools-Linear Momentum, AITrucks-Brake Efficiency, Crashex, Virtual CRASH, MADYMO, LS-DYNA, CARAT, PAM-CRASH, MSMAC3D, and RADIOSS. [15]

Software tools for reconstructing the traffic accidents are usually based on models for variety of traffic accident situations, which include several different parameters in the analysis [16]. These parameters are heterogeneous, and the models try to reduce this heterogeneity. Building different models, by including different parameters for the same traffic accident, will enable investigating different aspects of the accident.

In addition, several models have been proposed for the road safety. These models differentiate by targeting different aspects of safety, and by using different background models such as components models, sequence models, mathematical models, intervention models, process models, safety management models and system models [17]. These safety models should be considered in models used in the reconstruction of traffic accidents. Zhang et al. [7] proposed a technique for reconstructing crash accidents based on the combination of the finite element method and neural networks, suitable for handling accidents without tire marks. The authors compared the results of their simulation with the results obtained by using PC-Crash, and concluded that their model is more suitable for accidents without tire marks.

Software tools based on the impulse method are mostly used in Europe [18]. In the mid-nineties the software tools such as CARAT - Computer Aided Reconstruction of Accidents in Traffic, Virtual CRASH and PC-Crash [13] were developed. Unlike SMAC and CRASH, these software tools are based on the model of impulsive collision [14].

A. PC-CRASH

PC-Crash is a powerful software tool that allows 2D and 3D simulations of motor vehicle accidents [13]. The simulation can relate to different situations such as car to car accidents, car to motorcycle accidents, car to pedestrian accidents, occupant movements, roll over etc. In addition, an online database with the scale images of cars is available. The results of a simulation can be represented as 2D and 3D animations, variety of diagrams and text outputs. An example simulation is presented in fig. 2.

In PC Crash it is possible to carry out detailed simulations of restrained or unrestrained occupant motion and loading, with the optional interface to MADYMO (MAthematical DYnamic MOdel). MADYMO is an occupant modeler program developed by TNO Road Vehicles Research Institute for use by vehicle manufacturers and developers. MADYMO uses a

multibody occupant model with a finite elements for seat belt and airbag. In addition, a seat belt pretensioner can be denied [13].
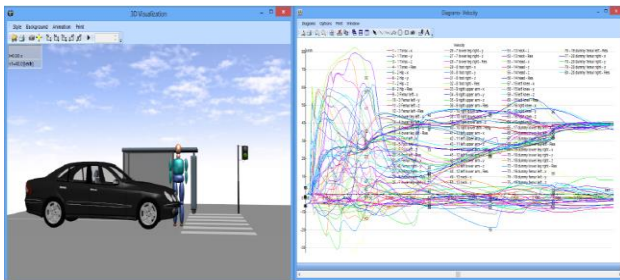

Figure 2.   An example simulation of a traffic accident in PC Crash [13]

Prentkovskis et al. [1] conducted a computer-aided experiment, the simulation of interactions between motor vehicles by using the software package PC-CRASH 8.1. By using speed-distance diagrams, the authors investigated variety of traffic situations, such as head-on collisions, the collisions of motor vehicles running in the same direction, and running perpendicular to each other. The authors stressed the importance of simulations that enable studying the circumstances of a collision, reconstructing the process, and determining various parameters of vehicles' movements during all stages of a traffic accident.

B. CARAT - Computer Aided Reconstruction of Accidents in Traffic

Geometric modeling of traffic accidents is possible with the help of a computer program CARAT. There are multiple versions of the CARAT program with different elements depending on the size and the type of the vehicles: the trucks and special vehicles with different types of trailers, tractor unit with or without trailers, cars, buses, working machinery. The software also allows reconstruction of collisions and hitting the pedestrians or vehicles with one trail. It allows geometric modeling of a movement of a vehicle participating in the crash. Fig. 3 presents the working environment of the program CARAT, with entered parameters required for geometric modeling of a traffic accident [19].

C. Virtual CRASH

Virtual Crash is a new generation program for the simulation of the vehicle accidents. It takes the advantage of the latest hardware and software developments, which allows increasingly complex real-time calculations on a personal computer. For the maximum versatility, Virtual Crash simulation results can be viewed in scale plan, 3D perspective view and in numerous diagrams and tables. Virtual Crash includes built vehicles, trailers, multi-body models and immovable objects from CAD blocks. Difficult 3D shapes can be created and applied in the program, as it is presented in Fig. 4. The Program models and shapes are stored in a databases and can be created and edited by users [20].
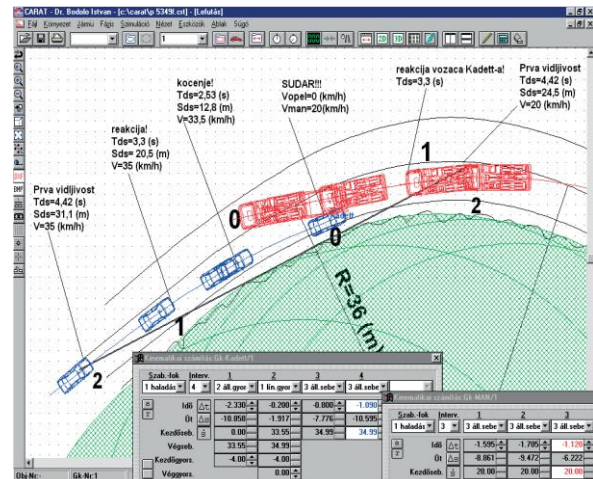

Figure 3.   An example of working environment in CARAT [19]
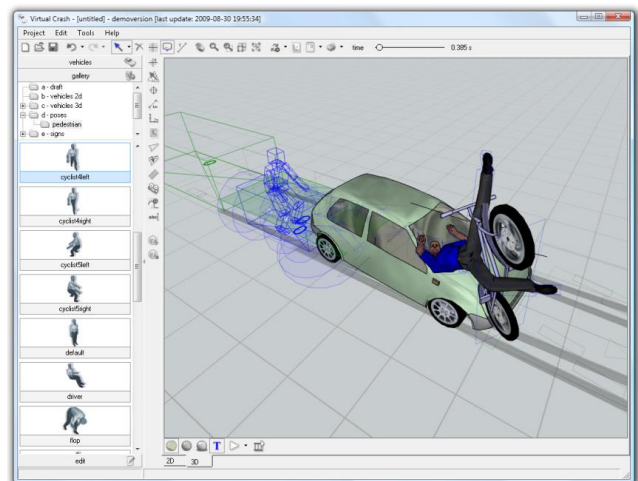
Figure 4.   An example simulation of a bicycle is hit by a car in Vitual Crash [20]

D. MADYMO (MAthemtical DYnamic MOdelling)

MADYMO can simulate the dynamic behavior of physical systems, with the focus on the analysis of 4-wheeled vehicle collisions and the sustained occupants' injuries. MADYMO is also very flexible to reconstruct motorcycle and bicycle accidents and to study the performance of the restraint systems such as seat belts and airbags. It has been developed by TNO Automotive in The Netherlands in the early 80's and has been continuously up-dated since then [9].

MADYMO combines in one program the multi-body techniques (for the simulation of the gross motion of systems or bodies connected by joints) and the finite elements techniques (for the simulation of structural behavior). A model can be made with only finite elements models or only multi-bodies or combination of both. The program allows 2D and 3D modeling. Fig. 5 presents the MADYMO simulation and test results.

In his PhD dissertation [21], Stevenson presented simulation based approach for analyzing vehicle-pedestrian interaction. Stevenson conducted the research aimed at discovering how accurately MADYMO can predict: (1) the influence of a vehicle speed on a pedestrian throw distance, and (2) the resulting pedestrian injury pattern based on a simulation of vehicle-pedestrian collision.
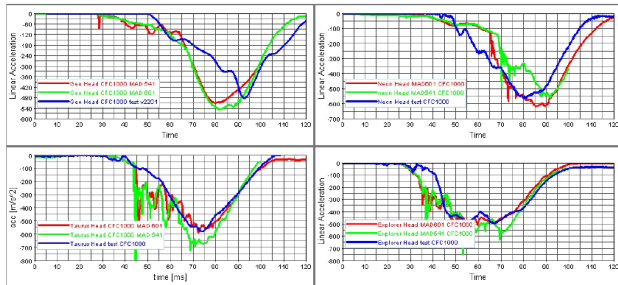

Figure 5. An example of the results for simulation and test in MADYMO [9]

IV. SPECIFIC SOFTWARE TOOLS

Several researchers worldwide developed specific software tools that provide some functionality that cannot be found in the commercial ones. For example, Yang et al. [2] constructed a flexible platform for simulating and analyzing traffic accidents. The platform enables dynamic adding and updating of traffic infrastructure including road, trees, street lights and buildings. The system is based on OpenGL technique for achieving displaying, and controlling the three-dimensional model.

V. CONCLUSION

As we have presented in our work, the traffic accidents are a serious problem in today's society. According to World Health Organization (WHO) [22], road injury are currently the 9th cause of death, and according to their forecasts for 2030, the road injury could reach the 7th place as a cause of death in the world. If we add millions of injuries and damage on the property, we can realize the magnitude of the problem. Software for simulation and reconstruction of the traffic accidents allow us to more easily and accurately deal with this problem. Software tools that are currently used, such as PC Crash, Virtual Crash, Crash, SMAC etc., give us the opportunity to better understand related parameters that occur before, during and after a traffic accident. Higher quality and more realistic simulations and reconstructions enable different agencies and experts to perform better and more reliable investigations in their work, aimed at making safer environment. Continuous development of existing, and creating new software tools and mathematical models significantly contribute to creating safer and more reliable vehicles, designing higher quality roads, and introducing stricter laws on traffic safety. The right questions are: Could new improved software tools can make predictions of the World Health Organization will not come true? Could new improved software tools help in designing safer cars and roads?

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Web Application for the Organization of Scientific Journal

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Abstract: This paper presents the application for the organization of scientific journal. This application consists of three user modules: administrator, reviewer and author. The goal of this application is to make organization of the scientific journal easier. Finished part of application will be presented in this paper. Application was based on the model of ″Easy Chair″ and other similar web application.

I. INTRODUCTION

This paper presents web application for the organization of scientific journal, which is created on the model of ″Easy Chair ″ and other similar application. The goal of this application is to make the organization of the scientific journal easier. Finished part of application will be exhibited later in the text.

Application was created using the following technologies: Microsoft ASP.Net and SQL Server for organization of data base in the application. The application is combination of information systems and document management system, because we have to have the flow of documents between users is necessary, In addition, it is important to stock our documents and data.

Application for the organization of scientific journal have three modules and every of its modules have specific functionality in the application.

Processes of the application are as follows: Firstly: Authors send papers to the journal. Administrator should decide whether paper fits to journal's themes or not. After that administrator should send paper to the reviewer. Functions required in this application are following:

- Edit data about author
- Registrations of authors and reviewers
- Data about new paper submit
- Upload of paper and version of paper
- Edit paper status
- Notification via e-mail
- Assigning work to reviewer
- Review of paper status to author

II. RESEARCH

Research which was helpful for creating of the application is presented in this chapter Application for the organization of scientific journal was based on the model of ″Easy Chair ″ and ″Academic Journals″. The aforementioned applications will be presented bellow.

Easy Chair is web based conference management system. This web application was created 2002.

″EasyChair″ has several modules: Author, Reviewer, and Chairman. Author module of ″EasyChair″ system is explained in this chapter. Although, this system serves for the conference management, ″EasyChair″ can be used as model for creating system for organization of scientific journal. Author module has several possibilities. Firstly, a user has to be registered. That leads to having options for registrations as well as log-in options. Then, a user can upload a paper with added list of authors as part of the application's functionality. After registration or paper submission, the ″EasyChair″ sends notification via email about the activities. User also has an option to review uploaded papers and their status. That can be called the author's profile. When user wants to upload a paper, user first must enter author list and then enter data about paper and upload the paper. Data needed for upload are: Title, Abstract, Key Words, Paper and Author List. These presented functionalities are used as model for creation of application for the organization of scientific journal [1].

The second inspiration for the creation of our application is web site of ″Tubitak Academic Journals″ which does not have many differences in comparasion to ″EasyChair″. Author has similar options like in ″EasyChair″. This web application of ″Tubitak Academic Journals″ has fine manuscript and review of papers. This idea of review and manuscript help us create our application.

The web application for the organization of scientific journal is presented in the following chapter. This application represents combination of the user-friendly ″EasyChar″ and ″Tubitak Academic Journals″ visibility of data. Functionalities of similar application and web sites could not be much different [2].

III. APPLICATION

The finished part of the application is presented in this chapter. Finished parts of application are:

- Registration of authors
- Paper upload
- Author profile
- E-mail notification for registration and paper upload.

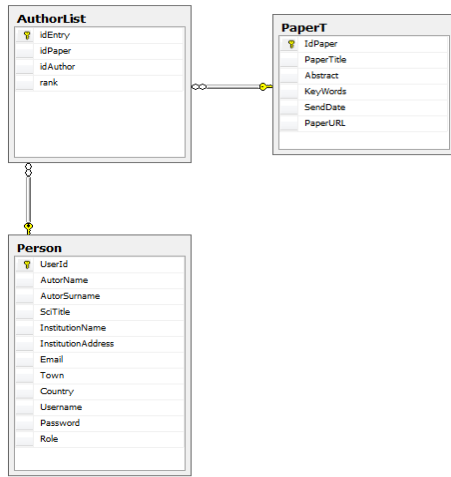Picture below shows database for part about author in application.

Figure 1. Display of database tables

Database for author has three tables:

- Person- contents data about person (author)
- Paper- contents data about upload paper
- Author List- contents list of the authors for one paper.

The following chapter explains screens of the author module in the application. The figures bellow shows web application functionality displays.

Figure 2 shows registration of user. For registration user has to enter: first name, last name, scientific title, institution name, institution address, email, town, country, username and password. After clicking on ″Finish″ button, user can use other functionalities and application sends email notification about author's registration.

Figure 2. Display of author registration

Figure 3 shows display of user profile, where user can see personal information and option that may be added is editing personal information.

Figure 3. Display of Author profile

On Figure 4 shows the first step of paper submission. In this step user has to enter: Title, Abstract, Key Words and Upload paper. After clicking ″Next″ button user has to enter author list. If author is not registered the user can register colleague in the second step of paper upload.

Figure 5 shows display of the second step of the paper upload.

Figure 4. Display of the first step of paper upload

Figure 5. Display of the second step of paper upload

When user adds first author, list of added authors appears on the page. ″Finish″ button means the end of paper uploading and application sends email notification about successful paper submission.

IV.   CONCLUSION

Only one part of the application for the organization of scientific journal is presented in the paper. Modules for the administrators and reviewer as well as work on the documents organizations in this journal system are to be finished. We will have to pay special attention to the security of the scientific journal system.

Application for the organization of scientific journal has to make easier organization of journal and has to be user-friendly. In the authors of application opinion, this application can be user-friendly and once finished it will contain many useful options and functionalities.

V.   ACKNOWLEDGMENT

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Model of a Hospital Information System

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Abstract – This paper aim is to present internationally defined and applied models of hospital information system and to propose general model of hospital information system. Empirical verification of the proposed model is given by comparison of the proposed model with the implemented models from various case studies.

I. INTRODUCTION

In aim to increase quality and financial aspect of medical care, most countries engage important efforts in quality assurance in health care. According to report on quality of Health Care in United States of America in 2000 [1], U.S. medical care system is in danger to produce significant errors that could cause dramatic loss of human lives (98,000 deaths per year) and increase unnecessary financial loss (approximately $38 billion per year). Application of information and communication technologies (ICT) improve quality of health care and influence economic benefits, as well.

"Patient care information systems (PCISs) are lauded as one of the core building blocks for a safer health care system. PCISs are broadly defined as applications that support the health care process by allowing health care professionals or patients direct access to order entry systems, medical record systems, radiology information systems, patient information systems, and so on. With fully accessible and integrated electronic patient records, and with instant access to up-to-date medical knowledge, faulty decision making resulting from a lack of information can be significantly reduced." [2]

Implementation of ICT in health care bring many benefits. In [3], particular aspect of information exchange and interoperability between health care institutions is evaluated, i.e. electronic health care information exchange and interoperability (HIEI) between providers (hospitals and medical group practices) and independent laboratories, radiology centers, pharmacies, payers, public health departments, and other providers. Eestablishing „interoperability between these organizations would enable computer-assisted reduction of redundant tests, and it would reduce delays and costs associated with paper-based ordering and reporting of results." [3].

ICT inappropriate development and use could produce more healthcare services issues and increase problems. In [2] some unintended consequences of information technology application in health care are examined. Results from research in [2] emphasize "silent" errors in

two basic areas: 1- entering and retrieving information, 2 – communication and collaboration support.

Aim of this paper is to examine current state in research and practice of creating a model of a hospital information system (HIS), as well to propose a general model of hospital information system.

II. RELATED WORK

Creating a general model of a hospital information system is faced with challenges related to distinction of business process-oriented approach and technology-based approach.

In aim to create a general model of e-Hospital Management System and determine key performance indicators of such system, researh [7] is conducted. Results of researh [7] are represented as mandatory and optional modules of e-Hospital system, and key performance indicators for such system are based on World Health Organization measurement framework for hospital performance.

Efforts in creating a general hospital information system model resulted in meta-models and ontologies that are represented by using specially designed tool $3LGM^2$ (Figure 1), described in [8]. "$3LGM^2$ combines functional meta-model with technical meta-model, it is represented by using Unified Modeling Language and distinguishes between three layers within an information system:" [8]. i.e domain layer, logical tool layer, physical tool layer and also includes inter-layer relationships.
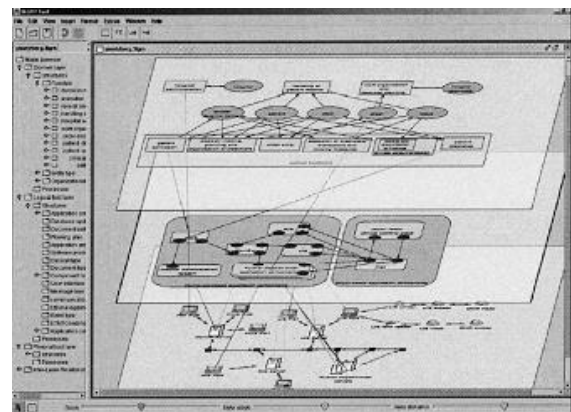

Figure 1. $3LGM^2$ tool for modeling hospital information system [8]

A case study of using the developed model particularly for modeling patient record management at the Leipzig University Hospital is presented in [9].

III. PROFESSIONAL SOLUTIONS

Certain ICT companies, such as Ericsson [4], Orion Health [5] and Quintegra [6] have developed and proposed solutions that could be easily deployed at particular hospital. Table I presents challenges that health care providers (organizations) are faced with.

TABLE I. HEALTH CARE PROVIDER CHALLENGES [4]

Aspect	Cost must decrease	Quality must increase
Focus	On the process and provider	Patient centric
Cost	Fragmented, isolated, non manageable	Centralized cost management
Processes	Fragmented and isolated	Managed, clinical pathways and guidelines
Clinical decisions	HC professional preferences	Guidelines, evidence based and personalized care
Order process	Manual, paper based	Automated
Experience	individual	Best practice
Information	Fragmented and isolated	Consolidated and centralized

Figure 3 presents the role of hospital information system within information systems of healthcare providers information systems environment, according to Ericsson [4].
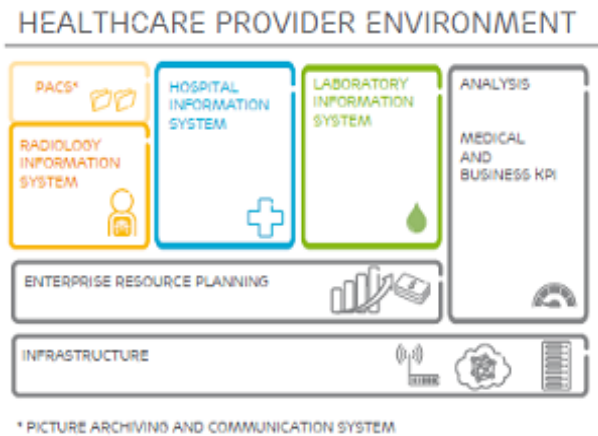

Figure 3. The role of hospital information within healthcare providers information systems environment

Figure 2 presents the functional modules of hospital information system, as proposed within Ericsson's Care4U system.

Figure 4 presents main functional modules of Quintegra's solution to hospital management and information system.

Appropriateness of professional solutions should be examined related to certain generally-accepted approach and model. Therefore it is necessary to have standard

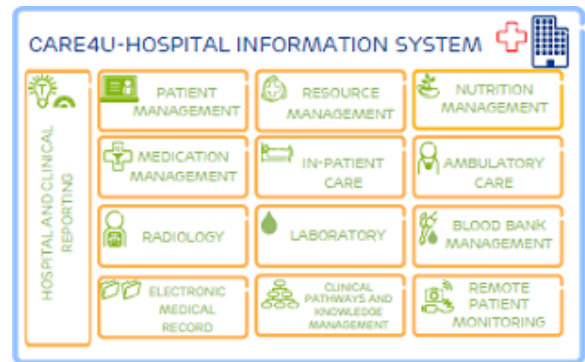model of a hospital information system defined at international or national level.

Figure 2. Functional modules of Ericsson's Care4U hospital information system [4]
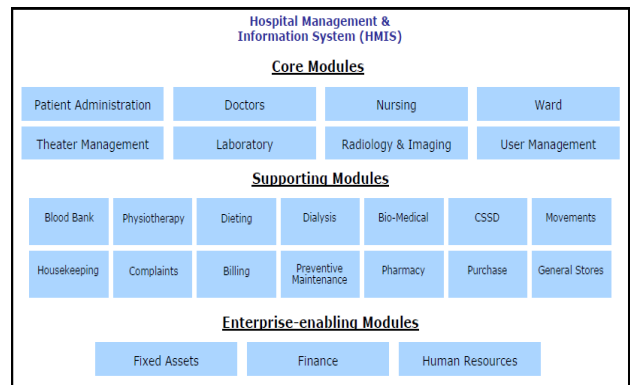
Figure 4. Quintegra's hospital management and information system

IV. NATIONAL EFFORTS IN HEALTHCARE INFORMATION SYSTEM IMPROVEMENTS – SERBIA AND EGYPT CASE

Different countries implement national projects supported by international institutions, within health care and health care information systems improvement efforts.

In Serbia, within IPA projects initiative with support of European Union, one of such IPA projects was successfully implemented in 2008, with title: "Implementation of hospital information system" [10]. Basic aim of this project is deployment of electronic health record in 10 target hospitals in Serbia, as continuation to previous CARDS 2004 project of electronic health record development.

In Egypt, country cooperation strategy between the World Health Organization (WHO) and Egypt has been established for the period 2010-2014 [11]. Within the cooperation strategy, development of integrated health information system that cover all areas and levels with a capacity for informatics support at all levels is planned to be implemented. Within national Egyptian HealthCare accreditation program, issued by the Egypt Ministry of Health and Population in december 2014 [12], special segment of the document is related to Information Management, with special concerns related to patient records management, security and confidentiality of

patients' data. Efforts in creating healthcare information systems in Egypt were supported by USAID [13]. Within [13], existing projects of information system development efforts were listed and described. Existing projects treated separate concerns and sometimes overlapped with their target data and functions. These projects were implemented in particular healthcare institutions mostly in Cairo and Alexandria, that were engaged in projects implementation. These projects were: Curative Care organization Project, Chuld Survival Project, Data for Decision Making Project, Health Insurance Organization, CRHP Component 1 Cost Recovery Hospitals, Family Planning Project, Tuberculosis control Project, Cabinet Information and Decision Support.

V. MODEL OF HOSPITAL INFORMATION SYSTEM

General model of an information system is described with basic functions of information system and essential components of IS architecture (proposed within [14]).

TABLE I.   BASIC FUNCTIONS OF INFORMATION SYSTEM

INFORMATION SYSTEM FUNCTIONS	REFERENCE
DOCUMENTING BUSINESS PROCESSES	[14]
Collecting/acquisition of data	[15] [16] [17]
Verification of data	[15]
Data registration	[15]
Recording/Memorizing data	[15] [17]
DATA EXCHANGE	
Transport from the place of production to the place of using	[15]
Distribution	[16]
Dissemination of data to users	[17]
DECISION SUPPORT	[14]
Data transformation and arranging	[15]
Data processing	[16] [17]
Information production	[15]
Data presentation	[17]

TABLE II.   ESSENTIAL COMPONENTS OF IS ARCHITECTURE

COMPONENT OF IS ARCHITECTURE	REFERENCE
INFORMATION ARCHITECTURE	[18]
Data	[19][20]
Data models	[21]
Data structures Database management systems	[18][19]
APPLICATION ARCHITECTURE	[18]
Function models	[22]
Software architecture, software, applicative software	[17][14][18][23] [19][20]
RESOURCE ARCHITECTURE	[22]
* *TECHNOLOGY ARCHITECTURE*	[18][17]
Data recording media	[19]
Hardware	[14[19][21]
Netware	[14][21]
* *LIFEWARE*	[22][19[21]
Personnel that uses and manages data	[19]
Programmers of application	[19]
ORGANIZATION ARCHITECTURE ("Orgware")	[22] [17][14][[21]
Principles and concepts	[17]
Organizational rules of using system	[17]
Information/Data flow	[17]
Methods and procedures of using system	[17]

Hospital information system model should be extension of a general model of any information system, supporting all basic functions (Table I) and having elements in all segments of information architecture (Table II).

Basic distinction of hospital information system between general model of information system and particular hospital support is in specific support to:

I)   Particular health care semantics
   - Business processes related to hospital workflow,
   - Data exchange to specific institutions such as laboratories and other medical diagnostic providers
   - Decision support related to medical conditions prognosis and hrealthcare treatment improvements and results.

II)   General organizational system semantics:
   - Business processes related to resources (human resources, materials, funding, equipment) providing and maintainance
   - Data exchange related to resources
   - Decision support related to resources.

VI. CONCLUSION

This paper's aim was to examine existing models of hospital information systems within practical efforts and research and to propose a general model of an information system that could be applied as referential in evaluation of any hospital information system.

Within introduction the value and significance of ICT application within healthcare institutions is presented. In this section definition of patient care information systems, is given. Benefits of ICT application is expressed particularly with electronic health care information exchange and interoperability system implementation. Possible unintended consequences of ICT application in healthcare institutions are described.

Second section presents related work in research efforts in creating a general model of hospital information system. Third section described professional solutions in this field. Fourth section describe national efforts in healthcare information system improvements with Serbia and Egypt case description. Finally, general model of any information system is described with functional and architectural aspect, together with additional functional features required for any organizational information system (supporting resources planning) and particular healthcare related functionalities in business process support segment, data exchange segment and decision support segment. This way, a general model of hospital information system is proposed.

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PHP application for publishing process support at Technical faculty "Mihajlo Pupin" Zrenjanin

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Abstract: Aim of this paper is to present a PHP application that is developed to support publishing process at Technical faculty "Mihajlo Pupin" Zrenjanin, University of Novi Sad. The application supports manuscript review process and catalogization.

I INTRODUCTION

The biggest problems facing book publishers today are disappearing bookshelf space at bookstores, the growing problem of how readers will discover new authors and books, and the fast pace of change across the industry. [1]

The future of publishing is also hotly debated. The advent of the Internet and mobile technology has greatly revolutionized a formerly traditional industry, giving it new form and new life. Ten years ago, few experts could have accurately predicted what the digital age would have done to publishing. There are 3 Massive Problems with Digital Publishing Today:

- Ad revenues are plummeting - First, the publishing industry faces a quality and a quantity issue. CTRs for display ads are at an all-time low and more content is created than we actually need.
- Publishing tech is either antiquated or is light-years ahead of its time - In publishing, many companies have been stubborn in their ways, using clunky, limiting legacy technology and practices that allowed the competition to leapfrog ahead. The early innovators have also had their fair share of issues since, historically, select advances in publishing have evolved too fast for their current time and were costly to implement, with those costs unfairly trickling down to audiences.
- Unpredictable traffic sources - Though it has become easier than ever to generate ungodly amounts of visits, without a moment's notice, your main source of traffic may consciously aim to send less and less traffic your way. [2]

II PUBLISHING PROCESS AT TECHNICAL FACULTY "MIHAJLO PUPIN"

Based on 2 signed reviews, authors approach pettition to the Department for approving publication of publications.

After the approving publication on the meeting of the Scientific and Academic Council that publication also needs to get approved. After that the comission of publishing makes the report. When it's everything done, author brings his publication to the library to get ISBN number. After that the publication with its ISBN is sending to the library of Matica Srspka in Novi Sad or to Public library of Serbia in order to get CIP cataloguing. After the publication gets it, they are inserting in it, and the publication is after that moving to the printing press or it gets burn on the CD, how it would be kept in electronical form. If it's in the electronical form, it is delivering to the library of the Faculty, where it's then archived in the inventory, also it will be posted like public on the Faculty official web site. If the publication is in the printing form, after arriving from the printing press, it will be also archived in the library's inventory of the Faculty.
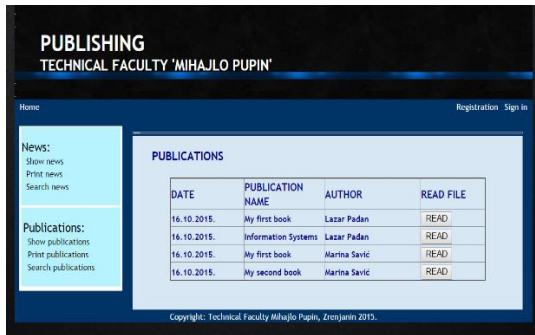
III WEB APPLICATION 'PUBLISHING'

Web application 'Publishing' is meant to several different types of users and it's written in PHP script language. This application is very helpfull in this area. It can be used in many institutions of educational character. Profiles of the users which will use this application are:

- Author – he would have the opportunity, after he registers, to upload all the publications he wrote, and he would be able to see the list of all publications that he has upload. Also, the author would have the opportunity to change or delete some of the publications he has previously uploaded.
- Reviewer – like the autor, he needs firstly to register. This user has the opportunity to add the reviews to the publications, librarian has previously assigned.
- Author and reviewer – There is also the type of the user who can be both, and author and reviewer at the same time. They need firstly to

register their profile as well, and they have the opportunity as author and reviewer together.

- Librarian – this type of user will be inserted directly from the database, that means that he can't register the profile like author or reviewer. He is able to see the list of all publications that have been previosly uploaded by the authors and has to set some information for it such as, cobiss, udk and isbn number. Librarirst has also to assign publication to the reviewer, which has to review it later.
- Admin – like the librarian, this type of the user will be inserted directly from the database. He has the overview of everything.
- Other users – other users are every person visiting this web application and don't have the account. They are only able to see the list of the uploaded publications and news.

Picture 1. Home page

On home page every person is available to see the list of all publications that have been uploaded on the application by all authors. They also can read all of them. On the left menu they are able to read news which are related to the web application's announcements, and to print or search publications. On the registration form users who are authors or reviewers can register their profiles and to log in and use the application later.

Picture 2. Registration form

After completing the form, users can choose whether they will be authors or reviewers or also like author and reviewer at the same time. Author can be for example some of the professors, and they would use this application to upload their publications. After they make a profile, they have the opportunity to see the list of all their uploaded publications, also they are available to edit or delete some of them.

Picture 3. Home page – author

Reviewers on the other side have much different tasks. After they sign up, they can see the list of every publications that librarian has previously assigned to him in order to add the review for that publication. They have the set time until when they need to add that review.

Picture 4. Home page – reviewer

Librarian has the obligation to insert the cataloguing numbers for every publications, also he has to assign the publication to the reviewer who needs to add the review later.

Picture 5. Home page – librarian

IV CONCLUSION

This is just the initial version of this application, and there are many things that can be added in order to improve operation of these applications:

- Automatic saving and status of work change
- E-mail notification where would the users (authors and reviewers) would be informed in what current status is their publication in
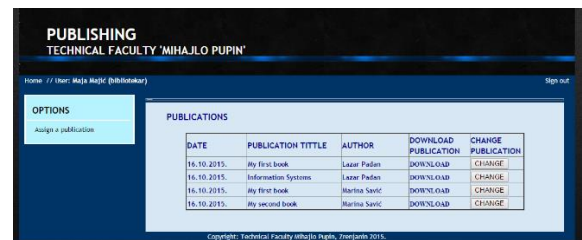- The system of adding more authors for one publication would be improved
- Librarian would be able o see the list of all the publications and the list of every reviewer and the publication he was assigned to add the review.
- Validation of Data Entry
- Working with transactions

V ACKNOWLEDGEMENT

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Software Industry in India: an Overview

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Abstract – Main aim of this paper is to present the current state and trends in software industry in India. This way example of Indian software industry experiences could be basis for improvement of software industry and higher education in software engineering field in other countries.

I.   INTRODUCTION

Indian software industry today is one of the largest and most successful industries in India. Many software companies joined within NASSCOM (the National Association of Software and Service companies), which presents the primary business association for the Software and Services Industry in India and estimates that its members account for about 90% of industry revenues [1]. NASSCOM encouraged many research efforts which ended as valuable results, that could lead industry and higher education in this field toward better solutions.

Aim of this paper is to present systematized results in Indian Software Industry evaluations and explorations. This way current state and future trends could be described, which could be a good basis for improvement in other countries software industry, based on Indian experiences. Other aim is to enable a foundation for software engineering higher education improvement, with examples from well-established Indian software industry practices.

II.   INDIAN SOFTWARE INDUSTRY SUCCESS STATISTICS, STRUCTURE AND EVOLUTION

In study [2], overview of the Indian software industry has been presented. Figure 1 presents comparison of computer software and electronic hardware production and rise in Indian IT industry for the period 2005-2011.
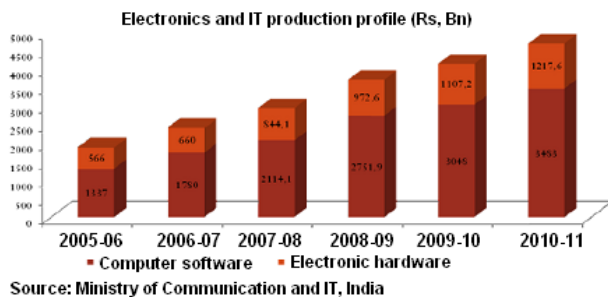

Figure 1.   Rise of Indian IT production financial value (in Rs) and comparison for computer software and electronic hardware, for period 2005-2011.

Indian IT industry consists of four types of companies according to the number of employees (statistics from 2011 [2]):

- Large companies with more than 40.000 employees : 7 firms

- Mid-sized companies with 5000-40.000 employees : 75-80 firms

- Emerging companies with 100-5000 employees: 300-350 firms

- Small firms (startups) with less then 73 employees: more than 3500 firms

„Multinational firms dominate industry revenues with 12 firms listed among the top 20 firms and 67% of top 200 firms. Top 200 firms contribute with 86% of the total revenues of the Indian ICT industry." [2]

History of Indian ICT industry development could be presented with several phases of evolution [2] [5]:

- First period (till 1984) – discouraged enterpreneurship and foreign investments, by state attempt to run the industry

- Second period (1984-1990) – liberalization of Indian economy, potentials of software industry recognized, established computer policy and computer software export policy (1984), formation of NASSCOM (1988)

- Third period (1990-2000) – establishment of software technology parks in 1990, trade liberalization, openness to foreign investment, change from low-end onsite services to high-end offshore services of multinational corporations, Indian firms: product as service and co-development (working on behalf of client)

- Fourth period (2001-present) – intellectual property, export, reverse migration of Indian immigrants, national e-Government plan (2000), government programs promote use of IT, large multinational firms establish research centers in Bangalore. Learning through outsourcing in India, co-creators of products, creating their own product brands.

Current enabling factors that encourage growth of ICT industry in India include [2]:

- Policy environment

- Strategic Government intervention in skill formation: annual output of graduates with Bachelor's degree in engineering from 247 in 1947 to 237.000 in 2006 (comparing to USA in 2006 was 104.200).

- Proactive role of Indian middle class: human capital investment and risk taking enterpreneurs.

- Research and development (R&D) centers from large multinational companies

According to [2], there are still some limitations to enable better development in this field:

- Lack of dynamism in the government R&D system

- Poor research output from the higher education system

- Limited scope and impact of government support programmes for R&D

- Weak University-Industry alliances

- Absence of an institutional environment to facilitate the sharing and circulation of ideas

- Poor knowledge diffusion in the local technology systems

III. COMPARISON OF SOFTWARE INDUSTRY OF INDIA AND OTHER COUNTRIES – THE ROLE OF MULTINATIONAL COMPANIES

Particular research has been conducted in aim to compare software industries from other countries to software industry of India. In study [4] comparison is made between Israel, Ireland and India regarding ICT industry, i.e. particularly the role of multinational companies (MNCs) to the development of local software industry in particular countries.

Results of the study [4] show that activities and the role of MNCs vary considerably across the analyzed three countries. Main differences are in:

- Time of entry of MNCs – in Ireland many MNCs entered the country before the development of local ICT companies; in India and Israel it was a contrary situation – majority of MNCs have entered after domestic industry have emerged.

- Activities of MNCs – in Ireland, MNCs in first period focused on including local human resources in low value added activities, just like in India, while in Israel the majority or MNCs conduct higher value added activities, including R&D. Only recently, MNCs have started to shift to India also R&D operations.

Some benefits of MNCs influence to domestic software firms were:

- People mobility and spin–offs - former employees that were employed in MNCs very often create start-up firms and implement

organizational models and managerial and technical knowledge within new domestic firms,

- Business models and marketing – successful organization of MNCs was a good model to organization of smaller domestic firms,

- Market opportunities – linking domestic companies with foreign clients firstly within sub-contractor alliances and then as co-development.

IV. INDIAN DOMESTIC SOFTWARE INDUSTRY AND THE ROLE OF DIASPORA SOCIAL TIES

NASSCOM supports many research efforts and one of research results is related to relationships and success comparison of domestic (in India) and diaspora (in other countries) software industry[3]. "This study explores the importance of cross-border social networks for enterpreneurship in developing countries by exmining ties between Indian expatriate community and local enterpreneurs in India's software industry "[3].

It has been shown [3] that within India's software industry there are two types of software companies – software hub companies (mostly situated in large cities) and independent software companies (scattered in small and large cities). This study shows that software companies within hubs benefit from greater institutional environment and organizational support and do not necessary depend on help from abroad. Independent scattered smaller software companies express greater need and importance of social ties from diaspora, particularly for the support to international trade.

In 2001, India was, along with Israel, the largest non-OECD exporter of software.[6] Study [6] examines the process and roots of transformation of Indian software industry from low-cost and low-skill services provider to provider of high-skill R&D services. In study [6], particular area of Bangalore in India was presented as one of most successful software development centers ("India's Silicon Valey"). According to [4], Bangalore area was choosen by MNCs as suitable region because of many quality engineering universities, supplying capabilities and appropriate climate conditions for living, which could attract many ICT professionals to live and work there. In first period, Bangalore region was not viewed as innovative region because of the lack of technical expertise, lack of technical community with deep and diverse range of capabilities, minimal interactions among local firms. These three dimensions changed in recent years, which turned local firms to shift to R&D services. Since R&D services become increasingly popular in India, this included the sale and transfer of intellectual property blocks, usually integrating software and hardware such as embedded systems.

V. CONCLUSION

Aim of this paper was to briefly introduce Indian software industry success, history of development and conditions that lead to current state of the Industry.

Obviously, great role in Indian software industry success was in MNCs, but much more important is the role od Indian Government that recognized the value of development of domestic firms, which are based on educated and skilled human resources. The roots are obvious – appropriate quality of higher education in the field and strong commitment to working excellence.

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The Comparison of Classifiers

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Abstract - The paper deals with the comparison of classification power of two rule based classifiers: Rosetta and SSCO. However, these systems differ because Rosetta applies rough sets based algorithm while SSCO applies classification tree algorithm. Besides that, Rosetta uses voting system, while no such system is implemented in SSCO. This means that multi-class multi-label classification is possible with SSCO. Classifiers are compared on three data sets available via UCI machine learning repository.

I. INTRODUCTION

Classification has important role in many information management and retrieval tasks. The classification as a process is conducted as a pre-step in different data analysis problems with substantial impact to the results, so it is very important to have a high-quality classifier. The classification problem typically includes multiple observations, which are used as a training set while building a classifier. After training procedure, classifier is used to classify newly presented objects to the predefined categories. Therefore, classification is the problem of identifying to which category (or more categories) a new observation belongs. There are many different families of classifiers, some of them are:

- Statistical: regression models, linear discriminant analysis, etc.

- Symbolic artificial intelligence: rule based classifiers, decision trees, etc.

- Connectionist approaches: neural nets, etc.

In addition, there are some different settings for classifiers depending on the number of the classes or categories [1]. Based on the number of classes in the problem, classifiers are divided into binary classifiers and multiclass classifiers. Binary classifier categorizes object into exactly one class; there are only two classes (Fig. 1), while multiclass classifier deals with more than two classes. Multi-class classifiers are divided into:

- Single-label classifiers so that each object is assigned with one and only one class label (Fig. 2).

- Multi-label classifiers so that more than one class can be assigned to an object (Fig. 3).
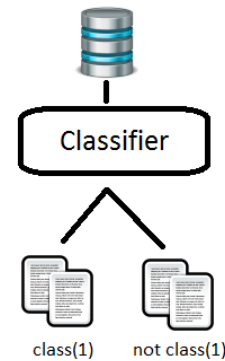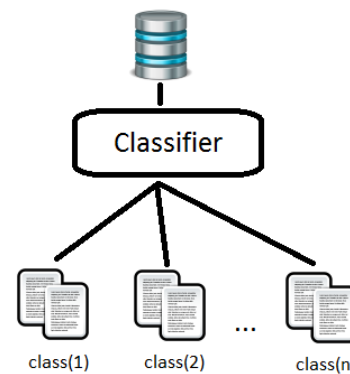

Figure 1. Binary classification

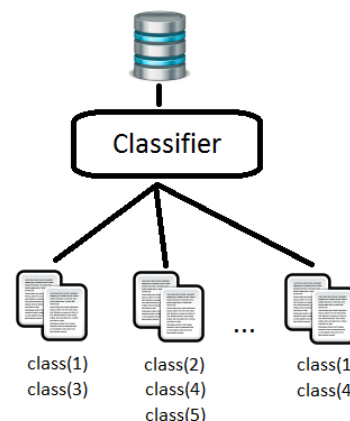Figure 2. Multi-class single-label classification

Figure 3. Multi-class multi-label classification

Regardless of family to which some classifier belongs, there are hard classifiers and soft or fuzzy classifiers. Hard classifier assigns one or more class labels to each object of the data set, but each class label is

"totally assigned" to an object. Soft or fuzzy classifier assigns more than one class labels to each object in the data set but there is a certain degree with which the object belongs to specified class. Classifiers depicted in Fig. 1, Fig. 2 and Fig. 3 are all hard classifiers, while fuzzy classifier is depicted in Fig. 4.
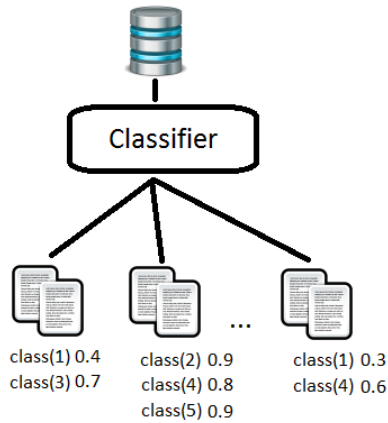

Figure 4. Multi-class soft (fuzzy) classification

Fuzzy classifier produces a measure with which an object belongs to a specified class. The measure is a number from [0, 1] interval.

There is a variety of the domains where classification problems emerge: classification in medicine where patients are classified to classes according to their diagnose/treatment, web classification where web pages are classified according to their content or genre; there are classification in economy, education, information systems, science, etc. Lately, there is the web page classification, a.k.a. web page categorization [1]. This is the process of assigning web page to one or more predefined categories. This problem is considered in the machine-learning domain in which a set of labeled data is used to train a classifier and after the training of the classifier, a new sample or data is presented.

The research presented in this paper deals with the comparison of different Rule based classifiers, which means that classification process is done by previously generated rule sets. These rules are in the form of If... Then rules, which were generated from different data sets.

The paper is organized as follows: Section II introduces previous research in the domain of classifiers and classification problems. Some previous results are shown in this section. Section III contains experiments descriptions, as well as methodology. Finally, Section IV contains conclusions, remarks and guidelines of future work.

II. PREVIOUS WORK

Fortunately, there are multiple literature references to research in the domain of classification. In [1] are described classification problems that can be applied to web pages. The focus is on classification of web pages where text is unstructured or semi-structured. Most of these efforts have focuses on hard classification with a single label per document. However, there are some multi-label classification and fuzzy classification. These

two types of classifiers had better represented the real world documents because real word documents are rarely well represented by a single predefined topic.

In [2] totally 179 classifiers are experimentally evaluated over 121 data sets, giving 21,659 combinations classifier-data set. The classifiers used are: Weka v. 3.6.8, R v. 2.15.3 with caret v. 5.16-04, Matlab v. 7.9.0 (R2009b) with Neural Network Toolbox v. 6.0.3, the C/C++ compiler v. gcc/g++ 4.7.2 and fast artificial neural networks (FANN) library v. 2.2.0 on a computer with Debian GNU/Linux v. 3.2.46-1 (64 bits). Classifier's families used in this comprehensive study are: Discriminant analysis, Bayesian, Neural networks, Decision trees, Boosting, Rule-based methods, Bagging, Stacking, Random forests, Support vector machines, Other ensembles, Generalized linear models, Partial least squares and principal component regression, Multivariate adaptive regression splines and Other methods. In this investigation the whole UCI machine learning repository (https://archive.ics.uci.edu/ml/datasets.html) was used, although some data sets were discarded as unsuitable. This repository is the most widely used data base in the classification literature. Having in mind that it is possible to fine-tune the classifier, as well as there are some data limitations, some classifiers work well on specific data sets while they cannot perform well on others. The classifier performance is related to the data set that is being classified. The best results were achieved by the parallel random forest (parRF), implemented in R with caret. This classifier achieves in average 94.1% of the maximum accuracy over all the data sets.

The article [3] reviews the current practice and then theoretically and empirically examines several suitable tests for comparison of multiple classifiers on more data sets. A set of simple, safe and robust non-parametric tests for statistical comparisons are proposed. The Wilcoxon and Friedman test are particularly suitable for this kind of comparison.

In [4] an experimental comparison of various classifiers was conducted. Various classifiers were combined into the combination schemes and the experiments demonstrate that the combination rule developed under the most restrictive assumptions "the sum rule" outperforms other classifier combinations schemes. A common theoretical framework for classifier combination have been developed and this showed that many existing schemes can be considered as special cases of compound classification where all the pattern representations are used jointly to make a decision. This finding can also be justified theoretically.

In [5] the Naive Bayes based classifiers were investigated. This kind of classifier is often used as a baseline in text classification because it is fast and easy to implement. Some simple, heuristic solutions to the problems with Naive Bayes classifiers, are proposed. This solutions address systemic issues, as well as problems that arise because text is not generated according to a multinomial model.

In addition to these investigations, there are a number of studies that are in various ways connected with comparison of classifiers. Extensive research described in

[2] can be considered sufficient for the very detailed insight into the comparison of classifier.

III. EXPERIMENTS

Experiments were conducted having in mind that main goal is to compare classification power of different classifiers that are rule based.

A. The Data

Experiments were conducted over the following UCI machine repository data sets:

- Breast Cancer Wisconsin [7, 8, 9, 10]. This is the most used medical data set used for classifier testing, as well as for classifier comparison. This data set is very suitable for classifier testing and comparison because the number of attributes is not too big also, there are totally 699 instances, but instances with missing values were omitted from the experiment so that there are 683 instances left.

- Hayes-Roth database [6] contains five numeric-valued attributes. This database consist of training set comprising of 132 instances and test set comprising of 28 instances. Rules were generated by applying classification algorithms to training set while test set was used for comparison.

- Monk's problem data set [6]. This data set was the basis of a first international comparison of learning algorithms. There are three Monk's problems, one of them has noise added. For each problem, the domain has been partitioned into a train and test set.

A common feature of these data sets is that attributes are divided into two categories: condition attributes and class attribute that specifies to which class that particular instance belongs. These data sets are all very suitable for this particular comparison because there is no need for data cleaning and preparation, these data sets are ready to be loaded to both classifiers used in this research.

B. Methods

Firstly, rules were generated from each training set, and secondly classification power of rule sets were tested on test sets. Specially, for the Breast Cancer Wisconsin data set, classification power was tested on the same sample that was used for rules generation.

The performances of rule sets were measured by confusion matrices, this is a usual and simple way to measure a performance of a classifier. The confusion matrix C is a $|V_d| \times |V_d|$ matrix, where V_d is a set of possible values of class attribute. Entry:

$$C_{i,j} = \left| \{ x \in U : d(x) = i, \overline{d}(x) = j \} \right|,$$

where $d(x)$ is the actual class and $\overline{d}(x)$ is the predicted class, counts the number of objects that really belong to class i, but were classified to class j. It is desirable for the diagonal entries to be as large as possible.

C. Classifiers

The classifiers that were used are:

- Rosetta GUI version 1.4.40, kernel version 1.0.1, developed by Knowledge Systems Group, Dept. of Computer and Information Science, NTNU, Norway [11]. This is rough sets based system that is capable of generating rules without univocal consequence, which means that OR logical operator can be included in the Then part of some rules. This system enables reduct sets generation, these are the sets of condition attributes that are sufficient for class label prediction, this also means that superfluous attributes are omitted. Two algorithm were used for reduct calculations: Johnson's algorithm [16] which produces single reduct set and Genetic algorithm that is random search based algorithm.

- SSCO system that is based on syntax systematic classification of objects [12, 13, 14], that was developed on Technical faculty "Mihajlo Pupin" in Zrenjanin, Serbia. This is classification tree based algorithm implemented by LIFO (last in - firs out) structure [15]. This system is also capable to generate rules without univocal consequence. Some of the properties of this system are: order of conditioning attributes is important and could affect the quality of the generated rules, calculation of the reduct sets is not required, this is done automatically during rule generation process, and the algorithm is relatively fast.

Both classifiers are capable to generate confusion matrix: Rosetta uses voting system, while there is no any voting system implemented in SSCO, which means that the same object can be classified to multiple classes.

D. Results

This sub-section contains some results of previously described experiments. In Table I the confusion matrix for Rosetta (Johnson's reduct algorithm and Genetic reduct algorithm) and SSCO is shown for Breast Cancer Wisconsin data set. It is obvious that both systems (Rosetta with two variants of reduct calculation) and SSCO gave same result from classification point of view. However, number of rules generated by Rosetta-Johnson's is 300, Rosetta-Genetic is 5850, while SSCO produces 118 rules.

TABLE I. BREAST CANCER WISCONSIN - ROSETTA (JOHNSON'S AND GENETIC) AND SSCO

		Predicted	
	class	2	4
Actual	2	444	0
	4	0	239

In Table II are shown the results for Hayes-Roth test set generated by Rosetta, while results for same data set generated by SSCO are shown in Table III. The results are similar from classification point of view: Rosetta generated 51 rules (three rules are not univocal), SSCO

system generated 54 rules (nine rules are not univocal), while number of undefined objects is 8 to Rosetta's 7.

TABLE II.   HAYES-ROTH - ROSETTA (JOHNSON'S AND GENETIC)

	Predicted			
	class	1	2	3	Undefined
Actual	1	11	0	0	3
	2	1	9	0	3
	3	0	0	0	1

TABLE III.   HAYES-ROTH - SSCO

	Predicted		
	class	1	2	3
Actual	1	10	4	0
	2	1	9	0
	3	0	0	1

In Table IV there are the results of classification by Rosetta system for Monk's problem test data set 1, while in Table V there are the results of SSCO system for the same data set. It is obvious that in this case Rosetta gives better classification in comparison to SSCO, the number of rules is smaller in the case of Rosetta (35 to 60 generated by SSCO). The number of undefined (unclassified) objects is much bigger for SSCO (52 compared to Rosetta's 12).

TABLE IV.   MONK'S PROBLEM TEST 1 - ROSETTA (JOHNSON'S AND GENETIC)

	Predicted		
	class	0	1	Undefined
Actual	0	204	0	12
	1	0	216	0

TABLE V.   MONK'S PROBLEM TEST 1 - SSCO

	Predicted	
	class	0	1
Actual	0	156	12
	1	34	178

Tables do not show the results for Monk's problem test data set 2 and 3. In both cases, Rosetta generates smaller number of misclassified objects, while the number of generated rules is smaller in the case of SSCO, 142 to Rosetta's 169 for test 2 set and 69 to Rosetta's 82 for test 3 set. The number of undefined (unclassified) objects is smaller in the case of SSCO, 78 to Rosetta's 263 for test 2 set and 54 to Rosetta's 104 for test 3 set.

IV.   CONCLUSION

In this paper are presented the results of the comparison of two classifiers: Rosetta and SSCO. Both systems are rule based which means that rules of the If ... Then form are generated from training sets, while the comparison is done on the test sets. The data used in this investigation are well known sets available via UCI machine learning repository. Three data sets are used: Breast Cancer Wisconsin, Hayes-Roth data set and Monk's problem data set. These data sets are suitable for this investigation because they can be easily prepared and loaded to both systems.

As this systems were compared purely form classification point of view, some other properties of generated rule sets such as rule support, rule length, etc were not discussed in this paper, neither some properties of these system were not discussed. It is concluded that Rosetta is in favor as a classifier in the case of Monk's problem data set (especially Monk's problem set 1), while results are similar in the case of Breast Cancer Wisconsin data set and Hayes-Roth data set. However, it should be kept in mind that Rosetta classified object through voting system (standard voting) while no such system was applied in the case of SSCO. This means that SSCO can classify the same object to more different classes so that multi-class multi-label classification is possible. Moreover, Rosetta is rough sets based system, while SSCO system applies classification tree based algorithm.

Future work will include additional experiments on multiple data set, as well as comparison of more than two classifiers. Important future work will be the implementation of parameter guided classification, as well as parameter tuning algorithms.

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Application of ISO 27000 Groups of Standards at University

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Abstract: It is a well-known fact that the information technology is more and more present in all fields, and all data are saved on various internal or external hard drives. Therefore, we come to conclusion to data protection from malicious or an accidental intrusion in computer systems is necessary. This paper presents ISO27000 which protects data in the information systems its purpose, application and also how it is implemented. Additionally, the implementation of previously mentioned standard at universities will be presented as well as suggestions where to start with the data protection in higher education institutions.

I.   INTRODUCTION

It is well known that for every area of business are rules prescribing some basic points that making business possible. Standards also exist to make sure there are no serve inconsistences in the international business and new standards are created every day in order to regulate that. Organizations that create those standards have international character consists group of experts. Some of the most famous standardization groups are ISO (International Organization for Standardization) and IEEE (Institute of Electrical and Electronics Engineers) of which there is no need to talk about. This paper presents a group of standards that is relatively young. It is ISO 27000 group of standards protects data in the information technology. This group of standards is not as much about methods of protection as it is about how and in what way to find a solution about overview of specific aspects in implementation and possible risks, and in the end about solution. This paper describes the implementation of this group of standards in data protection of universities and shows application of this group of standards. Later, it will be said more about that. First part of the paper describes and explains this group of standards and then second part explains its application in the business world.

II.   SECURITY AND DATA PROTECTION IN INFORMATION TECHNOLOGIES

Information security is defined as: ″protection of information and information systems from unauthorized access, use, revelation, disturbing, modification or destruction″. That means we want to protect our data and systems from those who want to abuse them. Security application of the information is similar to the security application of any other physical resource. Throughout the history the information security was called in different ways, such as data security, IT security, computer security, etc. These names don't consider the fact that information which we keep on computers is very often more valuable than the computers themselves. The most correct name is "information security", and it consists of three components (Whitman and Mattord, 2012):

-Confidentiality: Only authorized persons can access information.

–Integrity: Only authorized persons can change information, therefore they are credible and complete.

–Availability: Information must be available to all authorized persons, whenever there is need for it. These components have formed the base of Information security since the appearance of computers. At the same time, an ever-growing need for information security appears. From standards BS 7799, ISO 27002 and ISO 27001 two additional components are derived (Parker, 1998)

 -Responsibility: Person   responsible   and accountable for the protection of resources.

–Auditability: Complex component that consists of two parts: firstly, for any station or situation in which system is found, there must be possibility to determine how it came there by going back. Secondly, to provide that the system fulfills all documented requests by constant auditing process.
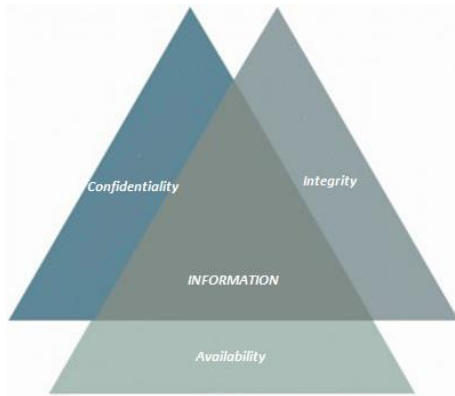
Figure 1. Confidentiality, Integrity, Availability

III.   ISO 27000

ISO family of standards offers group of specifications, code of conduct and the best guidelines for organizational practice in order to provide quality of IT services. Standards which are part of this series have options to: define request for ISMS as request for body that certifies ISMS; to provide support, give detailed instructions for the whole process plan – do – check – act; enables detailed sectorial instructions for ISMS and for evaluation of compliance for ISMS. The standards in this group are as it follows:

- ISO/IEC 27000:2009-Information security management system - Overview and Vocabulary
- ISO/IEC 27001:2005- Information security management system – Requirements
- ISO/IEC 27002: 2005 (previously BS 7799 -1 and ISO/IEC 17799) - Code of practice for Information security management
- ISO/IEC 27003 -Information security management system implementation guidance
- ISO/IEC 27004 - Information security management system – Measurement
- ISO/IEC 27005:2008, Information security risk management
- ISO/IEC 27006:2007-Requirement for bodies providing audit and certification of information security system
- ISO/IEC 27007 - Guidelines for information security management systems auditing

Beside listed standards being the basic standards of this group, there are also:

- ISO/IEC 27011, requests for telecommunication sector
- ISO/IEC 27012, requests for the automobile sector
- ISO/IEC 27013, world lottery organization
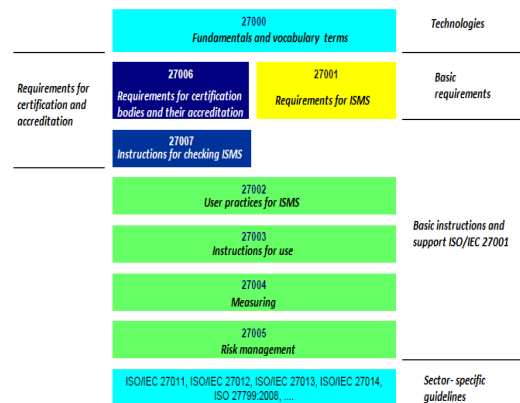- ISO/IEC 27014, information systems for transports

Figure 2. groups of ISO / IEC 27000 standard

The most important components for the information security are ISO 27001, ISO 27002 and ISO 27005. ISO 27001 is a technologically neutral standard for managing data, but cannot be used. From the three parts responsible for data protection, ISO 27001 offers a range of characteristics that promote efficient governance of information. The specification ISO 27001 offers the expectations from the ISMS. This means that to get a certificate or to pass the revision, ISMS companies have to follow certain standards. While ISO 27001 offers specification, ISO 27002 gives behavioral guidelines and the best practice suggestions for the implementation of the specifications. ISO 27002 is a guide for adopting successful ISMS. It is the second part of ISO 27001. Like ISO 27002, ISO 27005 offers guidelines and the best practical options for ISMS. The difference is that concentrates on managing risk. As a part of establishing the functioning security system for information management, the associated risks for the data and ways of softening these risks must be determined. Security standards

for the information are the crucial starting point for any organization that has launched a program for data security.

IV. PRINCIPLES OF GROUP STANDARD ISO/IEC 27000

What information and information security is, and what does ISO 27000 group of standards represents was presented in the previous chapters. As previously stated, the ISO 27000 group of standards stands for the protection and the information security. By protection and security of information it is not considered just protection of information technologies from cybercriminals and threats, but the protection in general. Implementation of this group of standards in business world is recommended, but there is no adequate law which would prescribe and oblige every company to use this certificate. It is highly recommended, but it is only implemented in companies that have big information systems and whose business depends on information systems. During the implementation structure of information system is assessed firstly and then the risks. However, there are certain criteria for the implementation of ISO 27000 group of standards and only after they are met certification are possible. Necessary criteria for the implementation of the ISO 27000 are:

- General provisions for information security management system
- Responsible management
- Internal assessment
- Re-evaluation of information security management system by person in charge of it.
- Improvement of information security management system

After meeting these criteria, the introduction and implementation ISO 27000 group of standards come. The introduction of this group of standards brings several positive effects:

- The trust in the organization's information system is created with existing or potential customers who leads to the trust of partners and clients.
- It is provided that organization's system is in coordinance with the legal regulation stipulating information streams, because

the standard possesses the flexibility in regards to those streams

- System focused on clear and permanent improvements of processes which provides information security is created.
- Transparency in provision of services is provided
- The system especially oriented on managing the risk by management activities which lower the risk to allowed and minimal levels is provided.
- The creation of the mechanism for cutting the costs by using better risk management and removing causes of mistakes in organization
- Realization of better analysis of incomes and outcomes
- Realization of easier monitoring process
- Increasing of preventative measures
- Lowering incidents and better understanding of causes
- Raising awareness of the employees regarding the information security importance
- Providing clear information flow and availability
- Providing frame for security questions and their solutions
- Providing compliance
- Achieving prestige and providing better positions on market

The company that firstly introduced this sort of certification was HDL company implementing integrated ISO 27001 with ISO 9001 in the end of 2006. Later more and more companies have decided to introduce those standards. First companies that started introducing standardization connected to information protection and security were those which depended on information systems, as well as banks.

At the beginning, when the data protection was starting to grow, that whole story was secret and people were whispering about it. Today the data security politic can be found everywhere. It is often seen on social networks.

In Serbia it has not been talked that much about data security and information protection, there is the example of company which had introduced ISO 27000 group of standards will be given information security and protection politic of Telekom company.

Telekom introduced in 2012 standard 27001:2005, which does management of information security. Goal of general management of information security politic is:

- Providing confidentiality, integrity and availability of information
- Securing business continuity
- Minimizing working damages by stopping security incidents or minimizing their influence
- Establishing general courses of activity principles in relation to information security

Fields in which is data security management applied represent working processes connected to information or their processing in used information technologies are used. There are also activities which have direct influence on services, recourses or information availability, then activities linked to risk management created by multiple factors (employees, technologies, physical security). General principles of Telekom Company connected to data protection and security are:

- System regulations for managing data security are documented and are available to all those who are interested and responsible for implementation
- Interests of internal and external users with their personal data are in focus of protection
- Information like the rest of property is protected in a way that is commensurate to risk, trough effective application of IT protection measurements
- Security requests of companies and business partners' interests are taken in consideration
- Management preventively and regularly estimates and controls security risks made during business
- Establishing effective system for information security management certain measurements are applied

V. ISO/IEC 27000 GROUP OF STANDARDS APPLICATION IN HIGH EDUCATIONAL INSTITUTIONS

Here an overview of university information system and the risks on which attention must be paid during introducing ISO certificate for data security and protection will be presented. Firstly, information system represents model of real organization system in which are mutually connected and the whole system is connected to the flow of information.

University information system is consisted from several parts, which automatically also share users:

- Student's office
- Accreditation
- Employees
- Student's service

Basic functions which university information system possesses are

- Support for lecture organization
- Managing student files
- Support for organizing exam terms
- Printing certificates, confirmations which students need
- Keeping record about employees, inventory and items
- Creating accreditation documents
- Registering for the exams
- Overview of passed exams
- Overview of failed exams

Part of information system used by students serves to save time that would be spent at counters of student office, which mean that students via this part of information system. This part of information system is connected to student office. Student office is information system connector between university and students. Student office information system is linked to keeping record in register book, student files, keeping record of registered exams, later forwarding to professors list of registered students and updating students' records.

Then, the availability of certificates. The rest of the faculty's information systems are comprised of data on employees, courses and inventory and faculty objects filing. While the part dealing with accreditation based on the data input creates the accreditation using the regulations defined by the state. Considering the information system security, there is a user division, and therefore a user must be logged in to gain access to work. Different users have different capabilities and available work options, all of which are granted by the administrator.

For the implemented ISO certificates there is a PDCA (Plan, Do, Check, Action) method. PDCA represents a model of constant improvement and is

one of the most accepted quality control tools, also known as Dominos cycle. PDCA cycle is comprised of four basic steps:

1. Planning
2. Execution
3. Control
4. Results

PDC is a model of constant organization management improvement. It is to be used by employees with the purpose of achieving constant improvement. It supports the basic management model- planning, organizing, control with feedback. The image below displays a general scheme of the PDCA cycle.
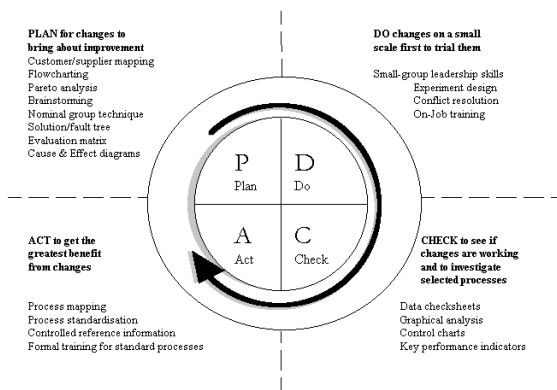

Figure 3. General PDCA schematic

While implementing the ISO certification, the before mentioned scheme is also used. The next part contains the implementation of ISO 27000 certification in a high education institution.

The first step of the PDCA methodology, considering the ISO 27000, is risk planning, seeing how data protection and security is based on the estimated risk. In high education institutions, the risks that could be fatal for the data are: hardware problems, user-made mistakes, and malicious incursions by students, employees or a third party. This step contains the protection plans against these risks. Step two would be tracking of standard procedures that are performed in the faculty's information system (student services, part of the information system in charge for students, part in charge for employees and accreditations). The third step of the certificate implementation would be control and comparison of the results with goals set. After the control is done, there comes the fourth step in which corrections and a new plan is made, from where the cycle starts again. The

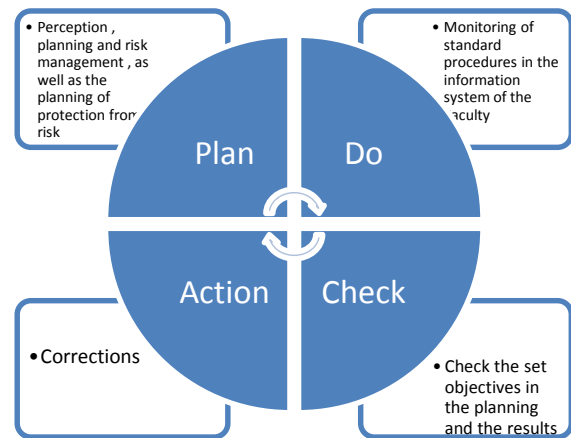image bellow shows a PDCA scheme for the before mentioned four steps.

Figure 4. PDCA in university

VI. CONCLUSION

System protection and data security is something prevalently present. Whether you make an order on Facebook or use the electronic- banking, and it is called privacy statement. In everyday life, everybody is turning to the data security as it becomes more and more important.

It is essential to introduce data security in which the user protection is present. If the government requires from companies to have ISO certificate of data protection, then the same institutions must implement this certificate first as well. The university information system and the way of implementation ISO certification of data protection into it is given because of that.

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Using Web services in Project Management Software Tools

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Abstract – Aim of this paper is to present current state of using web services within software tools that support project management. This way future direction for improvements of using web services within project management supporting web applications could be specified.

I. INTRODUCTION

The impact and value of project management (PM) within implementation of projects to success of business processes in organizations has been examined in [1]. Research has been conducted with 65 companies and 418 projects. It has been shown that elements that influence on importance and value of project management are:

- Context: Economic status, Human resources, Culture, Project type and context, Organization characteristics, strategic directions
- Context influences implementation, i.e. on: training, tools, people, motivation, organization
- Implementation influences values: satisfaction, consistency of application, process results, business results, implemented benefits.

Within research [1] it has been shown that in more than half of examined projects, value of implemented project management practices could be measured as ROI (return of investments), but in other cases where ROI could not be determined, other non-measurable indicators and improvements were succeded in: decision support, communication, work culture, effectiveness of organization. Level to which application of PM influences success is in direct correlation to the maturity level of PM practice and in direct correlation to culture – national, organizational and culture of PM application.

Aim of this paper is to present research results in implementing information systems that could be treated as project management support tools. Particularly, application of distributed information systems, that include web services as part of web-based project management software tools, is examined in this paper. Several existing solutions of using web services within software tools for project management support were analyzed.

II. RELATED WORK - PROJECT MANAGEMENT INFORMATION SYSTEMS RESEARCH

In research [2] the influence of application of project management information system (PMIS) to success of a project. Within this research, 224 project managers and consultants were included in survey using a questionnaire. It has been shown that that PMIS does not influence success of project directly, but indirectly, by enabling access to quality information to project managers. Another survey results shows that in aim to have more direct influence to project support, PMIS should be very sophisticated and to provide information of high quality.

An example of implemented information system for project management support in CARE organization, named DME-IS, has been presented in [3]. Basic characteristics of the developed system are: includes qualitative and quantitative data and feedback data within continual asessments and estimations during all project phases, enables systematic monitoring of processes and results, enables support to identification of potential problems and initiates suggestions to solutions to these problems and corrective actions, collects and stores data, performs analysis and enables information retrieval useful for decision support, flexible regarding requirements, supports principles of transparency, reliability, inclusion and participation, where project participants are able to influence and control decision making.

In research [4], influence of internet to project management success was examined. The need for web-based support to project management is emphasized. Particular web-based solutions to project management support were analyzed in this paper.

III. THEORETICAL BACKGROUND

A. Distributed information systems

Main reason for development of distributed information systems is to enable support to information needs of users whose business processes are performed at wide geographical area[5]. Other reasons include using available modules, such as web services, that exist at different locations at Internet, as partial functional solutions in creating more complex solution.

In [5], distributed information system is defined as information system that supports distributed data processing with distributed database. In literature, sometimes distributed information system is named with synonym – distributed system. According to [6], distributed system is software system whose components are located at computers linked with computer network and where components communicate and coordinate actions by message exchange.

According to [6], technologies of distributed information systems include:

- Technologies of servers organization, organization of services and clients – grid and cloud computing, mobile computing

- Technologies of distributed databases – distributed database management systems, with support to replications, framentations and distributed transactions

- Technologies of distributed software components – web services, agents, distributed multimedia systems etc.

B. Web services

Definition of web service is given in [7], based on:

- UDDI consortium definition as self-contained, modular business application that has open, internet-oriented and standard-based interfaces.

- World Wide Web consortium definition as software application identified by using URI, whose interfaces and links have ability to be defined, described and discovered as XML artefacts. Web service supports direct interaction to other software agents by using XML- based messages that are exchanged via Internet-based protocols.

Within [8], conceptual model of using web services is described with elements: Service Provider, Service Requestor and Services Registry (Figure 1).
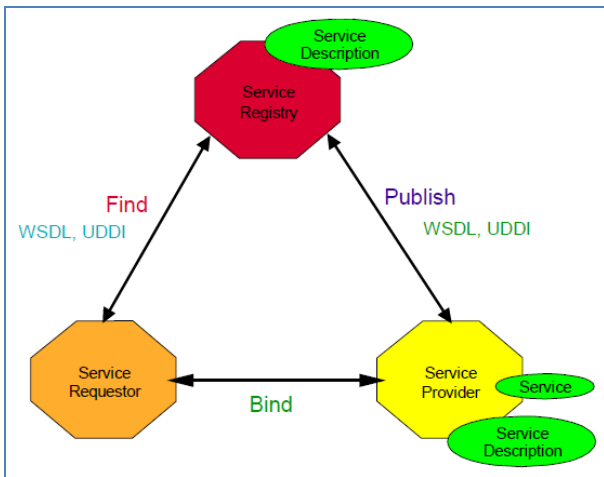

Figure 1.   Conceptual model of using web services [8]

According to [7] [9], usual technics and protocols in using web services include:

- XML (Extensible Markup Language) – for data structuring,

- SOAP (Simple Object Access Protocol) – for data transfer,

- WSDL (Web Service Description Language) for description of available web services, i.e. it presents a formal description of web services

- UDDI (Universal Description Discovery and Integration) directory of available web services descriptions.

According to [10], web services today are implemented by applying one of two most frequently used technology approaches/standards:

- SOAP

- REST/RESTful (Representational State Transfer) based on RSS, XML, JSON, MIME, URI, HTTP, SSL.

Basic similarity of the two approaches are in remote procedure calls and difference is in that SOAP approach emphasize messages exchange, where communication is based on the transport level protocols, while REST implements communication at the application level protocols.

IV.   USING WEB SERVICES IN PROJECT MANAGEMENT SOFTWARE TOOLS – SOME EXAMPLES

System iPlanWare [11] presents a web application that enables complete web-base support to general project management - via hosting of installed web application of via download and self-organized hosting of the application. The web application is implemented as ASPX/MSSQL server application. This system enables including web services to support interoperability, i.e. integration of this software to other types of application, such as Microsoft Project.

Figure 2.   iPlanWare software – using web services [11]

System ProjectInsight [12] offers possibilities of using ready-made APIs within installable software, i.e. using Web services that enable integration of primarily .NET applications with other applications. Web services that are available are related to basic functions of data entry and data retrieval from database which is designed as general support to project management (data record on firms, projects, tasks, costs/expenses, users etc.)
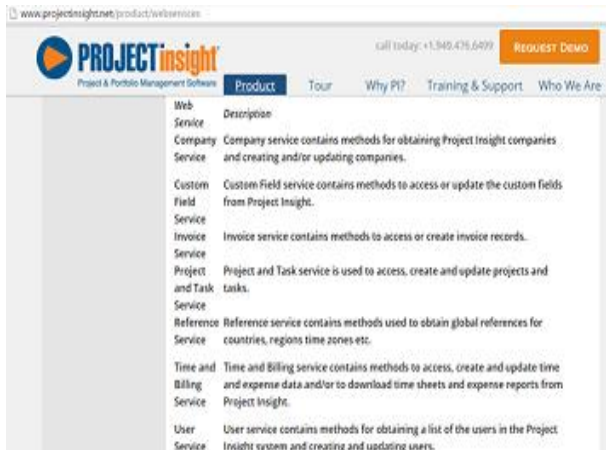

Figure 3. ProjectInsight – using web services [12]

Projektron system [13] enables support to basic functions of general project management, but also additiol functions that re related to multiproject work, customer relationship management by ticketing system (communication about requests and problems with clients), support to teamwork, record on working hours and time planning, quality control and client satisfaction, document management, working roles and using permissions management, reporting. It also supports SCRUM methodology.

Figure 4. Projektron [13]

Projektron system is implemented as three-tier java application, that enables interoperability with other applications, such as JIRA, SAP, Microsoft etc.

Figure 5. Projektron - interoperability [13]

Within Projektron system, using web services is enabled in context of data access (for read, adding and updating data) which are stored in Projektron system database.

Figure 6. Projektron – web services [13]

System ProjectOpen [14] enables basic functions of project management, finance management and support to teamwork, and special concerns are implemented to support multiproject work with resource sharing among many different projects that are managed simultaneously.
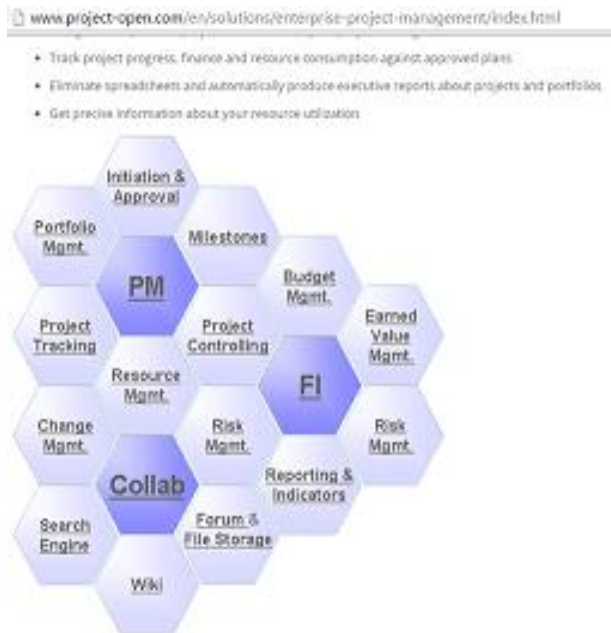

Figure 7. ProjectOpen [13]

Within ProjectOpen system, web services are implemented, based on REST standard. These web services enable access to data and objects of ProjectOpen system by other systems, in aim to enable those other systems to read and add data to the ProjectOpen database.

V. CONCLUSION

Aim of this paper is to examine using web services within software tools for project management support.

This paper presents importance of project management and value that project management add to organization functioning success. Using software tools in project management is one of aspects that add value to overall project management application success.

Research results in development of information system support to project management show that information systems in project management need to be developed as sophisticated and detailed systems, that provide quality information as basis for decision support.

Theoretical background include definition and basic characteristics of distributed information systems and web services, as well as brief description of two basic technological implementation standards for web services – SOAP and REST.

Existing solutions of using web services within professional software tools for project management support are described. According to analyzed characteristics of available professional tools, it could be concluded that most of the analyzed tools use web services for application interoperability, i.e. enabling other applications to access data (in both read and write manner) that are stored within these software tool using.

Possible direction for improvement in using web services within software tools support to project management could include:

- Support to adaptability of web applications, enabling web applications to be adaptable to change of project management methodology, particularly to support diverse software project management methodologies (such as different agile methodologies).

- Support to measurement of artefacts that are produced within project implementation, particularly within software project implementation, such as models, documentation, software source code etc.

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Web Application for Recording External Documentation and Regulation

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Abstract – Archiving and recording of all forms and types of documents, as well as the manner of filing thereof becomes contemporary needs of every serious organization. Paper documents are gradually overcome, for known reasons related to the problems of storage and later for inability to reuse them. It is difficult to ensure the use of electronic documents in the future, if it does not at present provide effective and efficient conditions for it. A positive outcome is obtained only by ensuring the cooperation of professions: business managers, archivists, computer scientists, programmers, IT industry representatives and others. Cooperation must be complementary, not a rivalry. For this reason, it is attempted in this paper to be a little more clearly on showing the ability of the digital archiving of existing documents.

I. INTRODUCTION

The basic tenet of making the initiation of introducing any innovation in business processes, increase productivity and / or reduce costs. Converting documents in the course of business processes in the instruments of labor accelerates the process and the optimization of each process. [5]

The advantages of digital archiving can be summarized in two points: cost and safety. Through working with document management systems, it enormously increases the working efficiency and reduce material costs. [6]

By introducing EDMS in business process is conducted at improving the productivity by reducing the time required for processing while the focus is on key and specific jobs:

- To improve the relationship with customers.
- To perform quality improvement.

EDMS includes hardware, software and operational procedures that allow:

- translation of documents involved in business processes in electronic form, if necessary,
- safe storage with the possibility of backing up,
- quickly and easily find the data in the archive,

- easy exchange among the participants in the business process, as well as
- their printing, if necessary, [1]

II. THEORETICAL BACKGROUND

A. EDMS software

Basic functions of EDMS software are:

- Upload of documents (text, graphics, hypertext and multimedia);
- Recognition through various technologies such as OCR (Optical Character Recognition), OMR (Optical Mark Recognition), ICR (Intelligent Character Recognition), VR (Voice Recognition), converting scanned documents into a form suitable for subsequent digital processing;
- Marking - assigning markers every document in the selected marking system, on the basis of which can be clearly identified;
- Search - finding a document or group of documents that meet the established requirements expressed through queries according to certain criteria. [6]

III. RELATED WORK

A. Problems and possible solutions

It is necessary to build an application that is intended for administrative and accounting staff of the Technical Faculty "Mihajlo Pupin". Faculty operates in accordance with the laws and regulations that have been adopted at the state level, provincial authorities, the University of Novi Sad, etc. Periodically competent institution send to the Faculty new regulations, forms, work rules, which should subsequently be harmonized with the work of the Faculty. Certain documents, regulations and forms arrive in paper form, but usually by e-mail at various e-mail addresses: the Faculty dean's office, the students' service, legal service, administration. About some rules and forms the Faculty is informed from the websites of these institutions, therefore, this application allows you to record all the above mentioned documents and upload the resulting material into a single database of the Faculty, which is easy to use and always available. The application should have

multiple functions that allow users to have an insight of all documents that are in the system. The user has the ability to see which competent institutions are in the records of the Faculty as a list of institutions that would potentially send regulations, documents and forms. Also, users can enter new documents, enter the date of receipt of any document, including uploading the desired material, enter the relevant institutions, delete or modify existing documents and institutions from the records. Each user is given an account through which it accesses the system and all data, and through which he can inserts, modifies, or deletes data from the system.

B. Documents and versions of documents

When the document is created in the company or its entry, the document becomes a matter which lives, suffers changes, processes and it becomes a part of the system. All these documents are called entry documentation.

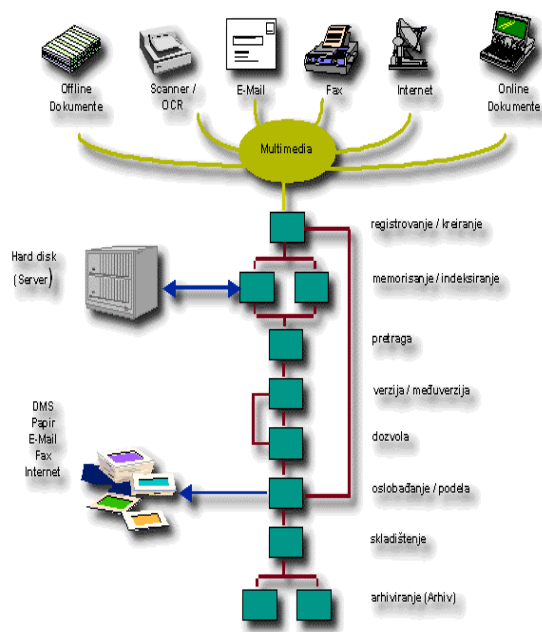Forms that are experiencing the input documents are shown in Figure 1.

Figure 1 - The algorithm procedure of documents from the entrance to the archive [4]

C. Self-decribing documents

Using self-describing documents can ensure the creation and revision, and a long-term security of archived documents. Self-describing documents permit the re-creation of a system to manage in case of problems with the same.

For self-describing document objects and architecture, there are different standards as DFR (Document Filing and Reatrieval - ISO 10166), SGML (ISO 8879), ODA (Open Document Architecture - ISO 8613), CORBA - object model and DMA - a document model. Some archive

systems stored a complete environment together with documents and thus provide self-describing functionality [4]

D. The electronic document with a digital signature

Using the digital signature provides an electronic document dimension of originality and the law provides to character the evidence in legal proceedings. Digital or electronic signature is directly linked to the owner of the signature and the signed document. He provides technical form document in the form of binary characters but does not give a precise definition of the interpretation of the content. Electronic signatures is based on a dual system of the electronic key. It is necessary for data exchange in the network when the people who participate in the exchange are unknown. [4]

E. Relations with the environment EDMS

Figure 2 shows a simplified system of relations in EDMS environment.

Used ISO IEC 15489 is a standard, which defines the functional characteristics of EDMS.
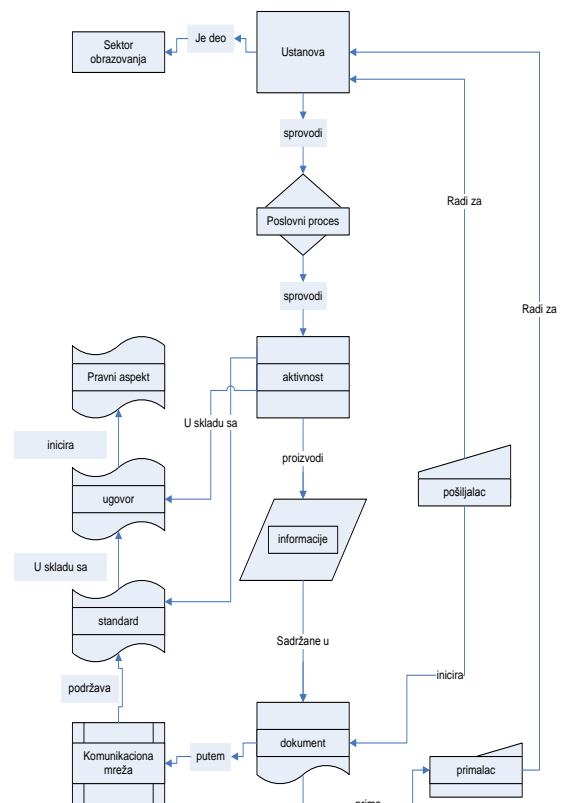

Figure 2 – Relations in EDMS environment in the education sector [3]

ISO 15489 consists of 2 parts:
• Part 1: General;
• Part 2: Guidelines [Technical Report]

ISO 15489-1 specifies the elements of document management and define results and outcomes to be achieved. It is used to manage

documents of all formats and on all media created or received in the conduct of activities of public or private organization or any individual who has an obligation to create and maintain records. [4]

ISO 15489-2 provides a methodology for implementing, step by step, and he is the first in a series of professional standards that need to comprehensively regulate the area of document management, as well as to provide new legislation in this area, based on the new values of storage and use documents. [4]

IV. MODELS

A. Creating Use Case diagram

Before creating the database, best practice is to create Use Case diagram and Conceptual data model in order to create database as accurate as possible and to make easier to see all of the functionality performed by the user. Use Case diagram shows the relationship between the Actor (User) and Use Case (user functions). It serves for a better understanding of the problem in the early stages of the project.
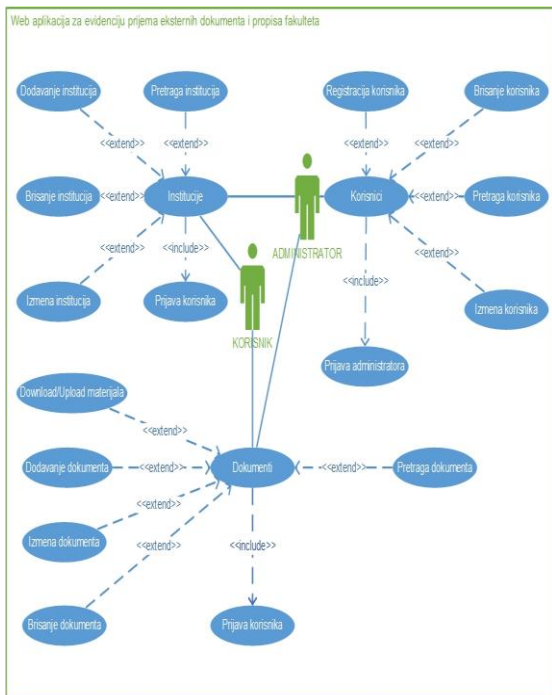

Figure 3 – Use Case diagram

B. Creating Conceptual data model

Conceptual data model identifies the highest level of relations between different entities in the database. CDM involves: The most important is to show entities and their relationships, where the attributes of the entities and primary keys are less important. CDM is the simplest of the three diagrams (Conceptual, Logical, and Physical) therefore best practice is to always begin with CDM in order to understand which entities exist in

the database and what is the relationship between them. In this case we have three Entities (user, document, institution) where relationships are one-to-one and one to many.
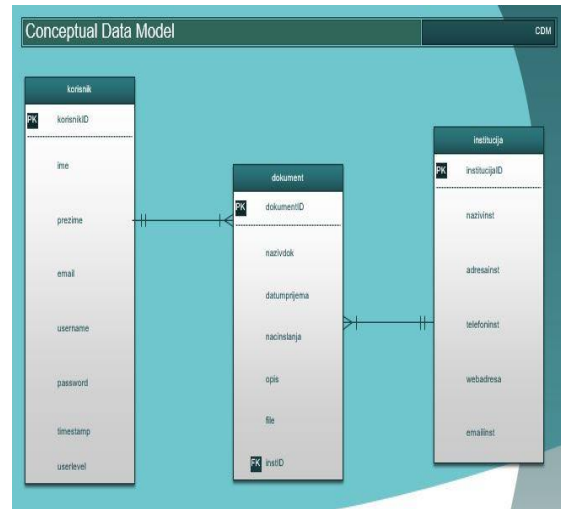

Figure 4 – Conceptual Data diagram

C. Creating Physical data model-a

From the Physical data model on Figure 5, we can clearly see the relationship between the tables, foreign key relationships in the child table and how to implement the entire system in the database. PDM shows all structures of tables, columns, data types, primary keys, foreign keys, and relationships between tables. [2]
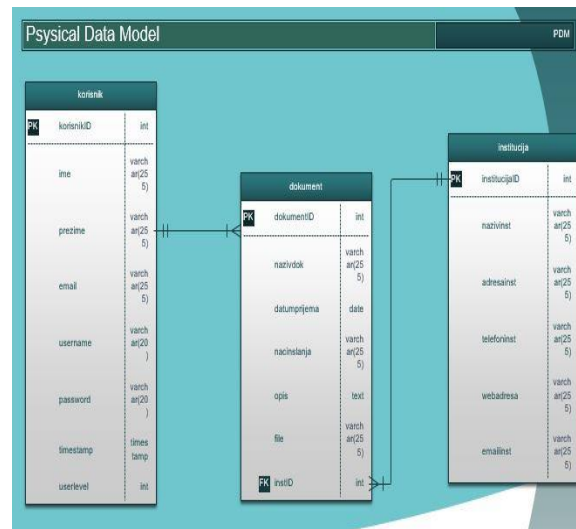
Figure 5 – Physical data model

D. Creating Business process model

The business process model is a set of related activities which achieve specific goals or user requirements. It also represents a set of related activities that create value through a transformation of some inputs into a more valuable output. Inputs and outputs can be products and / or information. Activity (i.e. Transformation inputs into outputs) are carried out by people and machines. [6]

Figure 6 – Business process model

V. IMPLEMENTED SOLUTION

A. Selecting technologies for developing the application

Before the start of developing an application, it is necessary to choose the technology for its development. In developing of this application the following technology was used. Apache 2.4.16 to create a local Web server. Google Chrome browser for displaying the application. JetBrains PHPStorm 9.0.2 and Notepad++ IDE (Integrated development environment) tools for development of the application. PHP version 5.5.28 scripting language in which the application was written, also JavaScript programming language, and its library JQuery, to create application more interactive. The database server MySQL version 6.5.26 and the tool for database administration, phpMyAdmin 4.4.14.

The application needs to have an elaborate system of accounts which allows the administrator to register users which will be able to log in the application and have access to all the functionality of the application. It should also enable the input of all documents and departmental regulations but also access their administration interface (modify and delete). In addition, it should be a tabular presentation of all the document and the institutions, their search ability and the possibility of downloading and uploading document material. The application's administrator has the ability to register users, administer all users and assign access levels.
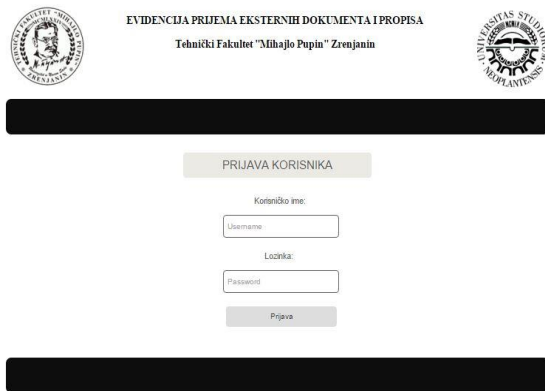

Figure 7 – Login page / Index page

On the index page of the application is login form of the application. There are two levels of users. Level 2: "Administrator" who has access to all the functions, and level 1 "User" who has access to administration of the documents and

the institutions. The login form automatically registers user's access level and it gives the allowed access to functions accordingly.

Figure 8 – Document adding page

It is not possible to enter a document name if it already exists in the database. There is a select menu for the possible ways in which the document was sent. The application allows us to upload document material into the database. The select menu of institutions allows us to select which institution had sent the document. The date format is (day. month. year).
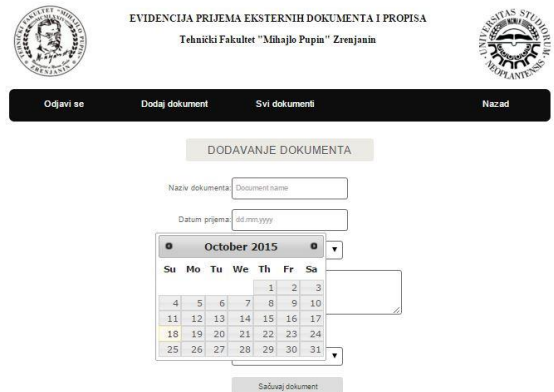

Figure 9 – Document adding page – date entry calendar

Clicking on the input date of receipt of the document pops up a calendar (JQuery) function which allows us to select date faster and more efficiently.

Figure 10 – Preview of all the documents in the DB

On this page users have access to the documents that are currently in the database. There is a search bar that allows users to search all documents by name. From this page, users can download the document material, delete documents, and get insight into the details of a document. There is also a display of the total number of documents in the database and also the numbers of the document that are currently being displayed on the page.

Figure 11 – Document search bar

It allows users to enter a full name, or just a fragment of a document's name which users would want to search for.

Figure 12 – Document detail page

On this page users can get insight of all the details of a specific document. The date when it was received, the way it was sent, its detailed description, the institution which sent it and its download. Also, on this page we have the possibility of switching to the page for its modifying.

Figure 13 – Edit document page

This page enables users to modify a document which had been previously entered in the database.

Figure 14 – User registration page

User registration page allows administrators to register new users. Possibility to register has only the users with the level of access "Administrator (2)". Users with the same username are not possible to register. Username input has a pattern format that allows uppercases and lowercases, combination of numbers from 0-9, and the username length between 3 and 15 characters. Password input has the same pattern format and requires its confirmation (Confirm password). Possibility to select level of user access. User (1) and administrator (2). Format of the e-mail must be (name@name.name)

Figure 15 – User detail page

This page allows users an insight into the details of any user. Automatically displayed date when the user was registered and the option to switching to the page of modifying the user.

Figure 16 – Preview of all registered users

Allows the administrator to preview all the registered users. There is a search bar for username and the possibility for deleting users and getting insight of the details of any user.

Figure 17 – Edit user page

Administrator has possibility to modify all the data about any user, except for changes to the date of registration, which is automatically entered into the database during user registration.

Figure 18 – Institution adding page

On this page users can enter institutions in the database that will later be able to be selected while entering a new document.

Figure 19 – Preview of all institutions in the DB

This page gives users search, insight and administrating ability, including deletion and modification of all institutions which are entered in the database.

Figure 20 – Edit institution page

This page allows users to modify information about institution that had been entered in the database.

VI. CONCLUSION

The previous system of archiving documents was slowing the possibilities to analyze and the ability to react. For this reason, the transition to digital archiving is necessary, perhaps more importantly, for the ability to manage documents that occur in the process of education. The author had in mind the necessity of addressing this segment of education, without any intention of suggesting solutions. Current version of the application is tested, fully functional and ready for further use.

ACKNOWLEDGMENT

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One example of Digital Audio Broadcasting system design based on ATDI the simulation software tool

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Abstract - This paper presents a simulation of a closed SFN networks for broadcasting T-DAB signal in the territory of AP Vojvodina, and compared the method of synchronization in the first signal (first server) and the strongest signal (best server). To simulate design T-DAB a software tool ICS telecom French company ATDI is used. The software tool ICS telecom covers the simulation and analysis needs of fixed and mobile broadcasting systems.

I. INTRODUCTION

FM radio services in VHF Band were originally developed in the 1950s for fixed reception using a directional receiving antenna at a height of 10 m above ground level. However, the majority of radio listening today is carried out with portable and mobile receivers which use only a simple whip or telescopic antenna, resulting in substandard FM reception quality in many areas.

The frequency bands available for sound broad casting are either rapidly saturating or have already become saturated. As a result, the reception quality is suffering more and more from mutual interference between transmissions. In many countries, there are now very little or no prospects of additional radio services being provided by means of the existing analogue technologies.

Radio broadcasting technology has evolved rapidly over the last few years due to ever increasing demands for as high quality sound services with ancillary data transmission in mobile environment. In order to accomplish this, Members of European Broadcasting Union (EBU), the European Telecommunications Standards Institute (ETSI) and International Telecommunications Union (ITU-R) developed a completely new digital radio broadcasting technology called the Eureka 147 Digital Audio Broadcasting (DAB) system which improves the overall broadcasting performance by delivering near CD quality audio and data services in mobile receivers along with efficient use of the available radio frequency spectrum. Digital Audio Broadcasting (DAB) system developed within the Eureka 147 Project is a relative new digital radio

technology for broadcasting radio stations that provides high-quality audio and data services to both fixed and mobile receivers. The Eureka 147 DAB system has been developed by a European consortium which was established in 1987 and now has over 40 members; it is composed of manufacturers, broadcasters, network providers and research institutes.

The Eureka DAB system can operate in any dedicated broadcasting band at both VHF and UHF. Even when working in severe multipath conditions, such as in dense urban areas, the system provides an unimpaired sound quality in the DAB receiver. It allows use of single frequency networks (SFNs) for high frequency efficiency. The system uses Coded Orthogonal Frequency Division Multiplexing (COFDM) technology that combats the effect of multipath fading and inter-symbol interference (ISI) makes it spectrally more efficient compared with existing AM/FM systems [1].

II. THE WORKING PRINCIPLE AND ELEMENTS OF DAB SYSTEM

The overall DAB transmission system can be divided into a number of functional blocks that process the input signal to produce complete DAB transmitted signal. The DAB system enables several sound programmes to be multiplexed together and broadcast on the same radio-frequency channel. The number of programmes in an a multiplex depends on the trade-off implemented between:

- the encoded bit rate per audio programme;
- the channel protection that is provided against errors occurring on the propagation path;
- the data capacity required for the various programme associated and independent data services that are included in the multiplex.

A. DAB transmitted signal

The DAB transmitted signal is built up around a transmission frame structure consisting of synchronization channel, the Fast Information Channel (FIC) and the

Main Service Channel (MSC). The transmitted frame duration is denoted by T_F. Each transmission frame consists of a sequence of OFDM symbols. The number of OFDM symbols in a transmission frame depends on the transmission modes. The first two OFDM symbols in each transmission frame are kept reserved for the synchronization channel (SC).

The first OFDM symbol of the transmission frame should be a Null symbol of duration T_{NULL} and the remaining part of the frame to be made of OFDM symbols of duration Ts. Each of these OFDM symbols have set of equally spaced carriers, with carrier spacing 1/Tu. The symbol denotes L the number of OFDM symbols per transmission frame without Null symbol; K is number of transmitted carriers and T_F is transmission frame duration [2], [3].

B. Surce coding and chanel coding

Source coding in the DAB system employs MUSICAM (Masking Pattern Universal Sub-band Integrated Coding And Multiplexing) audio coding that uses the principle of Psycho acoustical masking as specified for MPEG-2 Audio Layer 2 encoding. This exploits the knowledge of the properties of human sound perception, particularly, the spectral and temporal masking effects of the ear.

Principle of MUSICAM audio coding system is that it codes only audio signal components that the ear will hear, and discards any audio component that, according to the Psycho acoustical model, the ear will not perceive [4]. This technique allows a bit rate reduction from 768Kbit/s down to about 100Kbit/s per mono channel, while preserving the subjective quality of the digital audio signal. This allows DAB to use spectrum more efficiently and delivering high quality sound to the listeners.

Channel coding is based on punctured convolutional forward error correction (FEC) which allows both equal and Unequal Error Protection (UEP), matched to bit error sensitivity characteristics. The UEP is primarily designed for audio but can be used for data. The UEP can be used for audio as well as for data. Basic idea of compatible punctured convolutional (RCPC) channel coding is to generate first the mother code. The daughter codes will be generated by omitting certain redundancy bits. [5].

The channel coding is based on a convolutional code with constraint length 7. The octal forms of the generator polynomials are 133, 171, 145 and 133, respectively. The encoder can be thought as shift register. The DAB signal frame illustrated in Fig. 1, has the following structure that helps in efficient receiver synchronization.

According to Fig. 1 the first symbol is the Synchronization channel consisting of Null symbol and the phase reference symbol. The next symbol must be FIC

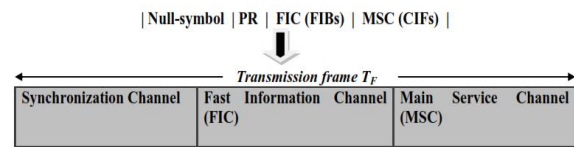channel and last symbol is the MSC. MSC forms the useful payload of the DAB frame.

| Null-symbol | PR | FIC (FIBs) | MSC (CIFs) |

Figure 1   DAB signal frame

The DAB transmission frame has three channels:

- Main Service Channel (MSC): The MSC is a time interleaved data channel divided into a number of sub-channels which are individually convolutionally coded, with equal or unequal error protection. Each sub- channel may carry one or more service components. The MSC is made up of CIFs. The organization of the sub-channels and service components is called the multiplex configuration. The MSC of the DAB system has a gross capacity of 2.304 Mbps.

- Fast Information Channel (FIC): This is used to signal the multiplex configuration of the DAB transmission and service information. It has fixed symbols which are known to the receivers to decode any of the sub-channels instantly. The FIC is made up of FIBs. The FIBs contains 256 bits. The FIC data is a non-time-interleaved channel with fixed equal error protection (code rate 1/3).

- Synchronization channel: It consists of two symbols i.e., Null Symbol, during which no information is transmitted and Time frequency phase reference symbol (TFPR) which has predetermined modulation. Synchronization channel is used internally within the transmission system for basic demodulator functions, such as transmission frame synchronization, automatic frequency control, channel state estimation, and transmitter identification [6].

C. Coded Orthogonal Frequency Division Multiplex (COFDM)

The main advantage of the DAB system developed in the European Eureka 147 standard is its ability to deliver high quality audio services to mobile receivers under different RF channel conditions. This is because of the use of transmission technology called the Coded Orthogonal Frequency Division Multiplexing (COFDM). COFDM modulation combines the multicarrier modulation technique OFDM with convolutional channel coding in such a way that the system can exploit both time and frequency diversity. This is achieved by interleaving data symbols, in the time and frequency domains, prior to transmission.

In this system, the complete ensemble is transmitted via several hundred closely spaced RF carriers which occupy a total bandwidth of around 1.5 MHz, the so called frequency block. Each individual RF carrier transmits, at a fairly low data rate, only a tiny fraction of the total data which makes up the ensemble, thus providing a form of diversity reception.

With COFDM, multipath reception is practically eliminated. Due to the low data rate of each RF carrier, any delayed reflections of the signal (passive echoes) add in a constructive manner to the direct signal already received. The only situation where passive echoes do not contribute in a constructive manner is when the delays are much greater than the time guard interval of the DAB signal [7].

The Eureka 147 DAB system also able to use active echoes constructively, delayed signals generated by other co-channel transmitters. This leads to two important concepts:

- Single Frequency Networks (SFNs)
- Co-channel gap-fillers

The SFN concept enables all transmitters covering a particular area with the same set of sound programmes to operate on the same nominal RF channel, i.e. within the same frequency block. All SFN transmitters need to be synchronized, in terms of both frequency and time, and the transmitted bit stream must be identical. Although the signals emitted by the various transmitters are received with different time delays, the receiver recognizes this as a direct signal coming from the nearest transmitter, followed by active echoes coming from other transmitters in the SFN.

Gap-filling represents the second type of application which makes full use of the active echo concept. A gap-filler receives the signals from the main transmitter and retransmits them at low power on the same frequencies to provide coverage in an area where the main transmitter is not received satisfactorily. Although the listener receives signals from both the main transmitter and the gap-filler at slightly different times, the two sets of signals add together constructively to enhance the reception [5].

D. DAB transmision modes

The Eureka 147 DAB system can operate over a wide range of frequencies from 30MHz to 3GHz. This wide range of frequencies includes VHF Bands I, II and III, UHF Bands IV and V, and L-Band (around 1.5GHz).

Since the propagation conditions vary with frequency, DAB system use four transmission modes of operation named as Mode-I, Mode-II, Mode-III, and Mode-IV, each having its particular set of parameters.

These modes are detected automatically by the receiver and are transparent to the user.

Mode I is suitable for SFNs operating at frequencies below 300MHz.

Mode II has been designed for local and regional services at frequencies below 1.5GHz and

Mode III is available for satellite broadcasting below 3GHz. Mode IV has recently been introduced to enable existing transmitter sites to provide optimum and seamless coverage of large areas by means of SFNs operating in L-Band.

The parameters of Mode IV lie between those of Mode I and Mode II [2], [5].

E. DAB transmitter

Figure 2 shows a conceptual DAB transmitter drive, in which a sound and a data service are coded individually at source level, then error protected and time interleaved. At the input of the system the analog signals such as audio and data services are MPEG layer-2 encoded and then scrambled. Next, the sound and data services are multiplexed into the Main Service Channel (MSC), together with other services.
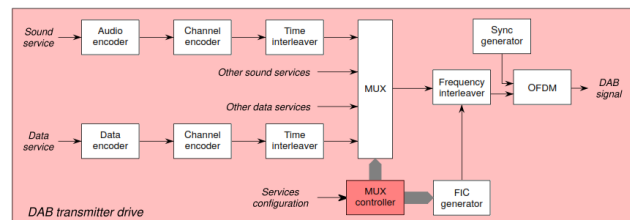

Figure 2   DAB Transmitter

The multiplexer output is frequency interleaved and combined with multiplex control and service information which travel in a Fast Information Channel (FIC). At this stage, synchronization pulses are added and then OFDM is applied to the signal. Finally, signal is DQPSK modulated onto a large number of RF carriers to form the complete DAB signal.

F. DAB receiver

Figure 3 shows a conceptual DAB receiver in which the wanted DAB ensemble is selected in the analogue tuner, down converted and demodulated before applying it to an analogue to digital (A/D) converter. The receiver performs the operations of the transmitter in reverse order.
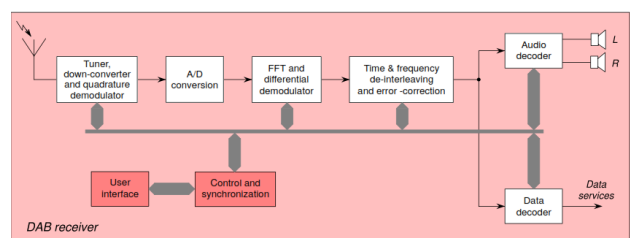

Figure 3   DAB receiver

The digitized output of the converter is fed to the Fast Fourier Transform (FFT) stage and then differentially demodulated. This stage is followed by a time and frequency de interleaving process, and error correction. Next, the original coded services are further processed in an audio decoder, to produce the left and right audio signals. The decoding of more than one service component from the same ensemble, such as an audio programme in parallel with a data service, provides appropriate possibilities for new receiver features [1].

In the case in vehicle reception, as the speed of a vehicle increases, the performance of DAB receiver progressively degrades, due to the Doppler effect. In the case of an SFN operating at VHF, the receiver speed limit is about 200km/h. When the receiver operates at 1.5GHz and transmission Mode IV is used, the speed limit is about 120km/h [5].

III.   T-DAB SIMULATION MODEL

The final acts of the Regional Radiocommunication Conference (RRC) held in Geneva in 2006, for planning of the digital terrestrial broadcasting, service in parts of Regions 1 and 3, in the frequency bands 174-230MHz and 470-862MHz (RRC-06) within the T-DAB frequency blocks for the Republic of Serbia for the territory of AP Vojvodina provided the T-DAB frequency blocks 11B and 12D. This means that in the SFN network, which is being used on the territory of AP Vojvodina, broadcast signals at radio frequencies from 218.640MHz or 229.072MHz, as the central frequencies of the listed radio T-DAB frequency blocks 11B and 12D [8].

A.   T-DAB network plannig consideration

In the process of planning a T-DAB radio networks are seen assignment planning and allotment planning. An assignment plan provides a frequency or a set of frequencies for each station and at the completion of the assignment planning process the locations and characteristics of the transmitters in the planning area are known. The resulting allotment plan contains the T-DAB frequency blocks to be used in particular areas without specifying the technical data for the transmitting stations. Each allotment in the plan has to be converted into a transmitter assignment or set of transmitter assignments before the service can be brought on air.

Based on the recommendations of the ITU-R BS.1660-3 basic structure of the T-DAB reference network is hexagonal structure, which may consist of a single base station, open or closed network SFN networks. Theoretically the most important hexagonal structure closed SFN networks with a total of seven base stations (six peripheral base stations and the central base station). Closed SFN networks means that all base stations, which are part of the same SFN networks, using omnidirectional transmission antenna.

When planning a transmitter network four field strengths are important:

- One is, of course, the field strength of the wanted signals inside the coverage area (the wanted field strength).
- The second results from the power radiated by the wanted transmitters towards areas outside of the coverage area and is usually called outgoing interference or outgoing interfering field strength.
- The third is the field strength inside the wanted coverage area due to radiation from interfering transmitters outside the wanted coverage area (incoming interference or incoming interfering field strength).
- The fourth field strength arises in SFNs. It is the self-interference that may be found in SFNs when inter-symbol interference of wanted signals occurs [9], [10].

B.   ATDI ICS telecom radio network planning tool

To simulate design T-DAB network for the territory of AP Vojvodina using a software tool ICS telecom French company ATDI [11]. ICS telecom tool covers the simulation and analysis needs of fixed and mobile broadcast:

- Migration from an analogue network to a digital network
- MFN or SFN configuration
- Support of all technologies: analog TV and radio, DVB-T, DVB-T2, T-DAB, DVB-H
- Full compliance with ITU recommendations and RRC Geneva06.

ICS telecom tool provides the capability to adjust any parameter of the network (antenna characteristics such as power, height, location, azimuth, frequency plan) in order to achieve targets expressed in terms of coverage or interference. ICS telecom also features a prospective planning/gap filler engine which allows:

- An initial search for optimal site locations in order to build a network from scratch
- The search for additional site candidates in order to optimize an existing network performance based on coverage or cost targets
- Flexibility to define specific constraints.

ICS telecom is a unique tool to plan technology transitions and convergence.

C.   The parameters of base stations closed SFN networks in the territory of AP Vojvodina without synchronization

Table I contains the list of all base stations with the basic parameters. In total there are 15 base stations, base station 13 (8 peripheral and 5 central) and 2 gap fillers. The base stations that provide coverage in areas where there is no in range and whose values Effective Radiated

Power are effectively small Radiated Power (ERP=100W) are called gap fillers. Base stations for broadcasting T-DAB signals are placed at the locations of existing base stations to broadcast analog FM signal, with the aim of reducing the costs of implementation [12].

According to the RRC 2006 final acts T-DAB frequency block 12D (within twelve digital TV channel) is used, based on Recommendations of the ITU-R BS.1660-3 assigned to the territory of AP Vojvodina. It is important to note that the above values of the height of transmitting and receiving antennas planning level, which are used for the calculations in the software ICS telecom. Effective radiated power of the transmitter are selected to provide the best possible coverage without interference [8].

TABLE I   THE BASIC PARAMETERS OF T-DAB BASE STATIONS

Number of BS	Name of BS	The spatial x, y, z coordinates of the Base Station	T-DAB frequency block	Transmitter antenna height (m)	ERP (W)
1.	Subotica	19.38040/46.04310/112	12D	159	3000
2.	Sombor	19.09018/45.46496/80	12D	150	3000
3.	Zrenjanin	20.21254/45.23088/76	12D	74	3000
4.	Kikinda	20.27112/45.51428/75	12D	150	3000
5.	Srbobran	19.47406/ 45.32598/78	12D	50	1000
6.	Bač	19.14409/45.23598/79	12D	50	3000
7.	Čot	19.42398/45.09156/538	12D	60	1500
8.	Kula	19.31478/45.36478/98	12D	50	1000
9.	Bečej	20.02363/45.37285/77	12D	50	1000
10.	Ada	20.06148/45.48172/77	12D	50	1000
11.	Kanjiža	20.01387/46.03202/76	12D	50	1000
12.	Bačka Topola	19.39141/45.48220/100	12D	50	1000
13.	Karađorđevo	20.32153/45.35283/72	12D	50	1000
14.	Gap filler	19.50190/45.45310/92	12D	30	100
15.	Gap filler	20.42581/45.33427/74	12D	30	100

There are other parameters that are not listed in Table I, as shown for example are the same for all base stations:

- Central radio frequencies - 229.072 MHz
- Type of transmitting antenna - omni-directional
- The transmission antenna pattern- undirected

- Polarization transmission antenna - horizontal
- Receiving antenna height - 10m
- Broadcast signal - T-DAB
- Bandwidth - 1536 kHz
- Used modulation - COFDM and DQPSK

All base station T-DAB system, as defined in Table I, broadcast the same signal at the same time and in this way form a closed SFN network [12].

D. The coverage area of individual base stations

The coverage area of a broadcasting station, or a group of broadcasting stations, in the case of a single-frequency network (SFN), is the area within which the wanted field strength is equal to or exceeds the usable field strength defined for specified reception conditions and for an envisaged percentage of covered receiving locations.

In defining the coverage area for each reception condition, a three-level approach is taken: Level 1:

Receiving location; Level 2: Small area coverage and Level 3: Coverage area [10].

Based on software simulation obtained with ADTI ICS telecom tools Fig. 4 shows the closed SFN networks with field strength (in dB μV/m and dBm) and zones of coverage of individual base stations without gap fillers on the part of the territory of AP Vojvodina without synchronization. Figure 4 shows a total of 13 base stations, within a closed SFN networks, for broadcasting T-DAB signal. It is important to note that the value of the field strength decreases with distance from base stations. The minimum signal level required for good reception is 62dBm. In some areas we may note of overlapping of T-DAB signals of neighboring base stations.
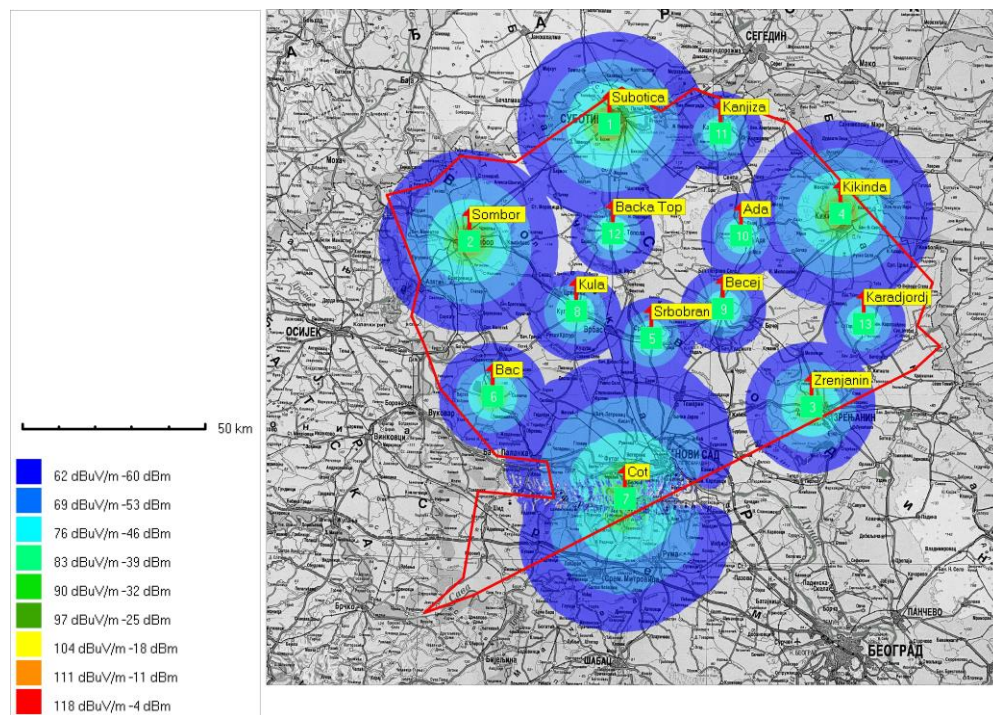

Figure 4   Closed SFN networks without synchronization, with zones of coverage of individual base stations

E. Comparison of methods for the synchronization on the first signal and the strongest signal within a closed SFN network in terms of the whole network

Figure 5 shows the relations between the C/I (Carrier to Interference) in dB, in a closed SFN network with a total of 15 base stations in the territory of AP Vojvodina, in the case of the method of synchronization to the first signal (first server) is applied. All base stations within a closed SFN network broadcasting T-DAB signal.

Figure 6 shows the applicable C/I (in dB) in a closed SFN network with a total of 15 base stations in the territory of AP Vojvodina, in the case of the method of synchronization to the strongest signal (best server) is applied. All base stations within a closed SFN network broadcasting T-DAB signal. It is noteworthy that in Fig. 6 shows relations C/I of individual base stations without

displaying areas where there is overlapping T-DAB signals of neighboring base stations.

Figure 7 shows the coverage zone of individual base stations within a closed SFN networks with a total of 15 base stations in the territory of AP Vojvodina and areas where there is overlapping T-DAB signals of neighboring base stations, if used synchronization to the strongest signal (best server).

Based on the Figures 5, 6 and 7 we conclude that in the present case better coverage (in terms of enhanced relations carrier to interference), inside a closed SFN network in the territory of AP Vojvodina, the method of synchronization is achieved at the first signal. This fact does not mean that the general method of synchronizing the first signal provides better coverage of the synchronization method in the strongest signal.
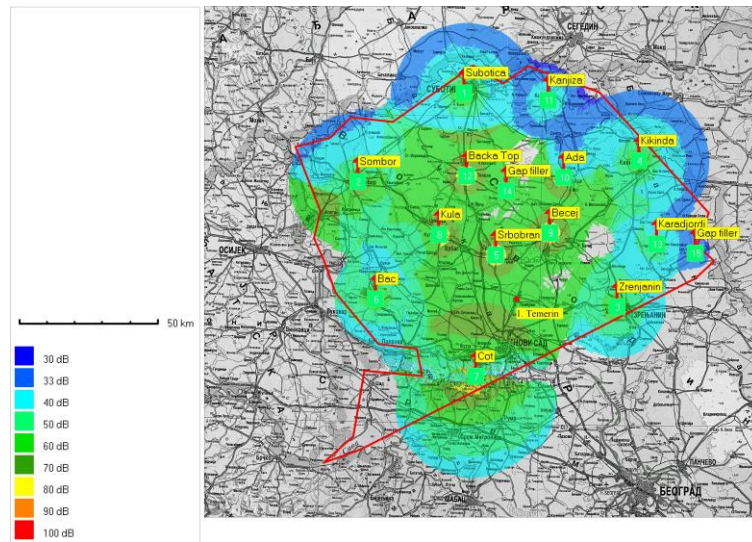
Figure 5   The C/I ratio in dB, in the case of the method of synchronization to the first server
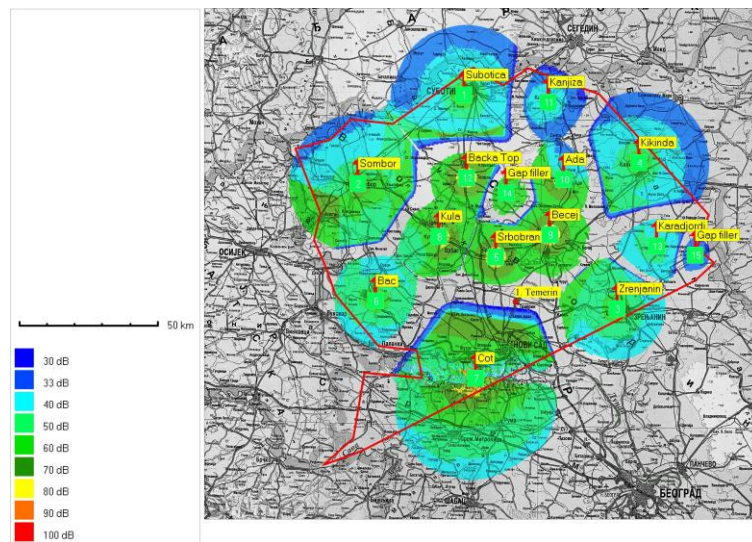

Figure 6   The C/I ratio in dB, in the case of the method of synchronization to the best server
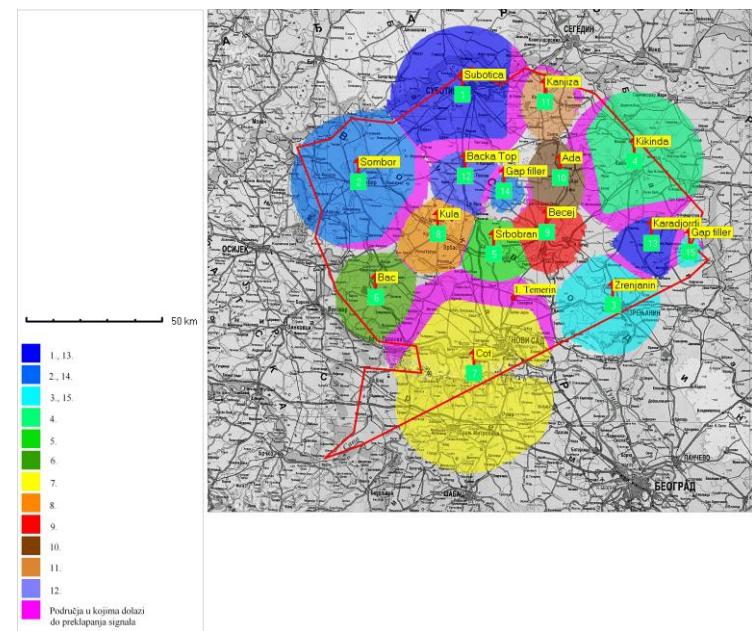

Figure 7   The coverage zone of individual base stations

F. Comparison of methods for the synchronization on the first server and the best server within a closed SFN networks on one receiving location

Table II shows the calculation of field strength (FSR) and signal delay of all base stations for the destination place number 1 "Temerin", when used in the first method of synchronization signal (first server). In the example shown first server base station number 5 "Srbobran". Delays signal all the base stations are positive, so the overlap of signals of all base stations during process of Inverse Fast Fourier Transform (IFFT) be constructive. This means that there is no interference (I=0dB). For speaking reception place ratio C/I=66dB, which is the value of the carrier (C=66dB) because they are all overlapping signals constructive. Figure 5 also illustrates this situation.

TABLE II FSR AND DELAY FOR BS NUMBER 1 TEMERIN (FIRST SERVER METHOD)

Signal overlapping	BS	FSR (dBµV/m)	Signal delay (µs)
Constructive	1.	34	198
Constructive	2.	35	178
Constructive	3.	46	64
Constructive	4.	37	165
Constructive	6.	35	109
Constructive	7.	66	44
Constructive	8.	41	62
Constructive	9.	44	32
Constructive	10.	32	100
Constructive	11.	23	185
Constructive	12.	32	102
Constructive	13.	28	124
Constructive	14.	24	73
Constructive	15.	14	165
C = 66 dB, I = 0 dB, C/I = 66 dB			
BS No 5. FSR= 54 dBµV/m			

Table III shows the calculation of field strength (FSR) and signal delay of all base stations for the destination place number 1 "Temerin" if is used a method of synchronization to the strongest signal (best server). In the example shown best server base station under number 7, "Cot". There are positive or negative delay signal base stations, and will overlap the signal base stations under 5 "Srbobran" and 9 "Bečej" when IFFT process be destructive. Signals of base stations under 5 and 9 come much earlier, which interferes with reception. This means that there is interference (I=23dB). For reception place number 1 ratio C/I=43dB, which is the value of the

carrier (C=66dB) because some overlapping signals are destructive. Figures 6 and 7 also illustrates this situation.

TABLE III FSR AND DELAY FOR BS NUMBER 1 TEMERIN (BEST SERVER METHOD)

Signal overlapping	BS	FSR (dBµV/m)	Signal delay (µs)
Constructive	1.	34	153
Constructive	2.	35	133
Constructive	3.	46	18
Constructive	4.	37	120
Destructive	5.	54	− 45
Constructive	6.	35	64
Constructive	8.	41	17
Destructive	9.	44	− 13
Constructive	10.	32	54
Constructive	11.	23	140
Constructive	12.	32	57
Constructive	13.	28	78
Constructive	14.	24	28
Constructive	15.	14	119
C = 66 dB, I = 23 dB, C/I = 43 dB			
BS number 7. FSR= 66 dBµV/m			

For reception place number 1 "Temerin" is more efficient synchronization of the first server than the best server, because we can get a higher ratio of carrier to interference i.e. higher signal to noise ratio (SNR). This fact does not mean that the general method of synchronizing to the first server of more efficient methods of synchronizing to the best server, but this is only the case in the example shown.

IV. CONCLUSION

The main advantage of the DAB system from the point of broadcasters is using the same radio frequencies for radio broadcasting of certain programs within the territory of the whole country or part thereof. From the user's perspective the basic advantage of the DAB system is a good quality of reproduced sound without interference and disruption. Thanks to the use of SFN enabled the continuous reception of high quality DAB signal without interference, on the same radio frequency, regardless of whether the DAB receiver is fixed, portable or mobile. Given that the DAB receiver automatically controlled, all the available radio stations are automatically selected, stored and displayed on the display of DAB receivers in the form of a list. So, while driving certain DAB radio stations can be heard on the same radio frequency within the territory of the whole

country or part thereof and no need to manually tuning the radio station but the desired radio stations selects from the displayed list.

This paper presents a simulation of a closed SFN networks for broadcasting T-DAB signal in the territory of AP Vojvodina, and compared the method of synchronization on the first signal (first server) and on the strongest signal (best server). Based on these results we conclude that in the present case a more efficient method of synchronizing the first signal. This fact does not mean that the general method of synchronizing the first signal of more efficient methods of synchronizing the strongest signal. Presents methods of synchronization are simpler methods for synchronization, and there are several complicated methods for synchronization. Substantial engineering question is: "Which method you choose to sync?". The unique answer to this question generally does not exist!

The efficiency of methods for synchronization depends on the selected broadcasting network Multi Frequency Network (MFN) or SFN, the structure of the broadcasting network (single base station, open or closed), the total number of base stations, geographic locations of base stations, planned height of transmitting antenna, the value of ERP these transmitters and many other parameters.

The best solution is to individually use multiple methods to synchronize and to compare the results and based on them in practice to implement the most effective method for which there are funds.

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CRM as a concept of successful business

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Abstract - The better a business can manage the relationships it has with its customers the more successful it will become. Therefore IT systems that specifically address the problems of dealing with customers on a day-to-day basis are growing in popularity. Customer relationship management (CRM) is not just the application of technology, but is a strategy to learn more about customers' needs and behaviors in order to develop stronger relationships with them. As such it is more of a business philosophy than a technical solution to assist in dealing with customers effectively and efficiently. Nevertheless, successful CRM relies on the use of technology. This guide outlines the business benefits and the potential drawbacks of implementing CRM. It also offers help on the types of solution you could choose and how to implement them.

I. INTRODUCTION

Selling has always been the vital force in carving the economic development of any company. Aptly described, "the development of selling has been from 'hawkers and walkers' to a burdensome role imposed by the aggressive marketing regimes introduced by the large, bureaucratically managed companies." More so in the present world, where competition and fast track culture dominates the market place, selling is a real challenge. Today, selling or even marketing means a lot more than what the dictionary defines it as' the exchange of goods for an agreed sum of money. "Both for selling as well as for marketing, they must have knowledge of everything - leads, queries, customers, sales, feedback, relationship, and requirement and so on. Similarly, the advent of technology has brought about an apparent change in the organizations' approach to customer relationship. And technological advances have brought more of company's relationships to be managed through electronic means. There is a need created for companies to automate services and personalize communication with customers. The need is primarily about having an application or a system in place to effectively manage the sales process and customer relationship; capture vital data and information about customers - purchase history, revenue generated, up selling / cross-selling opportunities, etc.., and generate sales or create quote orders. To be precise, the need of the hour is to have a 360-degree view of ones business. This is why the Customer Relationship Management has gained so much popularity among all businesses.

II. DEFINITION OF CRM

Customer relationship management (CRM) is a term that refers to practices, strategies and technologies that companies use to manage and analyze customer interactions and data throughout the customer lifecycle, with the goal of improving business relationships with customers, assisting in customer retention and driving sales growth [6]. CRM systems are designed to compile information on customers across different channels or points of contact between the customer and the company which could include the company's website, telephone, live chat, direct mail, marketing materials and social media. CRM systems can also give customer-facing staff detailed information on customers' personal information, purchase history, buying preferences and concerns.

Customer Relationship Management is defined differently in the works of foreign and domestic authors. In short, the company or organization is very rich in information about customers. It knows lots about them. But the information is not shared. It's only available to specific job functions. If a sales person wants to know about what issues are outstanding with customer service for a particular customer, then they have to make contact with the holders of that information and wait for a response. In a customer focused company, the information flow and the ability to access Information is very different:

Figure 1. One of more CRM definition [8]

III. SIGNIFICANT STEPS TO IMPLEMENT CRM

Many Customer Relationship Management (CRM) applications saturate the market place today, but does choosing the right package to automate your Sales, Marketing, Service and Support functions automatically guarantee you success? Although selecting the right product is important, it is only one piece of the implementation cycle that will assure the expected ROI and the 'buy in' of employees. Keep in mind the overall goals of a successful CRM solution: [7]

- A framework for all areas of customer relations
- A record and report on the activities related to groups or individuals
- Analysis tools and reports for forecasting
- Ability to predict areas of success or failure.

A successful CRM solution must meet the goals without compromising employee productivity; thus it is also important for the solution to incorporate:

- Task automation for repetitious day-to-day activities
- Tools to avoid missed opportunities or forgotten promises
- A process that is tailored to best fit in the company's existing business processes.

Figure 2. 7 step methodology to successful CRM implementation [5]

IV. BUSSINESS BENEFITS OF CRM

Implementing a customer relationship management (CRM) solution might involve considerable time and expense. However, there are many potential benefits. A major benefit can be the development of better relations with your existing customers, which can lead to: [1]

- Increased sales through better timing due to anticipating needs based on historic trends

- Identifying needs more effectively by understanding specific customer requirements
- Cross-selling of other products by highlighting and suggesting alternatives or enhancements
- Identifying which of your customers are profitable and which are not.

This can lead to better marketing of your products or services by focusing on:

- Specifically at customer needs
- A more personal approach and the development of new or improved products and services in order to win more business in the future effective targeted marketing communications aimed.

Ultimately this could lead to: [2]

- Enhanced customer satisfaction and retention, ensuring that your good reputation in the marketplace continues to grow
- Increased value from your existing customers and reduced cost associated with supporting and servicing them, increasing your overall efficiency and reducing total cost of sales
- Improved profitability by focusing on the most profitable customers and dealing with the unprofitable in more cost effective ways.

Once your business starts to look after its existing customers effectively, efforts can be concentrated on finding new customers and expanding your market. The more you know about your customers, the easier it is to identify new prospects and increase your customer base.
Even with years of accumulated knowledge, there's always room for improvement. Customer needs change over time, and technology can make it easier to find out more about customers and ensure that everyone in an organization can exploit this information.

V. IMPORTANCE OF CRM

Customer Relationship management is the strongest and the most efficient approach in maintaining and creating relationships with customers. Customer relationship management is not only pure business but also ideate strong personal bonding within people. Development of this type of bonding drives the business to new levels of success.

Once this personal and emotional linkage is built, it is very easy for any organization to identify the actual needs of customer and help them to serve them in a better way. It is a belief that more the sophisticated strategies involved in implementing the customer relationship management, the more strong and fruitful is the business. Most of the organizations have dedicated world class tools for maintaining CRM systems into their workplace. Some of the efficient tools used in most of the renowned organization are Batch Book, Sales force, Buzz stream, Sugar CRM etc. [3]

Looking at some broader perspectives given as below we can easily determine why a CRM System is always important for an organization.

1. A CRM system consists of a historical view and analysis of all the acquired or to be acquired customers. This helps in reduced searching and correlating customers and to foresee customer needs effectively and increase business.

2. CRM contains each and every bit of details of a customer, hence it is very easy for track a customer accordingly and can be used to determine which customer can be profitable and which not.

3. In CRM system, customers are grouped according to different aspects according to the type of business they do or according to physical location and are allocated to different customer managers often called as account managers. This helps in focusing and concentrating on each and every customer separately.

4. A CRM system is not only used to deal with the existing customers but is also useful in acquiring new customers. The process first starts with identifying a customer and maintaining all the corresponding details into the CRM system which is also called an 'Opportunity of Business'. The Sales and Field representatives then try getting business out of these customers by sophistically following up with them and converting them into a winning deal. All this is very easily and efficiently done by an integrated CRM system. [4]

5. The strongest aspect of Customer Relationship Management is that it is very cost-effective. The advantage of decently implemented CRM system is that there is very less need of paper and manual work which requires lesser staff to manage and lesser resources to deal with. The technologies used in implementing a CRM system are also very cheap and smooth as compared to the traditional way of business.

6. All the details in CRM system is kept centralized which is available anytime on fingertips. This reduces the process time and increases productivity.

7. Efficiently dealing with all the customers and providing them what they actually need increases the customer satisfaction. This increases the chance of getting more business which ultimately enhances turnover and profit.

8. If the customer is satisfied they will always be loyal to you and will remain in business forever resulting in increasing customer base and ultimately enhancing net growth of business.

In today's commercial world, practice of dealing with existing customers and thriving business by getting more customers into loop is predominant and is mere a dilemma. Installing a CRM system can definitely improve the situation and help in challenging the new ways of marketing and business in an efficient manner. Hence in the era of business every organization should be recommended to have a full-fledged CRM system to cope up with all the business needs..

VI. FIVE REASONS WHY CRM IS IMPORTANT FOR SMALL BUSSINES

Customer relationship management (CRM) enables small business owners to tackle operational challenges, including sales decline, high client attrition, and misalignment between corporate revenue targets and salespeople's commission policies. If you are a small business owner, there are several ways a client tracking tool can positively affect your bottom line; check out our top five.

1. Client Management - You can use a CRM tool to get more visibility into your client base, ponder the tactics needed for long-term profitability, and formulate better plans that impel your staff to break new operational ground. For example, if the software reveals that 80 percent of your customers are in the pharmaceutical sector, you could hire more salespeople with a medical or pharmacological background, or implement a training program to elevate your sales staff's awareness of the pharmaceutical industry.

2. Profitability Tracking - This tool can also ease up the work of your accountants. They no longer need to worry about tracking every cent of revenue and focusing on shipping costs, product discounts, and client returns. The software helps give a small business a speedy bookkeeping system and more accurate financial reporting, which are important processes in the corporate value chain. When corporate strategists talk about "value chain," they are referring to the collection of tasks and tools that enable a business to grow sales, run efficient operations, and post positive results at the end of the year.

3. Regulatory Compliance - An effective client policy enables small business owners to automate some business processes that were previously manual. This is a winning approach in the long term, especially when it helps you comply with federal and state laws and industry standards. For example, you may not need to hire a team of compliance analysts to perform regulatory checks if you apply the correct settings to a CRM tool. You can instruct the tool to flag a high-risk client or generate the relevant documentation based on the client's risk score.

4. Sales Strategy - As a small business owner, the last thing you want is to lose income by targeting the wrong customer segment, an indication for slender margins down the road. Client administration programs can provide you valuable intelligence about long-term sales

trends, helping you adjust the existing corporate sales strategy and results tactics. For example, a five year analysis of your janitorial services company's sales data shows that income from car manufacturers is in decline, while revenue derived from the higher education sector is on the rise. Based on these results, you may decide to target universities and colleges more aggressively and gradually pull back from the auto sector.

5. Customer Service Improvement - CRM can improve a company's customer service practices, helping employees respond to clients' queries quickly and effectively. For example, an entrepreneur can track customers' complaints and see where and why the company is not performing well. The software can also provide insights into clients' order trends, ensuring that personnel never mess up any order related questions in the future.

Client management applications can give a small business operational superiority in key areas. This tool enables your company to understand what it takes to build an effective customer outreach policy and boost sales. Before selecting a customer tracking program, make sure it fits your company's operating processes, industry, revenue cycle, and customer base.

VII. CRM IN SERBIA

Improving the competitiveness of Serbia should look at shifting the focus on micro level decision-making, as well as acceptance of the new philosophy of business - strategic management and innovation. The survey was conducted in 2006. The EU has confirmed that companies without CRM: [4]
• On average lose 50% of their customers every five years,
• About 65% of lost customers leaving because of poor service and communication,
• The cost of acquiring a new service to the client is five times higher than the cost of retaining the old.
Companies that have developed CRM concept:
• Growth of almost 60% faster than their competitors without developed CRM
• expand the market by 6% per year,
• 10% charge more for their products,
• realize the return on investment (ROI) of 12%,
• Increase customer loyalty by 5% can result in increased profits by 25% - 85%.

VIII. CONCLUSION

Be sure to remember that no matter what size your company may be, customer relationship management is very important. New technology is available and using it to keep your customer relationship management techniques up to date is very important.

Analyzing this work, it can be said that the CRM:
• The Companies strategy, which is oriented towards creating and maintaining customer relationships
• Philosophy direction to consumers Organizational culture that contributes to the creation of a suitable climate for the establishment of a true relationship with customers
• A set of methodologies that define ways of establishing and maintaining good relationships with customers
• A set of software utilities that provide technical and technological support to managing customer relationships.

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INFORMATION RETRIEVAL FOR UNSTRUCTURED TEXT DOCUMENTS: LUCENE SEARCH

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Abstract - In performing their daily activities, primarily business, people produce a large amount of data in digital form. Most of these data are contained in text documents which are stored in various data warehouses. Most documents containing data, information and knowledge are in text format and adjusted for printing. In addition, these documents belong to unstructured documents, so the information search process is not trivial at all. Information retrieval, data mining, text mining, machine learning, statistics and computational linguistics are some of the fields concerned with this issue. Unstructured documents search requires development of a *search engine* based on indexing and search process. One of such available technologies that can be applied is Apache Lucene. Apache Lucene is a specialized library for complex searches, and consists of very complex functions. Algorithms and mechanisms on which the functions are based are very complex, and require a special approach aiding to their understanding. In this paper, the emphasis is on in-depth analysis of the Lucene search mechanism.

Keywords: Information Retrieval, unstructured documents, text mining, Apache Lucene, search mechanism

I. INTRODUCTION

In performing their various activities, primarily business, people daily produce a large amount of data in digital form. Most of these data are contained in text documents stored in various data warehouses. Most documents containing data, information and knowledge are in text format and adjusted for printing. Text documents are often in unstructured form [1].

The arising problem is the use of the information contained in unstructured documents, and which are stored in large document warehouses. One solution to this problem is the in-depth analysis of the text, so called text mining. In-depth analysis of the text refers to the search of necessary and nontrivial data, information and knowledge in unstructured

documents. Text mining is a new scientific discipline derived from information retrieval, data mining, machine learning, statistics and computational linguistics [2].

There are a number of tools dealing with text mining but, unfortunately, all of them have the problem in natural language processing. Natural languages are not designed for analytical processing; therefore it is necessary to previously prepare them for this process. One of the application concepts sees the Natural Language Processing (NLP) as a set of techniques and methods for automatic generation of texts in natural language. This concept is applicable and supports many languages [3] [4].

In general, consuming these solutions takes place through two processes: indexing and searching. The quality of obtained information depends on quality of indexing and searching performed by search engine. Data about documents are therefore stored in an index file or database, intended for later use in the search of a user giving query. An index can be seen as a traditional back-of-the-book index which contains a list of words, names or phrases which pointed to materials relating to that heading [5].

Indexing and searching features of document search engines could be provided by some specific applications called Search Engine Libraries. One of those applications is Apache Lucene. Apache Lucene is a part of Apache Foundation and according to the founder „Lucene is a Software library for full-text search. It is not an application but rather a technology that can be incorporated in applications." Lucene is a scalable search library. It is a solid basis, on which a search application can be developed. Lucene can analyse and index textual contents, it can search inside the created index and display hits for a given query.

Apache Lucene is a specialized library having complex search capabilities and functions. These functions may be included in various programming languages (Java, C, .NET, etc.), but it is primarily

necessary to understand their functionalities. Functions based on complex algorithms and mechanisms require a special approach to their understanding. Lucene search mechanism is a necessary component for search in text documents indexed by Lucene.

II. APACHE LUCENE

Lucene is a high performance, scalable Information Retrieval (IR) library. Information retrieval refers to the process of searching for documents, information within documents or metadata about documents. Lucene lets you add searching capabilities to your applications. It is a mature, free, open-source project implemented in Java; it's a project in the Apache Software Foundation, licensed under the liberal Apache Software License. As such, Lucene is currently, and has been for quite a few years, the most popular free IR library[6].

Applications such as Amazon are among the commercial application that use Lucene for indexing and allowing effective searching. Lucene is able to index text from a various formats such as PDF, HTML and Microsoft Word, and also in various languages. (Paul 2004) The key classes used to build search engines are:

a. Document - The Document class represents a document in Lucene. We index Document objects and get Document objects back when we do a search.

b. Field - The Field class represents a section of a Document. The Field object will contain a name for the section and the actual data.

c. Analyzer - The Analyzer class is an abstract class that is used to provide an interface that will take a Document and turn it into tokens that can be indexed. There are several useful implementations of this class but the most commonly used is the StandardAnalyzer class.

d. IndexWriter - The IndexWriter class is used to create and maintain indexes.

e. IndexSearcher - The IndexSearcher class is used to search through an index.

f. QueryParser - The QueryParser class is used to build a parser that can search through an index

g. Query - The Query class is an abstract class that contains the search criteria created by the QueryParser.

h. Hits - The Hits class contains the Document objects that are returned by running the Query object against the index.

Apache Lucene is a software library, a toolkit, and Lucene is not a full-featured search application. Lucene allows add search capabilities to full search application. Lucene can index and make searchable

any data that you can extract text from. In order to understand exactly how Lucene fits into a search application, including what Lucene can and cannot do, we will now review the architecture of a "typical" modern search application.

Compositional structure of an application based on Apache Lucene could be consist of following components [7]:
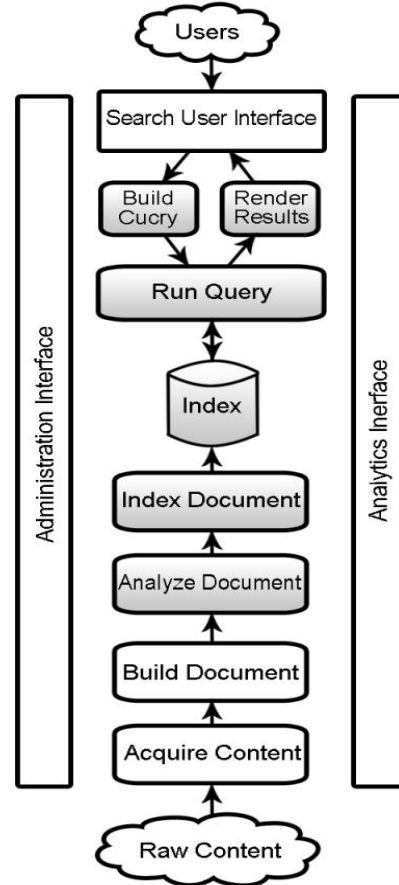

Figure 1: Typical components of search application.

- A data pool which holds all kinds of documents, for instance PDF, HTML pages XML documents, plain text document, Word documents or others. They may be files in the file system or contained in a database or generated by an application crawling the web. Lucene expects that data to be indexed are provided as Lucene Documents.

- Lucene Documents: The Lucene library does not contains the functionality to convert the original files in the data pool into Lucene documents. An application using Lucene should implement a document handler based on the provided Lucene document handler interface, in order to transform content into Lucene Documents. Nevertheless, for text

extraction, the application needs a so called document parser.

- An index: Lucene Documents are analysed and processed for indexing by the IndexWriter, that uses an analyzer and one or more filters, to generate index entries.

- An index search implementation: An Application can search the index by providing Lucene with search requests. A user request is analysed by the Lucene QueryParser and formatted in the Lucene query language. The Query parser builds a Lucene query data structure, which is a tree of clauses respecting the kind of user request. The Lucene query is passed to the Index searcher that retrieves the hits in the index. The result of the searching can then be displayed by the user application.

III. 3. LUCENE INDEXING SEARCH MECHANISM FOR UNSTRUCTURED TEXT DOCUMENTS

Lucene provides the mechanisms and components to search inside the index and to obtain hits on the search query. QueryParser and IndexSearch are the main components involved in Lucene based search engine. The search can be executed only after the indexing process and the creation of posting lists containing terms – the key words according to which the search is performed. In fact, search engine finds user query in the index. User query uses analyser as in indexing process and then transform the user query into a Query object with respect to the Lucene query language.

Figure 2 shows the concept of Lucene index search. The most important components of Lucene index search concept are QueryParser and IndexSearcher.
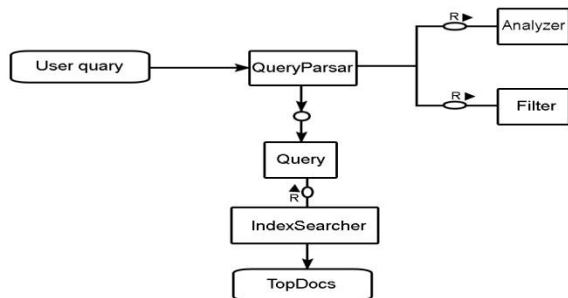

Figure 2: Searching a user query.

Package org.apache.lucene.QueryParser

Functionality of QueryParser (Figure 3) is defined in the package org.apache.lucene.QueryParser.

QueryParser parsed user query string and transforms it into query objects using a specific grammar for the Lucene query language. In the transformation process, the query terms are analyzed by a user specified analyzer, the one that has been used in indexing process.

The QueryParser, namely QueryParser.java class, processes the query with the support of the Lucene query grammar. Lucene query grammar, as defined in the „QueryParser.jj" class, defines semantic elements that a query should have, and the interpretation of those element. This class also gives the possible syntax of a clause in a query. With this specification QueryParser can translate user queries according to the grammar defined in „QueryParser.jj" class.
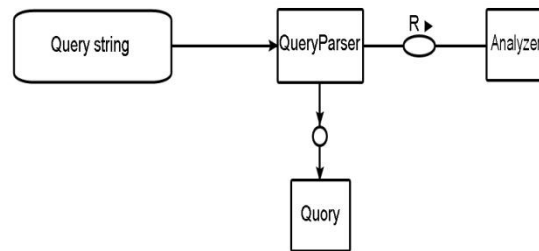

Figure 3: Lucene QueryParser;

As run time the QueryParser can take a query string from the user and recognize matches to the grammar. The query grammar is a list of specifications of what a user should look like before they are consumed by Lucene search engine. It means that the method of parsing () defined in the „QueryParser.jj" file is the one responsible for parsing user query into a Lucene query. A lucene query is defined as a set of clauses. A clause is made up of one or more terms and can also contain another Lucene query.

The representation of query in Backus-Naur Form (BNF) [8] is:

Query ::= (Clause)*
Clause ::= ["+","-"] [<TERM>":"] ([<TERM>|) "("Query")")

The role of QueryParser is to dissect a user query strings and pass it to the IndexSearch. The user query may have different forms: single word, sentence, conjunction, disjunction, etc.The Lucene defines a grammar according to whether a query is a clause or set of clouses. The clouse is a set of terms and symbols (*,?, tilde). The term is the textual part of the query (word, number). A condition between two query term can be „SHOULD" or „MUST":

- „SHOULD" - to specify that the term can be found (or not) in the index;

- „MUST" – means the term must necessarily be found in the index.

The QueryParser translates:
- Operator AND in a query MUST;
- Operator OR in a query SHOULD;

Package org.apache.lucene.Search

The result of the query parsing, i.e. performing of the QueryParser component, is produced by the Lucene Query.

Further in the process of search, Lucene Query is used by search package for retrieving terms and index. In particular, it is performed by IndexSearcher (Figure 4.) component being here, at the same time, a central component as well. IndexSearcher uses a directory or an IndexReader to access the index and collect information out of it. Directory is the representation of an Index as a File in the file system. IndexSearcher using an instance of Directory works with the path containing the index and accessing the Directory, by default, in read-only mode.

Afther accessing the index, the IndexSearcher uses one of the four implementations of the Searcher.search() method to search for the LuceneQuery. The search possibilities are represented by the structure: Weight, Filter, Sort, Query and Term, as seen below:

Weight - returns the weight of a query and scores documents for a query;
Filter - used to select which documents are to be displayed during search results;
Sort - use to displaied during searching;
Query - contains variable structure because it can be rewritten;
Term - can be taken out of the query and used to retrive all documents found in the index.
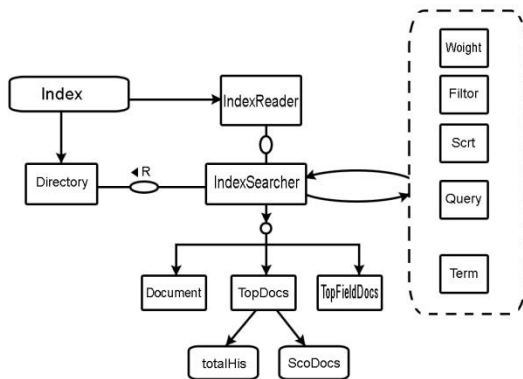
Slika 4. Lucene IndexSearch.

Lucene index search algorithm
The index search algorithm was describe in a paper written by Doug Cutting (the Lucene founder) and Jan O. Pedersen [9]. Considering a given query q, let scores be an array of length N, that will contain the result. Let queue be a queue containing the id (id) and the scores (scores[id]) of the matching documents, let k be the maximal number of results to display to the user. Here goes the index search algorithm:

```
Inverted_search (query) =
        scores = an array of lengh N initialized to zero
        queue = an emptx quene of (id, score) pairs ordered by
                ascending score
        for (t ϵ q) ; iterate over terms in query
                ps = postings(t) ; a posting stream for term t
                while (p = nextposting (ps)) ; iterate over
                postings
                        id = p.id, weight = p.weight
                        scores[id] = scores[id] + qt *
                                weight
                        if  (length(queue)=k + 1)
                                pop(queue)
                        inserte((id,scores[id]), queue)
                end
        end
        pop (queue)
        return (the contents of queue in descending order)
end
```

IV. EXPERIMENTAL RESULTS

To be able to perform the search process it is necessary to complete the process of indexing. Results of the paper "[5]" listed below in which the implementation of indexing process is presented are also used in this paper. Then, index files are created using a program written in Java SE 8 environment which includes the functions of the version Apache Lucene 5.2.0. Index files content is presented in the same paper in Figure 6 using LUKE 5.2.0. [10]. Term sorting is done according to the the number of occurrences of the term in a document.

In addition, LUKE 5.2.0 has the ability to perform term searches in index files. Index files here are designed for a set of documents FEDERALIST containing over 85 documents from Federalist No. 1 to Federalist No. 85. Their occurrence in the directory is shown in Figure 5 of Paper "[5]" listed below.

After index files are uploaded by LUKE 5.2.0, tab menu, where terms are sorted by numbers of occurrence in the documents, initially displays „Overview". By selecting tab menu "Search" you open tab for search. This tab contains field to enter terms which allow the search: "Enter search expression here".

The tab "Analysis" provides the option to choose one of the offered analyzers. During the process of indexing you choose the option "StandardAnalizer".

After you choose "StandardAnalizer" in the tab and perform search for the term (word) "government" you will obtain the result as shown in Figure 5.
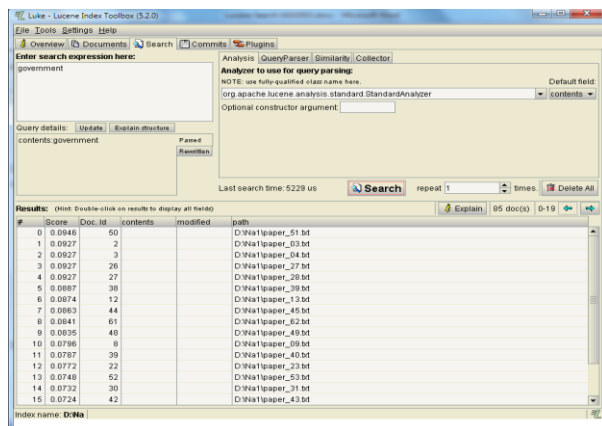

Figure 5: Display of search results for the term "government".

LUKE 5.2.0 shows that the term "government" is contained in 19 documents. The column "Score" shows the value of term occurrences in a document. For example, for the requested term "government" the greatest "Score" which is 0.0946 has a document with LUKE ID = 50 and its path is D: \ Na1 \ paper_51.txt. Performing this search takes 5202 total milliseconds.

V. CONCLUSION

Nowadays, people daily produce a large amount of data in digital form. Most of these data are contained in text documents stored in various data warehouses. The process of searching the necessary data, information and knowledge contained in text documents adjusted for printing and which are stored in large warehouses, is a very complex process. The search process itself includes various scientific, technical and technological achievements.

It is essential to carefully design and implement the process of indexing - search using state-of-the-art technology. One of the technologies is a package of Apache Lucene, which is a set of specialized functions for the purposes of indexing - search based search.

This paper presents some possibilities of the package of Apache Lucene version 5.2.0, with special emphasis on the process of search. It explains the mechanisms Lucena search and gives the algorithm by which the search is performed.

Based on research findings from paper "[5]" listed below and where the process of indexing is realized as well as index files created, this paper presents the process of search in Luke 5.2.0, in obtained index files. The search results for the term "government" using StandardAnalizer is shown.

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ICT creating new innovation ecosystems

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Abstract - Innovation is driving force for future growth. Economies of many countries are mostly based on old, traditional linear models of "closed" innovation, that include none or minimal external stakeholder engagement in creating market value. However, in order to achieve the well-being of the whole society, all relevant external stakeholders should be involved in creating open innovation environments and platforms that foster collaboration and co-creation of new business solutions. In today's knowledge society ICT enables availability of different and various pieces of information in global terms. One of the most brilliant scientists Einstein long time ago said that "Imagination is more important than knowledge". The core of every successful business or project is imagination. The more you use it, the better results you achieve. In order to use information to create new real market value and innovative business approaches, good ideas, imagination and intuition is necessary. Wisdom of innovative open-minded stakeholders creates wisdom society.

I. CLOUD COMPUTING

The Digital Agenda for Europe (DAE) is the European Union's roadmap for bringing the benefits of a digital society and economy to Europe's citizens [3]. DAE highlights the importance of developing EU-wide strategy on Cloud Computing. Neelie Kroes, Vice-President of the European Commission responsible for the Digital Agenda in says that Europe should be 'cloud-active' rather than only 'cloud-friendly'. She founds Cloud critical for further growth in Europe. To take full advantage of the cloud's potential, while protecting the citizens' interests, Europe needs a cloud-friendly legal framework, and a cloud-active community of providers and users [6]. In Summer 2012 European Commission proposed European Cloud Computing Strategy. In addition, new initiative on cloud computing has been announced – the European Cloud Partnership. Within the right framework, cloud computing can help create jobs and boost economic growth [6].

The three broad areas for the cloud strategy are [3]:
1. The legal framework which addresses the questions about data protection and privacy in international dimensions, as well as the other laws and rules.
2. Technical and commercial fundamentals with the aim to extend EU's research support and focus on critical issues such as security and availability of cloud services.
3. The market where pilot projects will be supported aiming at cloud deployment.
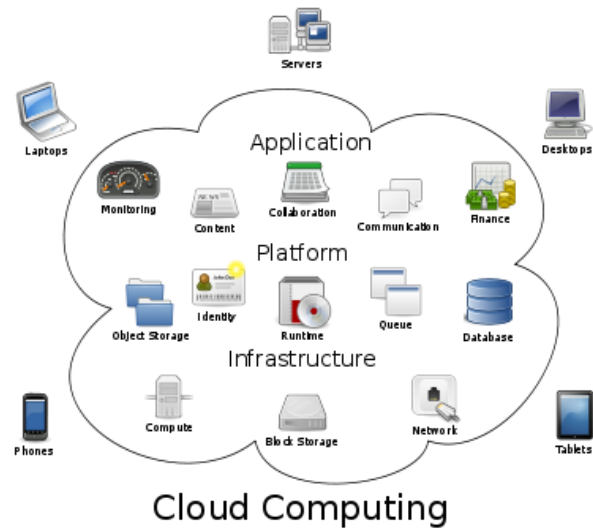

Figure 1. Cloud Computing – emerging trend that fosters e-services and enables societal growth

Cloud computing is a general term for anything that involves delivering hosted services over the Internet. These services are broadly divided into three categories: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS). The name cloud computing was inspired by the cloud symbol that has often been used to represent the Internet in flowcharts and diagrams. A cloud service has three distinct characteristics that differentiate it from traditional hosting. It is sold on demand, typically by the minute or the hour; it is elastic -- a user can have as much or as little of a service as they want at any given time; and the service is fully managed by the provider (the consumer needs nothing but a personal computer and Internet access) [4].

Main advantages of Cloud Computing are better availability of e-services with significant cost savings. Therefore, companies and national economies that will use in the future advance business concept cloud computing rather than the traditional will have bigger ROI and will contribute to more efficient societal development. In addition, new concepts and ICT enabled technologies create various kinds of different jobs towards prosperous societal development. Open innovation concept together with social media and cloud computing will create new business environment where all stakeholders are engaged in value aggregation and will have crucial impact on filling the targets of Europe 2020 strategy.

Removing the barriers by creating the legal framework for cloud computing strategy and setting the wide

community of active users is one of the ways to boost growth and jobs. Unlocking the full potential of social media technologies, cloud computing and other Internet-based emerging solutions will foster the process of establishing open innovation environment where new business solutions are being made.

II. FUTURE INTERNET PUBLIC – PRIVATE PARTNERSHIPS FI PPP

The Internet has become a fundamental enabler of economic development and growth [2]. Internet – based innovation will become leader on global Internet industry. As a result, the European Commission determined that the Future Internet and innovation will be crucial components of the Europe 2020 strategy for the EU's growth for the following decade, as well as its flagship initiative - the Innovation Union. The European Union is has the world's largest business-to-consumer (B2C) e-Commerce market. However, the EU is not a leader in the global Internet economy. Europe has been slower than the US or Japan to exploit the potential of Internet-based innovation. EU is not using all the benefits that it could have from FI PPP. Thus, European Commission is dedicated to establish solid fundamentals and foster future Internet economy in Europe.

The Future Internet Public-Private Partnership (FI PPP), officially launched on 3rd May 2011, is an initiative framed under the Digital Agenda for Europe (DAE) (European Commission, 2010). It aims to advance Europe's competitiveness in Future Internet technologies and systems and to support the emergence of Future Internet-enhanced applications of public and social relevance(European Commission, 2010).The FI PPP addresses the challenges of making public service infrastructures and business processes significantly smarter (i.e. more intelligent, more efficient, more sustainable)through tighter integration with Internet networking and computing capabilities. (2)

Figure 2. Future Internet PPP buzzwords: in what way it can affect European jobs and growth?

III. DYNAMICS OF NEW INNOVATION ECOSYSTEMS

Current ecosystems are in aligned to the existing rules of modern economy and entrepreneurship. In order to achieve Europe 2020 strategy targets, EU should create continuous growth and well-being of economies of Member states. The urge for societal growth creates new jobs and businesses that require different ecosystems. Ecosystems of the future are the ones that put open

innovation as the hub where only ideas and projects created by internal and external stakeholders start to get their successful realization at the market.

Future open innovation ecosystems are innovative, dynamic social media – based ecosystems where ideas and innovation find faster way to express themselves at the market. pen innovation is a paradigm shift where companies use expertise of external resources of innovation community. Dynamics by its definition means pattern of change or growth of an object, or force or intensity of a phenomenon [8]. Therefore, dynamic open innovation environments constantly change over time, including change of stakeholders, information, ideas, knowledge and other resources.

IV. CONCLUSION

Social enterprises are businesses operated by non-profits with the dual purpose of generating income by selling a product or service in the marketplace and creating a social, environmental or cultural value [8]. We define it as mission oriented revenue or job creating projects undertaken by individual social entrepreneurs, non-profit organizations, or non-profits in association with for profits [7]. Social enterprises address societal challenges: education, politics, health, transport, etc. The stronger the impact to the society is, the more successful the enterprise is. Strong dedication to solving societal issues is the main focus of these organizations. Entrepreneurs should be very familiar with the Europe 2020 strategy for growth and accordingly preparing the creative solutions that have the materialization at the market.

Socialenterprises that focus on overcoming technological challenges or cost barriers contribute to innovation. Many offer opportunities for small-scale producers and microenterprises,including those operating outside the formal economy, and thus contribute to poverty reduction and improved livelihoods.Crucial lessonslearned in ensuring the effectiveness of these social enterprise initiatives include [10]:

- governments shouldconsider development of "social enterprise" institutional and policy frameworks that include appropriate taxregimes and incentives, business support programmes that are tailored to the needs of the sector, and access topublic sector technological expertise and R&D;
- enterprises need to draw on both non-profit and for-profitfinance models;
- government needs to preserve the co-benefits generated by social enterprises; it may benecessary to introduce regulations and instruments that protect them from undercutting competition and encourage their attention to generation of co-benefits.

Nowadays social enterprises have big potential that is not fully used due to the lack of policy framework and ignorance of their business solutions. Consequently, people are not willing to take additional risk. Social enterprises are citizens' initiatives with few employees who put significant effort in ensuring financial resources.

Citizens are strongly involved in the process of providing services and goods in open innovation environment through public-private-people-partnerships (PPPP).

A social enterprise is an operator in the social economy whose main objective is to have a social impact rather than make a profit for their owners or shareholders. It operates by providing goods and services for the market in an entrepreneurial and innovative fashion and uses its profits primarily to achieve social objectives. It is managed in an open and responsible manner and, in particular, involves employees, consumers and stakeholders affected by its commercial activities. Social impact as intangible asset and contribution to the society prosperity is difficult to measure by existing economic metrics. Statistical data of real impact of social enterprises and their current status across EU is the goal of call for proposals of economic impact of social enterprises by Enterprise & Industry Directorate General, European Commission. The importance of using social enterprises as emerging efficient channel of communication between citizens, government and industry should be highlighted as one of the platforms that provide more efficient and user-friendly business solutions.

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Cross-border infrastructure for educational webcasting

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Abstract – In the era of IP technologies expansion and high speed Internet video broadcast via web becomes widely used technology. Besides its usage for streaming media (Internet TV and music), business and fun, it surely has its place in education. It can be used in education at all levels, from primary schools to universities. In this paper is presented EduWebCast system, cross-border platform for live and on demand educational video streaming. This platform is built and used on two universities, allowing students from both universities to access materials and allowing teachers from both universities to share the experience in building educational videos and to work together on joint curricula's. In this paper is presented structure of the system, as well as experience with its usage during the last two months of summer semester.

I. INTRODUCTION

The rapid development of communication technologies allows almost unlimited opportunities in accessing multimedia materials. The enormous growth of Internet users directly affected the accessibility to video streaming services via web.

Today, live and on demand video streaming is widely used on Internet. It is mostly used for fun and business, but it should be pointed that video streaming can be very useful in education [1,2,3]. It can be applied at educational institutions, from primary schools to universities. It can be used for distance learning [4,5] environments and as a support for the traditional classroom lectures. The area of application of video streaming lectures can be different, from computer science and engineering courses to medicine [6,7]. Video content is also extensively used by Massive Open Online Courses, known as MOOCs.

The variety of technologies and platforms can be used to deliver educational video such as: cloud computing [8], wireless mesh networks [9] and others [10]. Also there are a lot of researches in the academic world trying to improve or to evaluate the efficiency of educational video streaming systems [11,12].

In this paper an approach of building platform for educational web casting system – EduWebCast, is presented. This platform is made between two universities, one from Romania and one from Serbia. The platform is international and it is built to deliver courses from the field of Computer Science for students of both universities, as well as for high school pupils and interested IT professionals who wants to keep pace with the appearance of the new technologies.

This paper is structured as follows. In the second section it is presented joint cross-border EduWebCast system and its structure and components. In the third section the hardware infrastructure and software platform composing the system are introduced. The statistic data about the system usage is given in the forth section. The conclusion is given in the fifth section of the paper.

II. JOINT EDUWEBCAST SYSTEM STRUCTURE

EduWebCast platform development has been a joint effort between UPT (LP) and TFZR (PP) aiming at a redundant high performance infrastructure for uploading, storing, tagging, sharing and rating educational materials from both institutions to students and pupils in the Romania-Serbia border region. The main objectives of the hardware-software platform design are (1) provide both institutions with a redundant platform to store educational materials in both locations; (2) provide end users (students) in both regions with fast access at high quality video streaming to educational materials; (3) integration with existing hardware-software infrastructure existing in both institutions; and (4) provide access to common features such as platform analytics, or materials' rating and sharing.
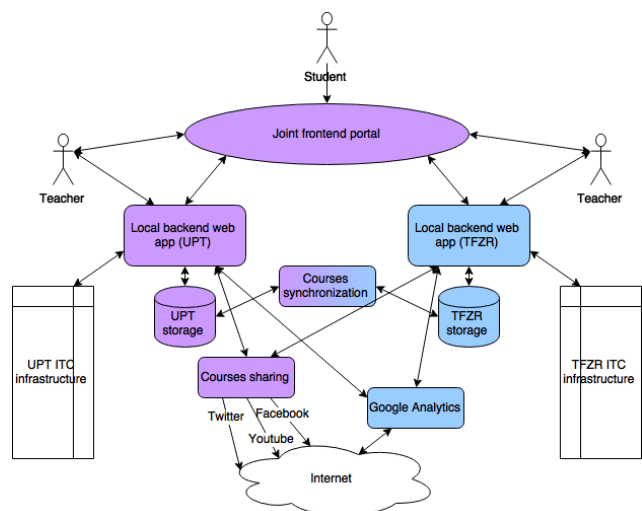

Figure 1. Joint EduWeb cast system infrastructure

In order to accomplish all these requirements a general design based on shared and distributed components has been proposed and implemented (Fig. 1). Some components are distributed between the two locations in order to support redundancy and fast local access to shared video materials. By redundancy, the published educational materials stored in both locations and synchronized between them, will be available for users in both locations no matter if one site is down due to maintenance or other local problems, such as network connectivity or power supply.

By fast local access to video streaming, local users will access by default local servers in order to avoid delayed traffic and peak bottleneck. Some other components are shared between both institutions being used in common by the distributed components. The whole implemented platform is a unique one, being transparent for the user by using a single entry point through a common frontend portal. Some components have been developed individually by the partners but using a joint established common design. Some other components, such as synchronization and analytics have been developed in common by both teams.

The overall solution architecture is presented in the following figure (Fig. 1). Local web applications, serving as backend for video streaming and integration with existing infrastructure of both universities, are distributed between partners and developed individually according with the existing local software, such as database, active directory, office 365, educational management systems, etc.

Several components acts as binders between the two local infrastructures, interconnects and deployments, making the system a complete one: the frontend portal, the materials synchronization and backend sharing and analytics tools.

III. HARDWARE COMPONENTS OF THE SYSTEM

EduWebCast system is a complex software hardware system designed for video streaming of lectures and educational materials within academic cross border collaboration. The EduWebCast system is designed to support standard curricula in the area of Computer Science of Politehnica University Timisoara, Romania and Technical Faculty "Mihajlo Pupin" Zrenjanin, Serbia.

A. Hardware infrastructure

Due to the system complexity, only hardware overview and their physical characteristics are presented. The hardware solution proposed and implemented by Politehnica University of Timisoara (UPT) is based on blade servers and SAN (Storage Area Network) technologies connected by Fiber Channel fast communication links, all embedded within one cabinet (rack) together with their supporting components: switches and UPS (Uninterruptible Power Source) (Fig. 2). Blade servers bring savings in per-server costs due to consolidation of system resources into a smaller footprint (shared modules and simplified cabling, power and floor space). Virtualization brings additional savings through consolidation of multiple servers onto single blades. The

modularity of blades within a chassis make them well-suited to implementation as groups of resources within a virtualized pool. Two blade servers make the core of the solution: the application server, dedicated to provide unified access for the end-users and the video or streaming server used to deliver video content to many and variate clients' platforms. The application server has 2x Intel Xeon E5-2620v2 6C/12T 2.10GHz and 15MB processing power and 4x 8GB (1x8GB) 1Rx4 L DDR3-1600 R ECC main memory. The video processing system, running Wowza streaming platform has the same type of processing and memory support.

The proposed SAN storage improves solution efficiency and enhance virtualization and consolidation. The storage provides also an architecture unified not only across protocols and disks, but also in storage efficiency, processes, data management, and data protection. SAN is a dedicated network that provides access to consolidated, block level data storage. SANs are primarily used to enhance storage devices access, such as disk arrays, accessible to servers so that the devices appear like locally attached devices to the operating system. A SAN typically has its own network of storage devices that are generally not accessible through the LAN by other devices, thus improving the security of the solution. Two rackable storage components are included, the main storage providing 12x DX8090 S2 HD SAS 600G 15k and the backup one with 12x DX60 S2 HD NLSAS 1TB 7.2.
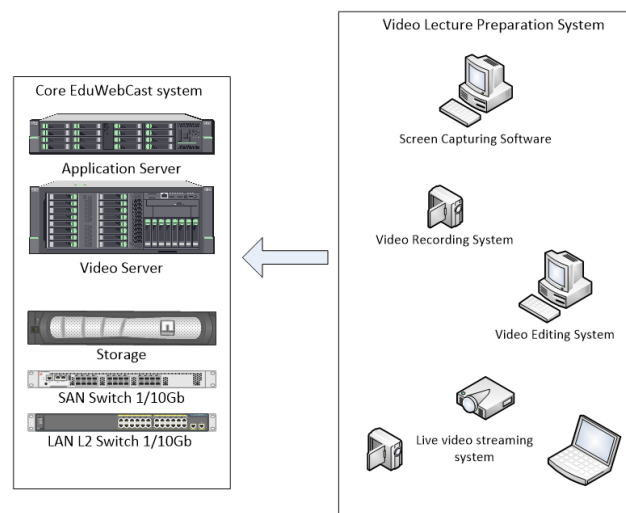

Figure 2. Components of EduWebCast system deployed by the Romanian partner

A SAN is essentially a switch-based technology that interconnects multiple physical servers or virtual machines to external storage. The proposed solution is based on Fibre Channel switch. Fibre Channel is a mature L2 switching SAN technology, and the predominant SAN variant today in the enterprise. The second switch is used to connect the whole cabinet to Internet and to the UPT intranet.

The hardware components deployed by the Serbian partner presented in Fig. 3, illustrate the technologies and platforms used for the system.
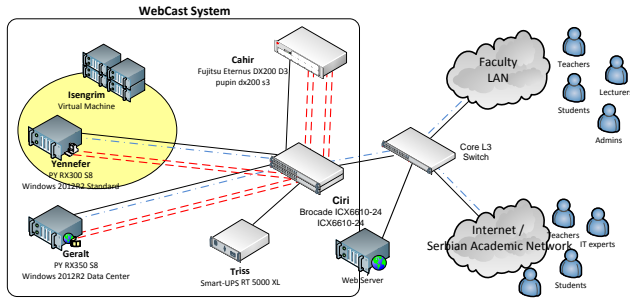
Figure 3.   Components of the Serbian side EduWebCast system

The system is installed as a part of the academic LAN behind the institution firewall. It is connected over core L3 switch with the Internet. The web server, hosting the web application for the site and video server management is also connected to the switch. It has one public and one private IP address. The rest of the system is in the separate segment of LAN network. The central part of this segment is core switch for LAN and SAN links.

This core L3 switch is composed of two stackable switches connected via stacking 40GbE QSFP port. Together, those switches have 48 1Gbps ports for connecting the computers and other network equipment in the segment, 8 10Gbps ports for enabling fiber optics connection between 2 servers and storage device for data transfer using iSCSI technology (red dashed lines of Fig. 3). Each server has its connection over two controller cards. The switch has two additional 10Gbps ports for connecting the switch to the network.

The storage device has 12 SAS disks in the current configuration with the capacity of 600GB giving in total 7.2 TB of storage capacity. Ten disks are in operation mode and two are in spare mode, acting as reserve disks. The number of disks is not limited to 12 and the storage system is easy to expand in the case of need.

Disk RAID Level is set to High Performance (RAID1+0) with total operating capacity of 2.67 TB. One part of the disk has capacity of 900.00 GB (943718400.00 KB) and this part is used by the application server. The other part of the disk has capacity of 1.79 TB (1918894080.00 KB) and this disk is used for video server. The video server part of disk space is used for storing its operating system, data and video content.

Video server is a computer with 64GB of RAM, two Xeon E5-2697 v2 12C/24T 2.7GHz CPUs and two GPUs TeslaK20X. Video server hosts the video streaming server application. The system is secured with 5000kVA UPS system for continuous power supply.

B. Software platform

The current project is part of continuous HW/SW infrastructure development actions initiated by UPT in order to provide its students, partners and visitors with modern high qualitative services for both education and research. The EduWebCast software portal has two main goals: (1) provide end users with a single point of access to the services implemented by partners within the frame of the project, and (2) integrate project software components of the partners with the hardware infrastructure in order to build an integrated solution.

Furthermore, integration considers existing hardware and software infrastructure of both partners.
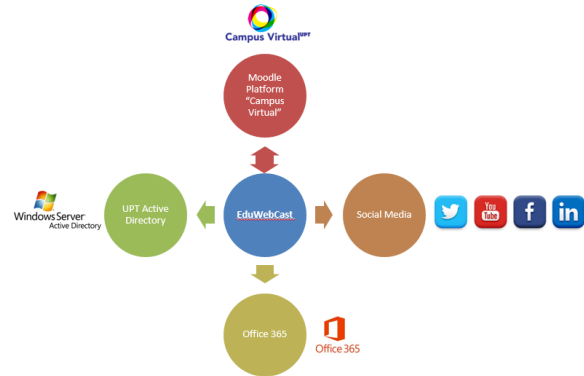

Figure 4.   Components of the Serbian side EduWebCast system

The existing software solutions and services used by UPT is built upon Office 365 users management for administrative and office tools and authorization (Active Directory). UPT provides its students with access to class materials resources through the on-line educational portal called "Campus Virtual" built upon the Moodle platform. The new portal extends the existing services for both UPT students and external visitors (on-site or on-line) with access to multimedia class materials and enhanced communication platform. The proposed platform provides also teachers and students the possibility to share the public available materials on social media, such as Facebook, Twitter or Youtube. (Fig. 4)

The portal has two main components: the frontend application, providing students with access to video educational content and the backend application, providing teachers and support staff with access to administrative and lecture management features. Students have access to lecture materials search engine. A special search feature will be accessed by the user. He/she could search using multiple words and a search results list will be displayed. They can do video content searches by lectors, topics or any metadata attributes. The results are presented in order of relevance based on video attributes / tags associated at video upload or at video creation. Guest users have access to view public materials and also search through public materials. Logged users can view materials to which they have access, view events, search through materials and events, publish on social media, rate educational materials and give feedback.

According with the user rights, users having lecturer role have the capability to create and upload multimedia content (video lecture or presentation slides). After authentication, lectors have access to their own home page where video content and lecture materials are listed, according to user's rights. Video content and other lecture materials publication consist of the following actions: (1) Augment video content with general information like: author, title, description (short and long), creation date, expiration date, (2) video content upload – an upload dialog window allows users to upload the video files, (3) video content attributes and searching tags can be associated with the video content, (4) video content publication, video content formatting for different screen

resolutions – the video content should be delivered to the end users personalized to the device types they use (desktop, smartphone, tablet, etc.)

A responsive design for great mobile users experience has been implemented in order to ensure easy and appropriate mobile users with access to portal information and video materials.

IV. EDUWEBCAST SYSTEM USAGE

The joint EduWebCast portal host 12 courses created by the both sides. 7 courses are created by the Romanian partner (Politehnica University of Timisoara/Faculty of automation and Computer Science) and 5 courses are created from the Serbian side (University of Novi sad/Technical Faculty "Mihajlo Pupin", Zrenjanin). Courses are bilingual with English and national language version (Romanian or Serbian). The system is launched on April 19 2015 and was intensively used during the last month and a half of summer semester and during the start of examination period, until June 19 2015.
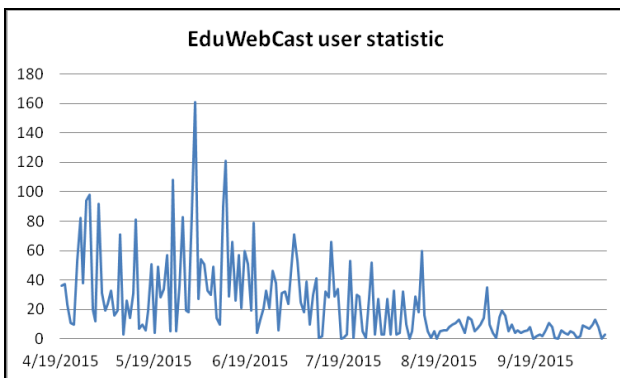

Figure 5. EduWebCast user statistic for joint EduWebCast platform

After the end of June, started period of summer vacation and the system is not intensively used. It is planned to restart with intensive usage during the winter semester starting from November 1.

During this period, from April 19 until October 13 2015, system used 2,911 users according the Google analytics. According to the same analytics, system has 3,258 visits and 4,406 page views. The detailed graph of EduWebCast users per day during the described period is given in Fig. 5, and of visits per day in Fig. 6.
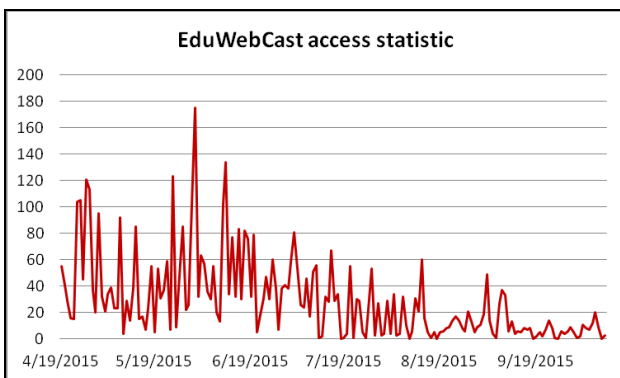

Figure 6. EduWebCast access for joint EduWebCast platform

The active user statistics gives the number of active users per 1-day, 7-day, 14-day or 30-day period, e.g. the number of unique users who initiated sessions on the site from last 30 days counting backward from last day of statistic. The parallel graphs for these four statics are given in Fig. 7.
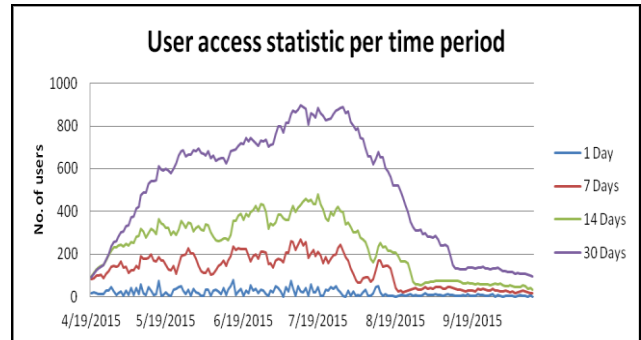

Figure 7. EduWebCast user statistic for 1, 7, 14 bd 30 days.

The browser statistic is given in Table I. It clearly shows that Chrome is the most used browser for accessing the EduWebCast video materials with in total 3,906 or 75.25% of page views.

TABLE I. BROWSER TYPE STATISTICS OF EDUWEBCAST

	Browser	Sessions	% Sessions
1	Chrome	3,906	75.25%
2	Firefox	607	11.69%
3	Internet Explorer	380	7.32%
4	(not set)	124	2.39%
5	Opera	89	1.71%
6	Safari	49	0.94%
7	Edge	20	0.39%
8	Android Browser	9	0.17%
9	Safari (in-app)	4	0.08%
10	IE with Chrome Frame	1	0.02%

The results of very interesting statistics concerning screen resolutions of the EduWebCast users are given in Table II. Most common screen resolutions are 192 x1080, 1366x768 and 1280x1024 with total 1,664 users or 32.06%. The problem here is that the screen resolution is not properly detected for the large number of the page views.

TABLE II. SCREEN RESOLUTION STATISTICS OF EDUWEBCAST USERS

	Acquisition			Behavior	
Sessions	% New Sessions	New Users	Bounce Rate	Pages / Session
	5,191	65.61%	3,406	56.50%
	% of Total:	Avg for View:	% of Total:	Avg for View:
	100.00%	63.88%	102.71%	56.50%
	-5,191	-2.71%	-3,316	0.00%
(not set)	2,889(55.65%)	97.89%	2,828(83.03%)	84.29%
1920x1080	678(13.06%)	17.70%	120(3.52%)	22.57%
1366x768	495(9.54%)	30.71%	152(4.46%)	21.21%
1280x1024	491(9.46%)	19.55%	96(2.82%)	14.66%
1440x900	107(2.06%)	26.17%	28(0.82%)	30.84%
1024x768	82(1.58%)	40.24%	33(0.97%)	10.98%
1280x800	50(0.96%)	34.00%	17(0.50%)	22.00%
1680x1050	41(0.79%)	46.34%	19(0.56%)	26.83%
360x640	35(0.67%)	42.86%	15(0.44%)	65.71%

1536x864	31(0.60%)	19.35%	6(0.18%)	32.26%

The Table III shows mobile users operating system statistics. The EduWebCast system is not generally built for the mobile users and only 41 users access using the mobile phones. The Android is widely used mobile OS with 56.10%. The adaptation of the system for the mobile users could be one of the possible directions for further system improvements.

TABLE III. MOBILE OS STATISTICS OF EDUWEBCAST USERS

	Operating System	Sessions	% Sessions
1	Android	23	56.10%
2	iOS	16	39.02%
3	(not set)	1	2.44%
4	Windows Phone	1	2.44%
	Total	**41**	**100.0%**

Besides the tracking of the users and visitors statistics, the system functioning is monitored with the hardware and software subsystem. The one part of the monitoring subsystem reads the device parameters from the variety of internal sensors. One of the acquired data is the switch internal temperature. The system temperature from one period of the system exploration is given in Fig. 8. Because of the complexity of the hardware and software system, this system will not be described in details in this paper.
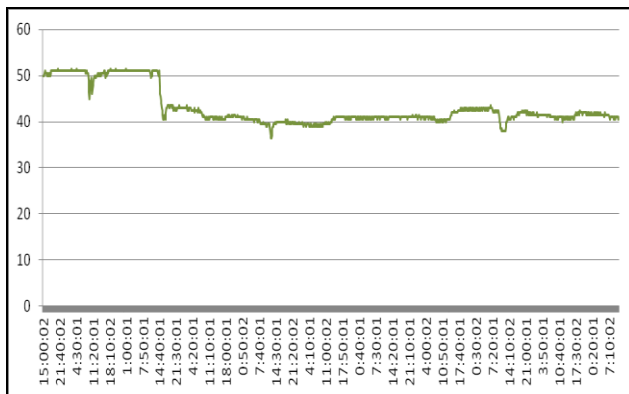

Figure 8.   One of the switch internal sensor temperatures

V. CONCLUSION

In this paper is presented the EduWebCast system. The system is built between two universities on international level for the educational video webcasting. The joint architecture of the system as well the components of the system are presented in this paper.

The system is launched and used during period from April 19 until today (the statistic is given until October 13 of year 2015). The initial number of courses is 12 and these courses are from the Computer Science area. During this period system is used by 2,911 users according the Google analytics. According to the same analytics system had 3,258 visits and 4,406 page views.

The testing and exploration of the system showed that students are generally satisfied with the system and the quality of its lectures. The system worked properly during testing period. The further system improvement will be made in scalable video which will be chosen according to

the user's device. Also, the student survey and evaluation of the lectures will be conducted in order to improve the system.

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Smart City, Smart Infrastructure, Smart Railway

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Abstract - How to implement an intelligent railway system in Hungary. According to Bjorn Hesskan (Railway industry consultant): „The rise of data systems within the industry has been gathering pace over the last decade. These days, IT is about as essential as coal was to the Victorians – if your data environment isn't robust enough, then you just can't run your railway." [1] In this study the motivation for developing an intelligent system in transportation is discussed. The aims for developing smart structures will need to be examined in the future.

I. INTRODUCTION

A. Im portance and relevance of the research topic

The importance of the research can be shown with the following examples. Firstly, the concept of making the human environment intelligent from two thousand and ten. Secondly, the Horizon 2020 strategy. One of its elements is smart, green and integrated transport. Finally, Hungarian National Transport Strategy (2013), which also mentions, although not in detail, the importance of intelligent systems, highlighting their role in increased safety (interlocking systems), in the standardisation of passenger information, as well as in the field of railway telecommunication (GSM-R).

B. Driving Factors

It can easily be seen how complex this research is regarding its driving factors.

Nyikes et al. show that: "The "smart city" program was started in Hungary to improve public safety, to increase the use of city cards, and to provide the necessary devices and training in several rural cities, e.g. in Nyíregyháza, Miskolc and Salgótarján." [2]

Development is fuelled by a lot of expectations of the society, concerning for example climatic change and sustainability.

Figure 1. Driving Factors: Horizon 2020 - Societal Challenges

Interoperability, liberalization and competitiveness are European expectations with respect to transportation. The development of the safety of transport is relevant to us from more points of view, like the safety of critical infrastructures, or data security. (Figure 1.)

II. SMART TRANSPORT IN SMART CITY

Smart Cities have been characterised and defined by a number of factors including sustainability, economic development and providing a high quality of life. Enhancing these factors can be achieved through infrastructure (physical capital), human capital, and social capital and/or ICT infrastructure. [3]Smart City should enable every citizen to engage with all the services on offer, public as well as private, in a way best suited to his or her needs. It brings together hard infrastructure, social capital including local skills and community institutions, and (digital) technologies to fuel sustainable economic development and provide an attractive environment for all. [4]

There are five key aspects of smarter approaches, which are strongly information driven: [4]

• a modern digital infrastructure, combined with a secure but open access approach to public re-useable data, which enables citizens to access the information they need, when they need it; [4]

• a recognition that service delivery is improved by being citizen-centric: this involves placing the citizen's needs at the forefront, sharing management information to provide a coherent service, rather than operating in a multiplicity of service silos (for example, sharing changes of address more effectively), and offering internet service delivery where possible (at a fraction of the face to face cost); [4]

• an intelligent physical infrastructure ("smart" systems or the Internet of Things), to enable service providers to use the full range of data both to manage service delivery on a daily basis and to inform strategic investment in the city/community (for example, gathering and analyzing data on whether public transport is adequate to cope with rush hour peaks); [4]

• an openness to learn from others and experiment with new approaches and new business models; and [4]

• transparency of outcomes/performance, for example, city service dashboards to enable citizens to compare and challenge performance, establishment by establishment, and borough by borough. [4]

"The Smart Transport and Roads Project is using advanced information and communications technologies to help solve the world's urban traffic congestion problems. With better
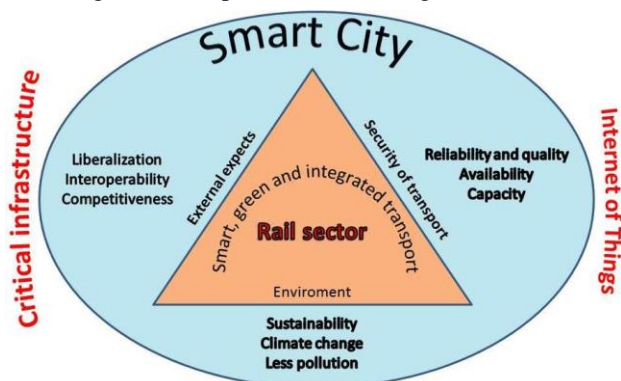
information and modeling capabilities, traffic systems, traffic managers and travelers themselves will be better able to predict and respond to traffic build ups, bottlenecks, accidents and breakdowns." [5]

A. Big Data on Rails

The day before yesterday (October 05, 2015) at the Railway Interchange 2015 conference, Siemens introduced new software solution. According to John Paljug (head of Siemens Rail Automation): "On any given railroad there are trillions of data points being created by train systems and devices along a line, but this data is simply not being put into action." "Rail Fusion brings all of these disparate data points together in one system and puts intelligence behind them, allowing railroads to make more informed, efficient decisions about how to operate and maintain their systems specific to their needs." [6]

B. The integration of system engineering in the research

It is also without a doubt that if such a complex system as the railway needs to be examined, the axioms of system theory and information theory need to be applied in order to understand today's information society and its reflection in the system of the railway network. The relations between the elements are shown in Figure 2 according to Faust.
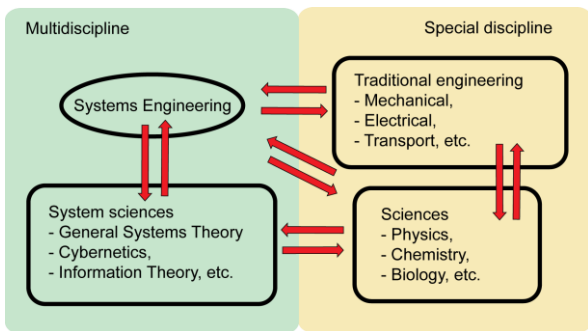

Figure 2.   The integration of system engineering in the research. Recast figure. Source: [7]

C. Levels of development of automated systems – The road to Smartness

It was a long way from machines via automated systems to intelligent systems. The creation of smart structures has already begun. (Figure 3.)
According to Craig A. Rogers, smart structures can be divided into five structures: sensory, adaptive, controlled, active and intelligent. (Figure 4.)
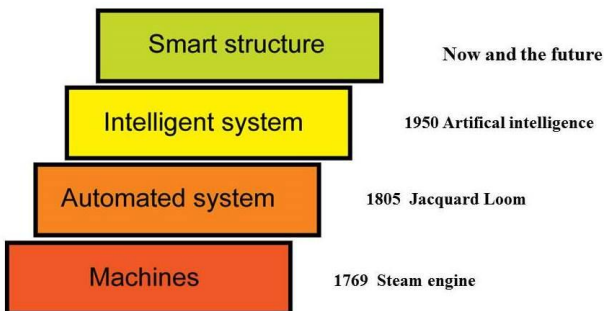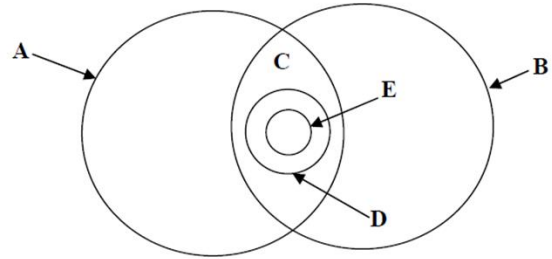

Figure 3.   Levels of development of automated systems – The road to Smartness

A: Sensory structures; B: Adaptive structures; C: Controlled structures; D: Active structures; E: Intelligent structures.

Figure 4.   Classification of smart structure [8]

III.   ARE THE SYSTEMS INTELLIGENT OR SMART?

The purpose of intelligent systems is to create a standardised, cooperative structure by the integration of subsystems. Here an important question arises: what is the difference between intelligent and smart? A lot of people think these two terms are synonyms. They differ according to us. Here is our definition of these concepts: intelligent entails an inherently cooperative structure, whereas a smart system is one that users can interact with efficiently, too. Intelligent systems are necessary for one reason: so that the security and efficiency of rail transport can become sustainable, and no catastrophes can happen. What is Smart Infrastructure? (Figure 5.)
Here we can see the definition of Cambridge University. In a smart city smart infrastructure is needed. Naturally, railway infrastructure is a part of that.
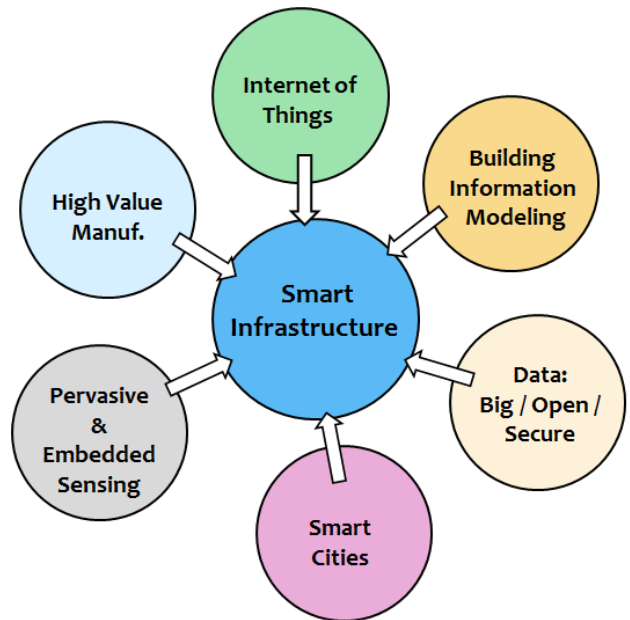

Figure 5.   Smart Infrastructure [9]

What is intelligent railway, then? It is a system with the following qualities: integrated, co-operative, secure, optimized, well organised and useful.

Why is smart railway more than intelligent railway? A smart system is integrated, secure, optimized and well organized, too. However, there are a number of crucial qualities in which smart systems differ from intelligent systems: they are predictable, distributive, self-healing and fully exploited by the users.

IV. What do and don't we know about Hungarian railway?

Transport technology hasn't changed much in the last few decades. However, railway carriages and electric multiple units are likely to be a lot more efficient, due to EU laws, and a handful of rail lines have been, are and will be renovated. There have been significant changes in signalling technology (communications-based train control) in the last 30 years.

V. Smart Railway Components

Examples for intelligent railway system that can have several subsystems integrated in it are power supply, traffic management system, station facilities, signalling system, rolling stock, and so forth. What makes it intelligent is the integration of the subsystems. What turns it into a smart system is usability engineering.

VI. Reliability of field section of Smart system

The reliability value of the field section can be calculated as for the probability chart that can be seen on Figure 6.
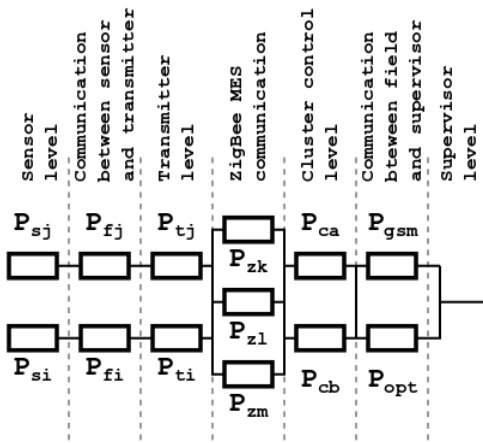

Figure 6.   Probability chart

P_{si}, P_{sj} are the working probability of the current sensors,

P_{fi}, P_{fj} are the working probability between the current sensors and their transmitters,

P_{ti}, P_{tj} are the working   probability of the current transmitters,

P_{zk}, P_{zl}, P_{zm} are the working probability of the current ZigBee communication,

P_{ca}, P_{cb} are the working probability of the current cluster controllers,

P_{gsm} is the working probability of GSM communication,

P_{opt} is the working probability of optical communication.

Note: If we have the working probability of a device its breakdown probability can be calculated the following way:

$$\overline{P} = 1 - P$$

$\overline{P}$ is the breakdown probability of the current entity.

Serial probabilty can be calculated:

$$P_{ser} = \prod_i P_i$$

Parallel probabilty can be calculated:

$$P_{par} = \overline{\prod_i \overline{P_i}}$$

It is easy to calculate the resulting working probability.

The current sensor and the current transmitter with the communication between them are so called serial probability model. If one of them is out of order the current branch won't work. Their working probability can be calculated:

$$P_{sft_i} = P_{si} P_{fi} P_{ti}$$

Since the sensor branches are close enough to each other that another sensor branch can take over the task of the broken down one. In this case the resulting probability can be calculated:

$$P_{sft_{ij}} = \overline{\overline{P_{sft_i}} \, \overline{P_{sft_j}}}$$

That means the current sensors branches are out of orders if both branches are broken down.

Using the above sketched method the working probability of ZigBee communication is.

$$P_{z_{klm}} = \overline{\overline{P_{z_k}} \, \overline{P_{z_l}} \, \overline{P_{z_m}}}$$

Thanks to the MES features of ZigBee network.

Because of the most safety critical part of the field section of the supervisory system is the cluster control that is why this layer has two controllers. Its working probability is:

$$P_{c_{ab}} = \overline{\overline{P_{c_b}} \, \overline{P_{a_b}}}$$

The communication towards supervisory system occurs via two channels namely GSM (or probably R GSM) and optical cable. These channels are used in parallel way. Its working probability is.

$$P_{gsm\,opt} = \overline{\overline{P_{gsm}} \, \overline{P_{opt}}}$$

The resulting working probability between sensor level and supervisory level can be described the following formulas:

$$P_{ss} = P_{sft_{ij}} \, P_{z_{klm}} \, P_{c_{ab}} \, P_{gsmopt}$$

VII. SMART RAILWAY BENEFITS

Smart railway has three major advantages. One is that they help protect critical infrastructures (see energetics subsystem). Another is that they are key components of further technological innovations. And third, they are part of smart infrastructure which is to make the standard of living higher for people in smart cities.

VIII. OPPORTUNITIES

Today's favourable regulations help exploit the potential of the research, just as tomorrow's railway development, like the European Railway Traffic Management System or the development of Hungary's GSM-R systems. 1085 billion Forints can be spent on railway in Hungary until 2020.

IX. PROPOSALS

Substantial funding is required for railway development. Therefore, new technologies are necessary instead of just exchanging the old systems for newer ones. An example for this can be the technological development of railway branch-lines.

X. IMPLICATIONS

With the help of smart systems we can be part of a new technological evolution. With this innovation we are creating an energy-efficient, sustainable, environmentally friendly system, which carries immense prestige as compared to competitors.

XI. CONCLUSION

The question is how to meet the challenges of the intelligent railway network implementation. The components of this research are railroad, critical infrastructure, smart and intelligent infrastructure, the measure of the intelligence considering today's systems, the realisation of the smart system and adaptivity in systems. Intelligent systems are necessary for one reason: so that the security and efficiency of rail transport can become sustainable, and no catastrophes can happen.

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The Web of Things and Database Services

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Abstract - The Web of Things (WoT) is slowly gaining grounds and through the properties of barcodes, QR codes, RFID, active sensors and IPv6, objects are fitted with some form of readability and traceability. People are becoming part of digital global network driven by personal interests. The feeling being part of a community and the constant drive of getting connected from real life finds it continuation in digital networks. This paper investigates the concepts of the internet of things from the aspect of the autonomous mobile robots with an overview of the performances of the currently available database systems.

I. INTRODUCTION

Information and communication technology has started on large computers called the main frame of the 1960s, the 1970s minicomputer was a practical solution, workstation appeared with the development of the microprocessor in the 1980s, and personal computers became popular in the 1990s. This progress is largely accelerated due to the development of a semi-conductor integrated circuit technology [1]. As a result, the computer and the network cost, made a remarkable progress in terms of performance, have infiltrated and became embedded into the society at large scale. In a network, stemming from the Internet to research of ARPANET, by the 1990s WWW (World Wide Web), showed the explosive spread. In the background, it may become capable of high-speed large-capacity communication by development of optical communication technology. From the wireless communication technology, to the spread of mobile phones and high-speed wireless LAN, all the equipment leads to the era of the global network. Dramatic improvement in communication speed, and to underpin the transition from e-mail to the video content, the fusion of communication and broadcasting has begun and started an expansion of the IoT devices as shown in figure 1.

II. WEB OF THINGS

The Web of Things is not a single standalone technology, it's a concept in which most new things are connected and enabled such as street lights being networked and things like embedded sensors, image recognition functionality, augmented reality, near field communication are integrated into situational decision support, asset management and new services [2]. These bring many business opportunities and add to the complexity of IT.
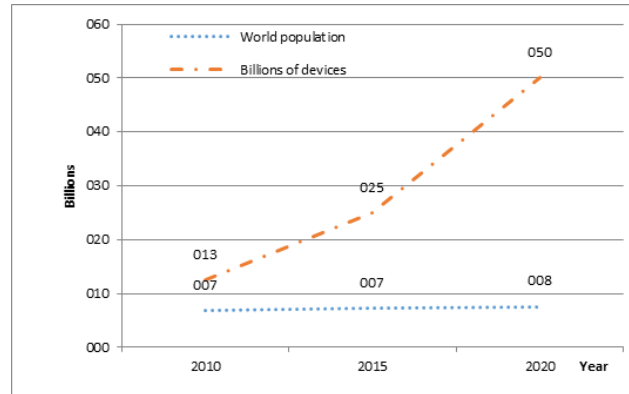

Figure 1. IoT devices and the future evolution

The Web of Things offers solutions based on the integration of information technology, which refers to hardware and software used to store, retrieve, and process data and communications technology which comprises electronic systems used for communication between individuals or groups [3]. The rapid convergence of information and communications technology is occurring at many layers of technology innovation (fig. 2): the cloud, data and communication pipes/networks and device.
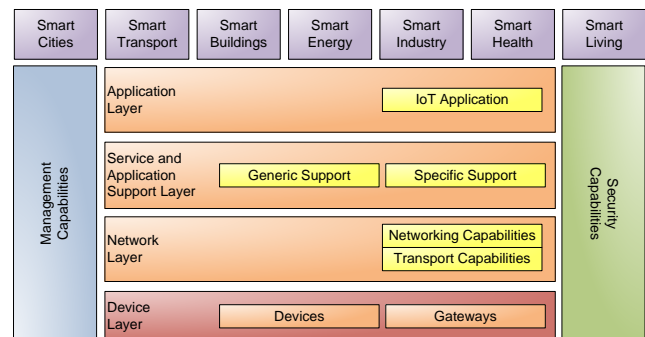

Figure 2. IoT Layered Architecture

The potential market for wireless communication technology is one of the rapidly-spreading segments in the industry of integrated circuits. Breathtakingly fast innovation, fast changes in communications standards, the entry of new players, and the evolution of new market sub segments will lead to disruptions (disorder, confusion) across the industry [4].

III. IOT AND AUTOMOMOUS MOBILE DEVICES

The connection of vehicles or mobile robots to the Internet brings about a wealth of new possibilities and applications which bring new functionalities to the individuals and/or the making of transport easier and safer. In this context the concept of Internet of Vehicles (IoV) connected with the concept of Internet of Energy (IoE) represent future trends for smart transportation and mobility applications as depicted (described, shown, illustrated) on figure 3 [5].
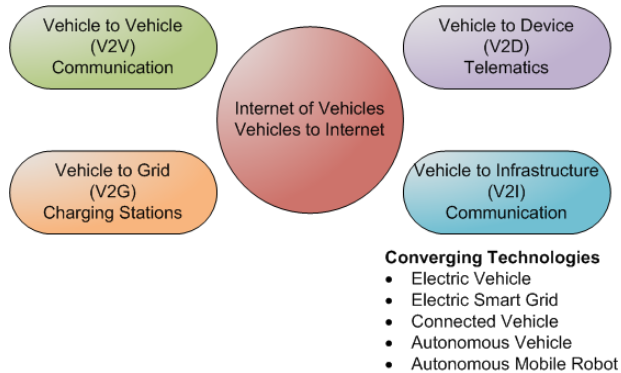

Figure 3. Converging Technologies

Self-driving vehicles today are in the prototype phase and the idea is becoming just another technology on the computing industry's parts list. Using automotive vision chips that can be used to help vehicles understand the environment around them by detecting pedestrians, traffic lights, collisions, drowsy drivers, and road lane markings [6]. Those tasks initially are more the sort of thing that would help a driver in unusual circumstances rather than take over full time.

IV. CONTROL DATA STORAGE TO THE CLOUD

By its name, a cloud database is a database that runs on a cloud computing platform, such as MS Onedrive, Dropbox and Google Drive. The cloud platform can provide databases as a specialized service, or provide virtual machines to deploy any databases on. Cloud databases could be either relational or non-relational databases. Compared to local databases, cloud databases guarantee higher scalability as well as availability and stability [12],[19],[20],[21]. Thanks to the elasticity of cloud computing, hardware and software resources can be added to and removed from the cloud without much effort. Users only need to pay for the consumed resource while the expenses for physical servers, networking equipment, infrastructure maintenance and administration are shared among clients, thus reducing the overall cost. Additionally, database service is normally provided along with automated features such as backup and recovery, failover, on-the-go scaling, and load balancing.

Cloud computing has been established as one of the major building blocks of the Internet of Things [13]. New technology enablers have progressively fostered virtualization at different levels and have allowed the

various paradigms known as "Applications as a Service", "Platforms as a Service" and "Infrastructure and Networks as a Service". As part of this convergence, IoT applications such as sensor-based services will be delivered on-demand through a cloud environment. This extends beyond the need to virtualize sensor data stores in a scalable fashion. It asks for virtualization of Internet-connected objects and their ability to become incorporated into on-demand services such as Sensing-as-a-Service. Figure 5 shows the performances of tested database management systems.
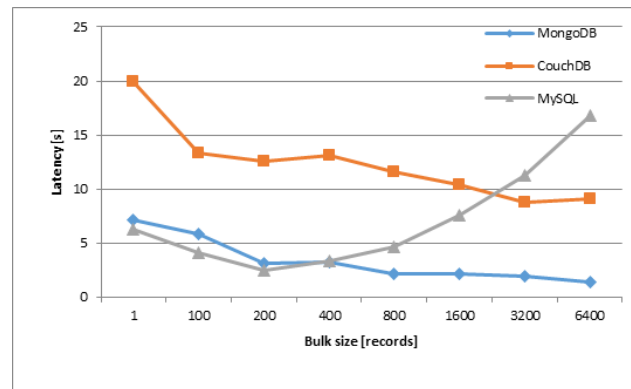

Figure 4. Bulk insert latency test with various DBMS

The choice of the databases was based on the fact that those were among the most popular databases available, and that they were the representatives for their kinds. Many large organizations have been using them in production, such as Facebook, Google, Wikipedia, LinkedIn, Instagram, etc. On the other hand, each database has its own promising strength that is worth exploring. MySQL so far has been the most popular open source SQL database. MongoDB was built to work with very large sets of data [13],[14],[18],[22]. CouchDB has its user-friendly RESTful API. Meanwhile, Redis is said to be very fast thanks to its in-memory storage. Redis is an open source, BSD licensed, advanced key-value cache and store system. With the bulk data, the MongoDB has the smallest latency, but the overall best score goes to MySQL.

Other important issues considering the Web of Things and Database services are system parameters such as Bit Error Rate (BER) and Packet Error Rate (PER). The PER values presented in this research are percentages calculated as a ratio of number of packets with errors divided with the total number of packets sent. Presented results are made during the two separate experiments using Arduino UNO platform and two different communication modules using ZigBee technology in indoor environment. The presented values are illustrative and not comparable because they are not used in the same experimental conditions. More data about the experiment can be found in [23, 24].

In experiment No. 1 [23] from each position ZigBee node sent 2500 packet in 100 ms interval. The duration of data transmission and the distance of the measurement stations from coordinator are given in Table I.

TABLE I.   RESULTS CONCERNING PACKET STATISTICS
EXPERIMENT NO. 1

Position	Packets Sent (No.)	Distance (m)	PER (%)
1	10087	1	0.73
2	10865	10	1.51
3	10091	6.5	0.66
4	10153	18	1.82
5	10126	12.5	0.41
6	10231	26.5	1.29
7	10171	31.5	1.7

In experiment No. 2 [24] data are sent as ASCII bytes. The packets are encrypted which results together with payload with 81 Bytes long packet. The data are sent every 100ms. Very short inter packet interval in both case is defined for the experimental purposes in order to analyze frequent packet transmission which are common for the presented environments.

TABLE II.   RESULTS CONCERNING PACKET STATISTICS
IN EXPERIMENT NO. 2

Loc.	Packet Sent	Data Packets Sent	Errors	PER (%)	Dist. (m)	Floor
1	457d8	4507	22	0.48	1	1st
2	4520	4395	44	0.97	18	1st
3	4553	4356	62	1.36	26.5	1st
4	4328	4049	114	2.63	28	1st
5	1292	669	287	22.21	31.5	1st
6	3067	2729	100	3.26	30.2	1st
7	3080	2777	111	3.6	29	1st
8	3032	2733	117	3.86	25.5	1st
9	2880	2321	267	9.27	22.5	1st
10	2821	1625	546	19.35	16	2nd
11	9	0	0	0	19.5	2nd
12	1693	796	407	24.04	17	2nd
13	2435	1473	484	19.88	9.5	2nd
14	3181	3104	22	0.69	9	2nd

V.   WEB 2.0 ENVIRONMENT

A Web 2.0 site may allow users to interact and collaborate with each other in a social media dialogue as creators of user-generated content in a virtual community, in contrast to Web sites where people are limited to the passive viewing of content. Examples of Web 2.0 include social networking sites, blogs, wikis, folksonomies, video sharing sites, hosted services, Web applications, and mashups.

Rapid Web Development means quick and efficient web application building. It is part of the Rapid Software Development described in [15]. Besides the obvious objective of meeting customers' deadline, another characteristic of Rapid Web Development is fast prototyping. Mockups and partial web application versions aid evaluation, usability testing and simulation of planned features.

The Rapid Web Development process uses existing technologies and brings them together allowing us to focus on the real task of application building. It implies integration of readily available open source and free to use software, frameworks, APIs, libraries, data sources, external services and functionality to create a platform for running our Web 2.0 service. This development model is known as "Mashup" - a web application hybrid [16].

Figure 5 illustrates a simple mashup model where web services and multiple external and internal data sources are combined.
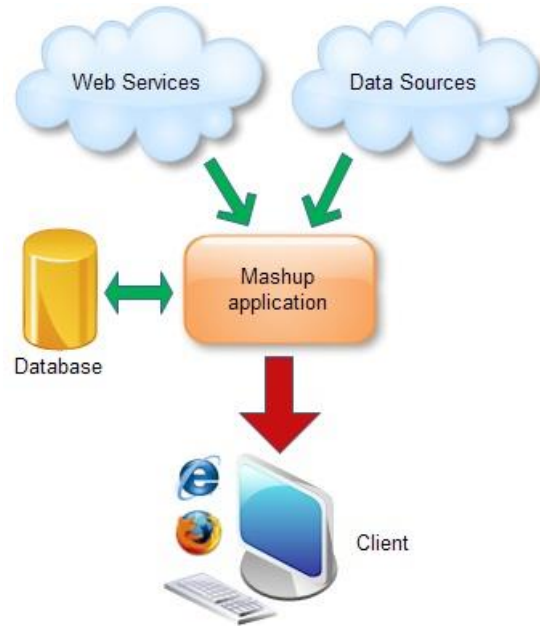

Figure 5.   Mashup model illustration

The term mashup originally comes from British - West Indies slang meaning to be intoxicated, or as a description for something or someone not functioning as intended. In recent English parlance it can refer to music, where people seamlessly combine audio from one song with the vocal track from another—thereby mashing them together to create something new.

VI.   CONCLUSIONS

The concept of Internet of Vehicles (IoV) is the next step for future smart transportation and mobility applications and requires creating new mobile ecosystems based on trust, security and convenience to mobile/contactless services and transportation applications in order to ensure security, mobility and convenience to consumer-centric transactions and services. This requires robust sensors and actuators which are able to reliably deliver information to the systems mentioned above. Such reliable communication needs to be based on M2M communication protocols which consider the timing, safety, and security constraints.

The vision of the future Internet of Things is setting new challenges and opportunities for data management and analysis technology. Gigabytes of data are generated everyday by millions of sensors, actuators, RFID tags, and other devices. As the volume of data is growing dramatically, so is the demand for performance enhancement. When it comes to this Big Data problem, much attention has been paid to cloud computing and

virtualization for their unlimited resource capacity, flexible resource allocation and management, and distributed processing ability that promise high scalability and availability.

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Web portal for monitoring the health and recreational aspects of sports

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Abstract – The primary purpose of the web based health monitoring is to collect fitness data from students about their sports activities. Main goal is to improve health education and conduct individual student health assessment in correlation to recreational aspects of sports. In this paper we will present how to monitor the student health and sport activity. Aim of this paper is to presents the system which collect, process, store, analyze and present data using modern technologies. We have used a web application to collect data, the application also provides useful visualization feedback, thus helps a student to monitor them self. The system also has a web portal, where an administrator can analyze, evaluate and monitor captured data. This system can help to ease the process of monitoring and analyzing data.

Key words : web portal, monitoring,health, sport

I. INTRODUCTION

Regular physical activity throughout childhood provides health benefits, by positively effecting body composition, muscular and skeletal development. Regular physical activity throughout life reducing the presence of coronary heart disease. [1]

The US Department of Health and Human Services' seminal, comprehensive, review provides an analysis of evidence of the relationship between physical activity and various aspects of health. It illustrates the positive impacts of activity on a number of systems - cardiovascular, musculoskeletal, metabolic, endocrine and immune. The overall conclusion is that those who are regularly active, even on a moderate basis, have lower mortality rates than the least active. It also outlines the positive impacts of physical activity on various aspects of mental health. Allison's review outlines a wide range of physical and health benefits associated with even moderate physical activity and it discusses some of the possible mechanism involved. Warburton et al present a narrative review confirming that there is irrefutable evidence of the effectiveness of regular physical activity (and a dose–response relationship) in the primary and secondary prevention of several chronic diseases such as cardiovascular diseases, diabetes, cancer, hypertension, obesity, depression and osteoporosis. Van Amelsvoort et al found that workers who reported physical activity at least twice per week also reported significantly less sickness absence compared to those doing less exercise. Rankinen and Bouchard's review, based on the

contributions of 24 experts from 6 countries, concludes that, despite strong evidence for the beneficial effects of regular physical activity across a range of health factors, the precise nature of the dose response relationship is unclear and requires more research. Twisk supports this conclusion via a review of physical activity guidelines for children and adolescents. Although acknowledging their public health value, the author suggests that guidelines are based on weak, if suggestive, scientific evidence. The review by the European Heart Network Expert Group on Physical Activity illustrates that a sedentary lifestyle more than doubles the risk of cardiovascular disease. It summarizes the evidence that regular, moderate and accumulated activity can lower heart rate, raise insulin sensitivity, lower blood pressure, raise HDL/total blood cholesterol ratio and helps weight control. Rodriguez et al illustrate that physical activity reduced the risk of ischemic stroke among those with increased left ventricular mass [2].

By monitoring a person over period, we can conduct about the student's behaviors and habits. Purpose of monitoring is to capture and analyze relevant data for student's activity. Web based application significantly reduces time in collecting and processing data as opposed to pen and paper methods. With use of modern technologies, monitoring becomes more efficient and time saving. We can with a mobile device to collect data, and automatically the data is securely stored on web server. A web application can fetch the data from the web server, graphically presenting and visualizing the captured data with charts. This system does not only simplifies the process of monitoring student's activities, but saves time and let users focus on analyzing and evaluating collected data. It is also possible extend the system to interpret and analyze captured data by itself [3].

II. THE PHP FRAMEWORK FOR WEB ARTISANS

Laravel is a free, open-source PHP web application framework, created by Taylor Otwell and intended for the development of web applications following the model–view–controller (MVC) architectural pattern. Laravel is regarded as one of the most popular PHP frameworks, together with Symfony2, Nette, CodeIgniter, Yii2 and other frameworks. Taylor Otwell created Laravel as an attempt to provide a more advanced alternative to the CodeIgniter framework, which did not provide certain features such as built-in support for user authentication

and authorization. Laravel's first beta release was made available on June 9, 2011, followed by the Laravel 1 release later in the same month. Laravel 1 includes built-in support for authentication, localization, models, views, sessions, routing and other mechanisms, but lacks support for controllers that prevents it from being a true MVC framework [4].

New features in the Laravel 5 release include support for scheduling periodically executed tasks through a package called Scheduler, an abstraction layer called Flysystem that allows remote storage to be used in the same way as local file systems, improved handling of package assets through Elixir, and simplified externally handled authentication through the optional Socialite package. Laravel 5 also introduced a new internal directory tree structure for developed applications [5].

Laravel 5.1 is the latest version released in June 2015. Laravel 5.1 is the first release of Laravel to receive long-term support (LTS), with planned availability of bug fixes for two years and security patches for three years. LTS releases of Laravel are planned to be released every two years [5].

Here are some key term which we must be knowing. Models are representatives of the database, and should be where all the business logic of an application resides. Controllers communicate with Models and ask them to retrieve information they need. This information is then passed by a Controller to the View and is rendered. It's very rare that a Model directly interacts with a View, but sometimes it may happen when necessary. Models can talk with other Models and aren't self-contained. They have relationships that intertwine with each other. These relationships make it easier and quicker for a Controller to get information, since it doesn't have to interact with different Models - the Models can do that themselves. The difference is that Laravel give an easy way of building these models, by providing general-purpose methods that most models would need - the Eloquent ORM [6].

The Eloquent ORM included with Laravel provides a simple ActiveRecord implementation for working with the database. Each database table has a corresponding "Model" which is used to interact with that table.

Models: Models are the heart of Laravel application. It mainly consist of business logic. The models mainly comprises of database interactions, File I/O operations, interacting with web services etc.

Libraries: Libraries are classes that perform tasks that aren't specific to Laravel application. For example a library which can convert table data to graphs and show that. Creating library is very easy. For eg we create a ShowMessage.php with following content and place this inside the library folder:

<?php class ShowMessage { public static function write($text) { echo $text; } }

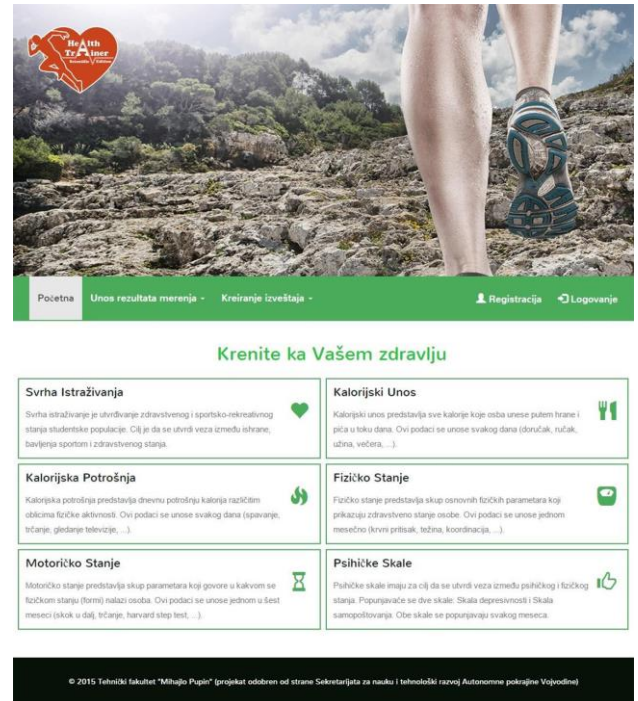After that, when ShowMessage::write("Hello") is called from anywhere in Laravel application, will print "Hello" [7].

Figure 1. HealthTrainer web application

III. WEB BASED APPLICATION OVERVIEW

In order to run the application, no additional requirements is necessary on the client and fig. 1 shows startup screen of "HealthTrainer" application.

User to be allowed to access the application content must be logged in. The user creates username and password by application registration from, fig. 2.

Figure 2. HealthTrainer registration form

With successfully fulfill required form, username will be added to the system. When the user is successfully logged in, he is able to input the measurement's data. In this screen the user can input all relevant data about health or fitness activity. For easier collecting data, data inputs are organized by measurements type and placed below navigation menu.

Figure 3.   Preview of calorie intake screen

Navigation menu "Unos rezultata merenja" has six different inputs and all fields are validated during inputs. By clicking on the "Kalorijski unos", the user can see the form for the calorie intake, fig. 3.

This form enables entering data such as data of measures, the type of meal, the type and quantity of food. Calories for specific type of food is predefined in database and automatically shown with selection of the type of food.

By clicking on the "Kalorijska potrošnja", the user can see the form for the calorie consumption, fig. 4.

Figure 4.   Preview of calorie consuption screen

This form enables entering data for the user energy consumptions, fields like date of activity, type of activity, activity weight, intensity and duration.

The form "Fizičko stanje", enables the user to input the physical activity data, fig. 5.

Figure 5.   Preview of physical activity screen

This form enables entering data for the user physical/medical conditions, fields like date of activity, weight of user's, blood pressure and heart frequency rate.

By clicking on the "Motorički status", the user can fill the fitness condition form by entering specific condition students' measurements, such as lay-sit, bend and chin-up exercises, standing long jump, coordination and flexibility data.

The web page "Skala depresivnosti", enables the user to fill data of the users' depression scale in the form of short questionnaire. The web page "Skala samopoštovanja", enables the user to fill the self-respect questionnaire form.

By clicking on the "Kalorijski unos" inside the menu "Kreiranje izveštaja", the user can perform report with all data related to calorie intake for specific date, fig. 6.

Figure 6.   Preview of calorie consuption screen

By clicking on the "Kalorijska potrošnja" inside the menu "Kreiranje izveštaja", the user can generate report for calorie consumption for specific date, fig. 7.

Figure 7. Preview of calorie consuption screen

For logout the user needs to click on the menu item "izloguj me".

IV. ADVANTAGES OF USING THIS OR SIMILAR APPLICATIONS

Health and fitness monitoring application offer students an opportunity to assess, track, and improve their health and fitness level.

Physical educators can integrate as the link between fitness, health, and physical activity. For society is important to have strategies on fitness education, ways to recognize students' fitness and physical activity achievements. The HelathTrainer software is easy tool to collect detailed health and fitness information from student's population and enables supervising specific data indicators.

V. CONCLUSION

Students, schools or states might use health and fitness data to identify the percentage of students in the population who are in the Healthy Fitness Zone and the percentage of students who need improvement on the various fitness components Application can help students understand and measure their health-related fitness and

learn how to improve it. Researchers, physical educators, and others can use student health and fitness results for monitoring student fitness levels in their population.

This application enables users to have precise and detailed insight of student's health and fitness status. There is also a psychological effect, as with the use of the application increases the responsibility of subjects to practice fitness activities. In this way, individuals, improve their health level.

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Local Cloud Solution's and Distance Learning System's Reliability

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Abstract - One of the distance learning system's functions is to train attendants for easier learning and new knowledge acquisition in education. Such a system introduction in education requires preparations regarding maintenance, system termination prevention and possible accompanying costs. Present paper shall elaborate the advantages of such a system within a local cloud solution compared to the traditional approach in more detail.

I. INTRODUCTION

The new age globalization brought about back door challenges to all institutions. The so far applied traditional learning methods are proving inadequate. Global economic crisis has largely contributed to reduction to IT related allocated funds. The above resulted with educational institutions being forced to undertake number of changes. Herein further the study will explain how the way distance learning system located on the local cloud solution compares to a traditional solution, and the way it's both technical and constructive solutions simplify system's technical maintenance.

II. MATERIALS AND METHODS

Firstly, we need to explain the cloud computing solution definition. The one that stands out is Gartner's definition, claiming that: "Cloud computing is a style of computing in which scalable and elastic IT-enabled capabilities are delivered as a service to external customers using Internet technologies".

The second cloud computing solution definition being imposed is the one provided by the US National Institute of Standards and Technology (NIST), stating that "Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction". [1]

In contrast to the traditional computing approach involving the software being actually purchased, cloud computing solution implies moving user's data to the Internet. Cloud computing solutions are being expected double-digit growth in the coming years, and according to Gartner's predictions as many as 30% of enterprises by the 2015 would change their IT resources usage

purpose. Private users are presently utilizing the cloud computing predominantly for file storage or Webmail services. In general, all applications that are currently being utilized on PCs should continue as services via cloud computing solutions.

At present, there is wide range of services being on offer in this domain In Serbia. Of significant importance is the cooperation based on VMware solutions. Telekom Srbija (thanks to their regional market presence in Montenegro and Bosnia and Herzegovina as well) has some nine million subscribers, and being mobile telephony services operator as well as broadband Internet provider, represents an ideal partner. There is a business requirement for both public and private cloud solutions offering flexible use of virtual infrastructure, virtual servers renting, i.e. either server and user applications or entire platform. Such services' elements include company Cloud computing connectivity with the system infrastructure location, access to the virtual desktop and/or server devices, virtual elements creation and setup according to customer requirements, as well as corresponding applications installation and configuration. Services are always accompanied by the data security support systems as well as system's crash recovery mechanisms. [2]

Data storage was one of the issues not previously associated with the solution. If the service being utilized is provided by cloud computing solution vendor not located in the country of our institution where it's actually being used, and we opt to cancel the services, what would then happen to our data and how sure can we be that they will not end up being misused?

The present paper shall herein after provide explanation of an ideal solution for the above problems, detailing the implementation of the local cloud computing solution containing distance learning software.

In order to gain insight into feasibility of distance learning system introducing we have conducted research utilizing the scientific investigation and survey techniques. Survey in written was conducted on a sample totaling one hundred students aged between 19 and 25. All of the surveyed had already accessed distance learning system. Survey questions designated as essential for the distance learning introduction are: whether the use of information technology is necessary in the distance learning process and whether they regard

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[1] NIST Tech Beat : "Final Version of NIST Cloud Computing Definition", October 25, 2011, Published

[2] Alargić P, Tanja K. " INFOTEH-JAHORINA" Vol. 13, March 2014.

Internet classroom as a useful tool for students. Survey results obtained were more than sufficient for us to realize the requirements for such system (Figure 1).
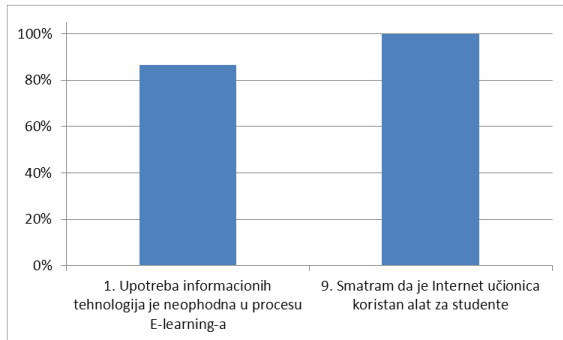

Figure1. Distance learning system requirement

Number of surveyed individuals answering affirmative regarding such a platform requirement amounted to 87%, while 100% of respondents believe this system is one of the most useful tools during the course of the study (Table 1).

The following factor affecting the feasibility of such a system introduction is renting storage space cost and leasing Cloud computing solution to store the required software.

As an innovative and cost-effective solution, taking into account the herein above pointed issues, indeed proved to be the one in the form of a combined free software tools, regular PC and widely available Internet connection. Free Ubuntu Server platform is the one we decided to implement as our basis platform[3]. In addition to free platform we utilized their free cloud computing solution called Ubuntu OpenStack, which we used to perform our server virtualization [4].

III. IMPLEMENTATION

The system of at least seven PCs, each of which have two hard drives, as well as additional requirement that the two PCs each have two network interface cards (NIC), are required in order to implement internal cloud computing server. Ubuntu Server platform needs to be installed on PCs that have two network cards.

It is then necessary for all of the PCs to be connected to the internal private network in order to utilize other PCs' resources. OpenStack Ubuntu platform implementation is the step that follows, used to configure or change our cloud computing solution performance (Figure 2).

TABLE I.   STUDENTS' REQUIREMENT REGARDING E-LEARN CLASSROOM

The use of information technology is necessary in the e-leaning process	*87%*
I regard Internet classroom as a useful tool for students	*100%*

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[3] www.ubuntu.com/server
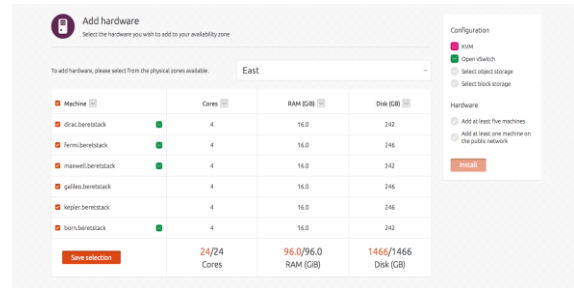[4] www.ubuntru.com/Cloud/openstack

Figure 2. Ubuntu OpenStack

With this our internal cloud computing solution is properly configured and ready for use. It is now necessary to install and configure one of the distance learning solutions on such configured and set platform. We also opted for a free of charge solution, based on Open Source platform. OpenSource platform is a term used to describe software provided to users free of charge, having no restrictions on how to be utilized, modified or shared. In general, source code is made fully available to user so that he/she is able to fully customize it as per specific requirements.[5] Moodle platform represents good solution being applied worldwide, and also translated into numerous languages, including Serbian.[6] Simple installation of Apache server[7] and a MySQL database[8] utilizing only the command line on our platform, as well as Moodle distance learning platform installation – rendered the system ready for setup and operation (Figure 3).

The very final step represents opening of our private Cloud computing PC network to the Internet. This is accomplished by enabling free passage on our router (allowing access to Internet) for the PC where Moodle distance learning platform has been installed. Those router settings are found in the section entitled "Port Range Forwarding", and where's necessary to enter the PC's with installed distance learning platform IP address and port 80, and save such data in settings (Figure 4).
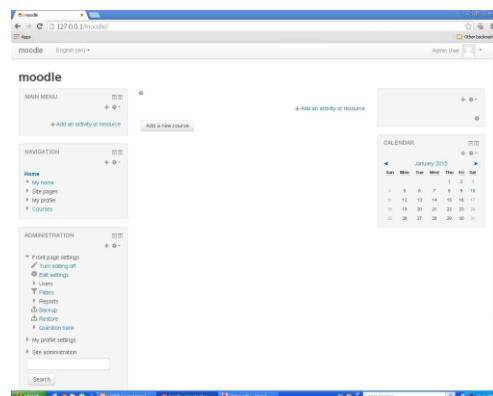

Figure 3. Moodle platform

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[5] http://tehnografija.net/operativni-sistemi/linux-operativni-sistemi/sta-je-zapravo-open-source/
[6] www.modle.org
[7] http://httpd.apache.org/
[8] http://www.mysql.com/

Such a configured system is ready for operation.

In order to explain why we opted for cloud computing platform model in a local network (with number of PCs, as in our case, are connected in one system) and not utilizing until now prevailing approach (available via the services provider lease), we must have knowledge regarding cons/pros of such systems. We have compared two systems in Table 2.

The advantage of our cloud computing solution is in its ability to:

- Control of the management system,
- Lock,
- Failure isolation,
- Risk adjustment,
- Data protection,

Failure isolation is an important feature to be singled out. Multiple leases and shared resources are the Cloud Computing defining characteristics during the services purchase. It Includes failure mechanisms for sharing storage, memory, routing, and even good reputation among different occupants such is the so-called VM/hyper jumping. One is to keep on mind the low current frequency of attacks on resources isolation mechanisms, with experience requiring caution even at this stage.

Another characteristic that must not be omitted is insecure or incomplete data deletion. At service purchasing point, when the request is made to delete cloud resources, it may happen, as with many operating systems, that the data is not actually deleted. Adequate or timely data deletion can also be disabled (or undesirable from a user's perspective) or for the reason of unavailability of additional data copies or because destruction disk contains other clients' data. In case of multiple requests and hardware resources re-use, this represents a greater user risk than a separate software.[9]

IV. MAINTENANCE SUITABILITY

System's maintenance suitability is the single most important as well as decisive characteristic of cloud computing solution in the local network in conjunction with distance learning platform.
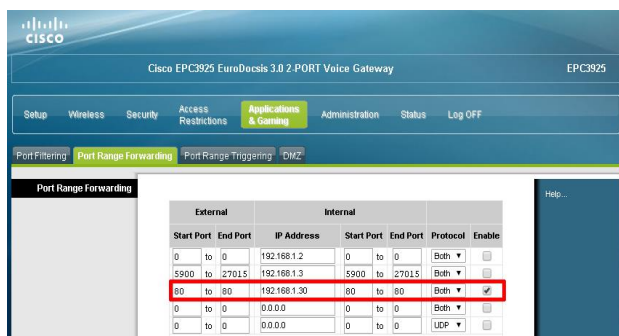

Figure 4. *Router settings*

SERVICE	CLOUD local	CLOUD service purchase
Usage and response time reduction	X	X
Infrastructure errors minimization	X	X
Basic costs reduction	X	X
Innovation pace increase	X	X
Loss of control over management system		X
Locking		X
Failure isolation		X
Harmonization risks		X
Management interface compromise		X
Data protection		X
Insecure or incomplete data deletion		X
Malicious intrusions	X	X
Delay		X

In an effort to define we can single out that maintenance suitability represents probability of projected maintenance procedure being carried out at the provided time, environmental conditions and at minimal cost.[10] Thereby, the maintenance suitability is related to:

- Technical system structure simplicity principle and benefits of combining them,
- System's build quality,
- Conditions for performing maintenance activities, and
- System's integral support level.

The herein laid out system is not flawlessly designed, and as well as with any other similar system, there are parts and particles prone to failure. Such positions can be called weak points. There are many different ways to detect weak points:

- During system's operation commencement, with initial failures, and
- During the working process.

The most important thing is to find them, and to analyze how to troubleshoot and remove them. Weak points may reveal themselves by the emergence of failure, so they should not be sought out, even though

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[9] Ljiljana Paunović, "Cloud computing kao vrsta web hosting servisa". http://www.itresenja.com/

[10] Prof. dr Živoslav Adamović, doc. Dr Cariša Bešić : „Održavanje tehničkih sistema", Želnid, Beograd, 2008.

weak points are often not recognized because the failure is remedied and a weak point remains and is able to surprise again.

Based on failure information on our local network cloud computing system, we are able to calculate the failure coefficient on the basis of which we can get information on whether system possesses weak points or not. Failure coefficient (K) is calculated utilizing the following formula:

$$K = \frac{a \cdot b}{c \cdot d} \left[\frac{otkaz}{deo/skl} \right] \qquad (1)$$

With :

- a Count on this kind of previous failures,
- b Mean time between two failures,
- c Records keeping time or system's integral parts that failures are being considered, and
- d number same type of assemblies or system's integral parts that failures are being considered.

The system being observed shall first include cloud computing solution purchase and calculate the failure coefficient (K_1), observing only the number of the same assembly which was in failure.

$$K_1 = \frac{a_1 \cdot b_1}{c_1 \cdot d_1} \left[\frac{otkaz}{deo/skl} \right] \qquad (2)$$

With :

$a_1=24$

$b_1=14$ (dana)

$c_1=365$ (dana)

$d_1=1$

Resulting coefficient is $K_1=0.92054$.

Another system being observed is local network cloud computing solution (herein above described) and we shall calculate its failure coefficient (K_2)..

$$K_2 = \frac{a_2 \cdot b_2}{c_2 \cdot d_2} \left[\frac{otkaz}{deo/skl} \right] \qquad (3)$$

With :

$a_1=3$

$b_1=36$ (dana)

$c_1=365$ (dana)

$d_1=1$

Resulting coefficient is $K_2=0.29589$.

As can be seen, measurement results show the obtained failure coefficient for Cloud computing solution in conjunction with the Moodle distance learning system is multiple times lower when compared to the same system with the service provider.

Finding technical systems' weak points, except for the failure monitoring process, there is a proceeding by which to monitor stoppage and stoppage caused costs. Utilizing this method of finding weak points by monitoring the cost or stoppage is done periodically, and results then compared with the expected state.

V. CONCLUSION

The present paper describes and identifies the benefits of local based cloud solutions in conjunction with distance learning system. The new era demands reliable information and communication systems operation, either for business or private purposes. Low reliability and availability lead to safety endangerment, customer dissatisfaction and great losses both because it is not delivering services, and at the same time running with higher maintenance costs. Reliability can be no longer calculated on the basis of hardware reliability only, but must take into account the software reliability as well. However, a human represents huge factor in system reliability, especially in determining the reliability of task execution system with human being part thereof, or is triggered in the event of failure of some of the system's functions. During the last twenty years, due to a lack of classical statistical approach in determining the reliability and suitability of the ever growing requirement for calculating the failure coefficient, based on the measurement and determination of the weakest links in the observed system. Rapid development of new and modern technologies indicates that the challenges being put before the reliability experts are still immense, especially when it comes to systems with increasingly present hardware and software.

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[3] Alargić P, Tanja K. " INFOTEH-JAHORINA" Vol. 13, March 2014.
[4] www.ubuntu.com/server
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[6] http://tehnografija.net/operativni-sistemi/linux-operativni-sistemi/sta-je-zapravo-open-source/
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Software Industry in India: an Overview

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Abstract – **Main aim of this paper is to present the current state and trends in software industry in India. This way example of Indian software industry experiences could be basis for improvement of software industry and higher education in software engineering field in other countries.**

I. INTRODUCTION

Indian software industry today is one of the largest and most successful industries in India. Technological revolutions have given rise to opportunities and the economic performance of a nation is closely related to the process of technological change. The Indian economy has reaped the benefits from the information technology revolution. It can be stated that the Indian IT industry identified as the 'sunrise' sector is recognized as enhancing the credibility of the economy as an exporter of IT software services despite the global economic crisis. In the context of globalization, the Indian IT software and services industry must emerge as a key player in terms of revenue growth, employment generation and value creation in the lucrative arena of IT software products.

According to [7], IT sector in India related to software is classified as: IT software sector and IT services sector, as presented at Figure 1.
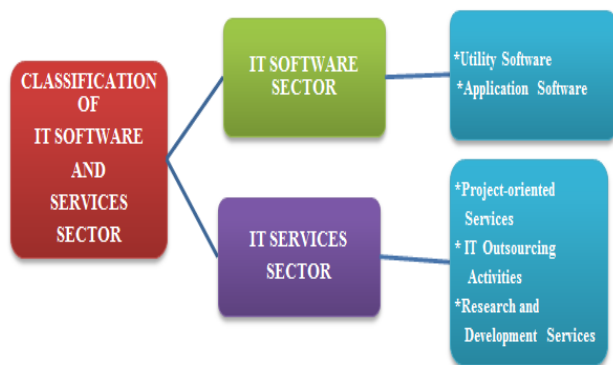

Figure 1. Classification of IT software and services sector [7]

Aim of this paper is to present systematized results in Indian Software Industry evaluations and explorations. This way current state and future trends could be described, which could be a good basis for improvement in other countries software industry, based on Indian experiences. Other aim is to enable a foundation for software engineering higher education improvement, with examples from well-established Indian software industry practices.

II. THE ROLE OF NASSCOM

Many software companies joined within NASSCOM (the National Association of Software and Service companies), which presents the primary business association for the Software and Services Industry in India and estimates that its members account for about 90% of industry revenues [1] [9].
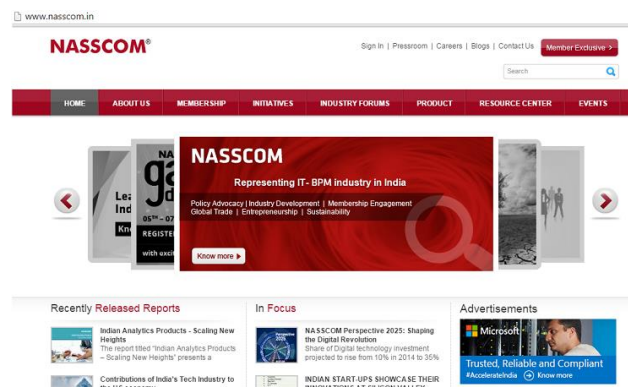

Figure 2. Web site of NASSCOM [1]

The NASSCOM association has positioned itself as a bridge between the Indian, the foreign governments as well as the Indian IT software and services players. Moreover, it can be noted that NASSCOM has helped in attaining key policy concessions and incentives by playing an advisory role with leading state governments across the country in the area of IT.

Figure 3. presents profile of NASSCOM member companies in period 2003-2012.

Profile of NASSCOM Member Companies (2003-2012)

Year	IT Services	Product Development	Engineering R&D, Embedded	BPO	Others
2003-04	75	35	-	24*	5
2004-05	70	38**	-	40**	5
2008-09	72	24***	-	44	9
2009-10	66.79	32.28	14.68	31.28	13.46
2010-11	68	37	16	33	10
2011-12	62	36	13	30	23

Note: Figures are represented as percentage values

Figure 3. Profile of NASSCOM member companies [9]

It could be concluded that NASSCOM member companies fall into one of four types:

- IT services

- Product development

- Engineering RAD, Embedded

- BPO (Business Process Outsourcing), i.e. ITES-BPO (Information Technology Enabled Services-Business Process Outsourcing).

NASSCOM encouraged many research efforts which ended as valuable results, that could lead industry and higher education in this field toward better solutions.

III. INDIAN SOFTWARE INDUSTRY SUCCESS STATISTICS, STRUCTURE AND EVOLUTION

In study [2], overview of the Indian software industry has been presented. Figure 4 presents comparison of computer software and electronic hardware production and rise in Indian IT industry for the period 2005-2011.
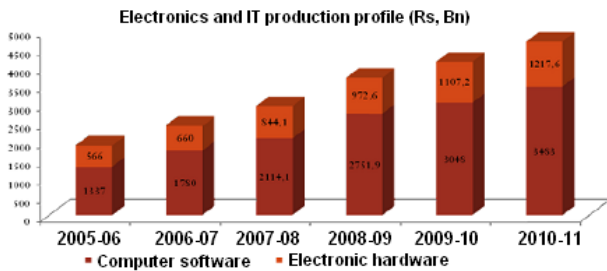
Figure 4. Rise of Indian IT production financial value (in Rs) and comparison for computer software and electronic hardware, for period 2005-2011. [2]

Indian IT industry consists of four types of companies according to the number of employees (statistics from 2011 [2]):

- Large companies with more than 40.000 employees : 7 firms

- Mid-sized companies with 5000-40.000 employees : 75-80 firms

- Emerging companies with 100-5000 employees: 300-350 firms

- Small firms (startups) with less then 73 employees: more than 3500 firms

„Multinational firms dominate industry revenues with 12 firms listed among the top 20 firms and 67% of top 200 firms. Top 200 firms contribute with 86% of the total revenues of the Indian ICT industry." [2]

History of Indian ICT industry development could be presented with several phases of evolution [2] [5]:

- First period (till 1984) – discouraged entrepreneurship and foreign investments, by state attempt to run the industry

- Second period (1984-1990) – liberalization of Indian economy, potentials of software industry recognized, established computer policy and computer software export policy (1984), formation of NASSCOM (1988)

- Third period (1990-2000) – establishment of software technology parks in 1990 (Figure 3), trade liberalization, openness to foreign

investment, change from low-end onsite services to high-end offshore services of multinational corporations, Indian firms: product as service and co-development (working on behalf of client)

- Fourth period (2001-present) – intellectual property, export, reverse migration of Indian immigrants, national e-Government plan (2000), government programs promote use of IT, large multinational firms establish research centers in Bangalore. Learning through outsourcing in India, co-creators of products, creating their own product brands.

Figure 5. presents a tabular presentation of cities where technology parks are established, together with number of companies they integrate, number of clients they serve and financial revenue in export.

Software Technology Parks Contribution to Exports (1998-99)

City with Software Technology Parks	Number of Companies	Number of Clients	Exports (In ₹ billion)	Exports (In Percent)	Exports per Client (In ₹ million)
Bangalore	245	746	43.2	37.2	57.9
Hyderabad	138	977	10.6	9.1	10.8
Noida (Delhi)	129	1,103	24.5	21.1	22.2
Pune	88	474	5.7	4.9	12.1
Chennai	67	535	18.9	16.3	35.3
Calcutta	29	131	1.5	1.3	11.5
Mumbai and Navi Mumbai	28	-	-	-	-
	-	755	9.6	8.3	12.7
Gandhinagar (Ahmedabad)	27	295	0.3	0.2	0.9
Mohali (Chandigarh)	24	131	0.2	0.1	1.1
Bhubaneswar	22	152	0.9	0.8	5.9
Jaipur	6	95	0.2	0.1	1.6
Trivandrum	-	188	0.6	0.5	3.0
Total	803	5,582	116.2	100.0	175

Figure 5. Software technology parks contribution to exports for period 1998/1999 [8]

Previous table (presented as Figure 5) represents cities in India with technology parks: Bangalore, Hyderabad, Noida (Delhi), Pune, Chennai, Calcutta, Mumbai and Navi Mumbai, Gandhinagar (Ahmedabad), Mohali (Chandigarh), Bhubaneswar, Jaipur, Trivandrum. The order of these technology parks, presented at previous table, is according to number of companies supported by the particular technology park.

Figure 6 presents major destinations for export of IT Software and services from Indian software industry, for period 2010-2011 [10].
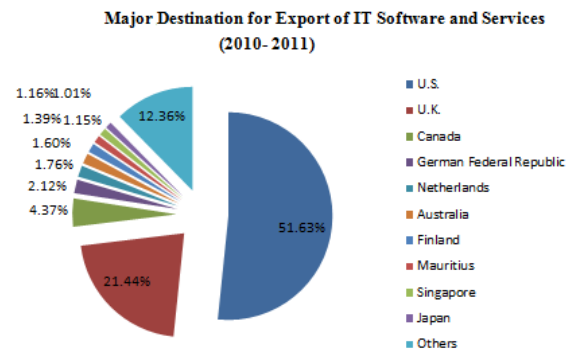

Figure 6. Major destination for Export of IT software and services in 2010-2011 [10]

IV. CURRENT ENABLING FACTORS AND LIMITATIONS OF INDIAN SOFTWARE INDUSTRY

Current enabling factors that encourage growth of ICT industry in India include [2]:

- Policy environment

- Strategic Government intervention in skill formation: annual output of graduates with Bachelor's degree in engineering from 247 in 1947 to 237.000 in 2006 (comparing to USA in 2006 was 104.200).

- Proactive role of Indian middle class: human capital investment and risk taking entrepreneurs.

- Research and development (R&D) centers from large multinational companies

According to [2], there are still some limitations to enable better development in this field:

- Lack of dynamism in the government R&D system

- Poor research output from the higher education system

- Limited scope and impact of government support programmes for R&D

- Weak University-Industry alliances

- Absence of an institutional environment to facilitate the sharing and circulation of ideas

- Poor knowledge diffusion in the local technology systems

V. COMPARISON OF SOFTWARE INDUSTRY OF INDIA AND OTHER COUNTRIES – THE ROLE OF MULTINATIONAL COMPANIES

Particular research has been conducted in aim to compare software industries from other countries to software industry of India. In study [4] comparison is made between Israel, Ireland and India regarding ICT industry, i.e. particularly the role of multinational companies (MNCs) to the development of local software industry in particular countries.

Results of the study [4] show that activities and the role of MNCs vary considerably across the analyzed three countries. Main differences are in:

- Time of entry of MNCs – in Ireland many MNCs entered the country before the development of local ICT companies; in India and Israel it was a contrary situation – majority of MNCs have entered after domestic industry have emerged.

- Activities of MNCs – in Ireland, MNCs in first period focused on including local human resources in low value added activities, just like in India, while in Israel the majority or MNCs conduct higher value added activities, including R&D. Only recently, MNCs have started to shift to India also R&D operations.

Some benefits of MNCs influence to domestic software firms were:

- People mobility and spin–offs - former employees that were employed in MNCs very often create start-up firms and implement organizational models and managerial and technical knowledge within new domestic firms,

- Business models and marketing – successful organization of MNCs was a good model to organization of smaller domestic firms,

- Market opportunities – linking domestic companies with foreign clients firstly within sub-contractor alliances and then as co-development.

VI. INDIAN DOMESTIC SOFTWARE INDUSTRY AND THE ROLE OF DIASPORA SOCIAL TIES

NASSCOM supports many research efforts and one of research results is related to relationships and success comparison of domestic (in India) and diaspora (in other countries) software industry[3]. "This study explores the importance of cross-border social networks for entrepreneurship in developing countries by examining ties between Indian expatriate community and local entrepreneurs in India's software industry "[3].

It has been shown [3] that within India's software industry there are two types of software companies – software hub companies (mostly situated in large cities) and independent software companies (scattered in small and large cities). This study shows that software companies within hubs benefit from greater institutional environment and organizational support and do not necessary depend on help from abroad. Independent scattered smaller software companies express greater need and importance of social ties from diaspora, particularly for the support to international trade.

In 2001, India was, along with Israel, the largest non-OECD exporter of software.[6] Study [6] examines the process and roots of transformation of Indian software industry from low-cost and low-skill services provider to provider of high-skill R&D services. In study [6], particular area of Bangalore in India was presented as one of most successful software development centers ("India's Silicon Valley"). According to [4], Bangalore area was chosen by MNCs as suitable region because of many quality engineering universities, supplying capabilities and appropriate climate conditions for living, which could attract many ICT professionals to live and work there. In first period, Bangalore region was not viewed as innovative region because of the lack of technical expertise, lack of technical community with deep and diverse range of capabilities, minimal interactions among local firms. These three dimensions changed in recent years, which turned local firms to shift to R&D services. Since R&D services become increasingly popular in India, this included the sale and transfer of intellectual property blocks, usually integrating software and hardware such as embedded systems.

VII. CONCLUSION

Aim of this paper was to briefly introduce Indian software industry success, history of development and conditions that lead to current state of the Industry.

Obviously, great role in Indian software industry success was in MNCs, but much more important is the role of Indian Government that recognized the value of development of domestic firms, which are based on educated and skilled human resources. The human resources as software industry roots are obvious, which could be created with appropriate quality of higher education in the field and strong commitment of workforce to excellence.

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Use of Bezier Curves in Medicine

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Abstract - Bezier methods for curves and surfaces are popular, and are commonly used in practical work, and in many other sciences. Here we will present some of the use of Bezier curves in medicine. Like we all know "A Bezier curve" is a mathematically defined curve used in two-dimensional graphic applications" – definition taken from whatis.com. In surgery it is used to modeling of organs or tisues that were damaged due to illness or any other factor. It also can be used for learning symmetry transformation of particulary bones or any other organ in human body.

I. INTRODUCTION

Pierre Etienne Bezier was a French engineer and mathematician born on 1910. In the year 1960, he began searching for ways to automate the process of designing cars, encouraged by his employer in the car manufacture of Renault [1]. Modern field of Computer Aided Geometric Design (CAGD), a field with practical applications in many areas, has on his methods as the basis of it. The first who was in 1959, to develop the various Bezier methods was Paul de Faget de Casteljau, an applied mathematician with Citroen, but because of the secretiveness of his employer he never published it. Two internal technical memos were discovered in 1975 by Paul de Faget de Casteljau [1]. That is why the entire field is named after the second person, Bezier, who developed it.

II. BEZIER CURVE

A parametric curve P(t) that is a polynomial function of the parameter t is represent as the Bezier curve. The number of points used to define the curve is represented by the degree of the polynomial.

On the given points P_0 and P_1, the linear Bezier curve is the simple straight line between the two points. The curve is obtained with the following function:

$$B(t) = P_0 + t(P_1 - P_0) = (1-t)P_0 + tP_1 \ , \ t \in [0,1]$$

And it is equivalent to linear interpolation.

The square Bezier curve is the path obtained with the function B(t), from the given points P_0, P_1, and P_2:

$$B(t) = (1-t)^2 P_0 + 2(1-t)t P_1 + t^2 P_2 \ , \ t \in [0,1].$$

It deviates from P_0 towards P_1 and seeks to reach P_2 from P_1. In other words, tangent lines in P_0 and P_2 passes through P_1.

The four points P_0, P_1, P_2 i P_3 in a plane or a bigger dimensional space are defined as cubic Bezier curve. The curve begins in the point P_0, continues to P_1, reaches P_3 coming from P_2. It usually does not pass through P_1 i P_2, these points are given only to show the information about the direction of the curve. The cubic Bezier curve can be defined as the linear combination of the two square Bezier curves:

$$B(t) = (1-t)B_{P_0,P_1,P_2}(t) + tB_{P_1,P_2,P_3}(t) \ , \ t \in [0,1].$$

That method employs control points and produces an approximating curve. This curve is not passing through the interior points but it is attracted by them. Each point of this curve, influences the direction of the curve by pulling it toward itself, and that influence is strongest when the curve gets nearest the point. In Figure 1. it is shown some examples of cubic Bezier curves. That kind of a curve is defined by four points and is a cubic polynomial. We can observe that one has a cusp and another one has a loop. Because points are not "set in stone" and can be moved it is easy to edit, modify and reshape the curve, which is one of the reason for its popularity. Curve can be edited by adding new points, or deleting points, too.
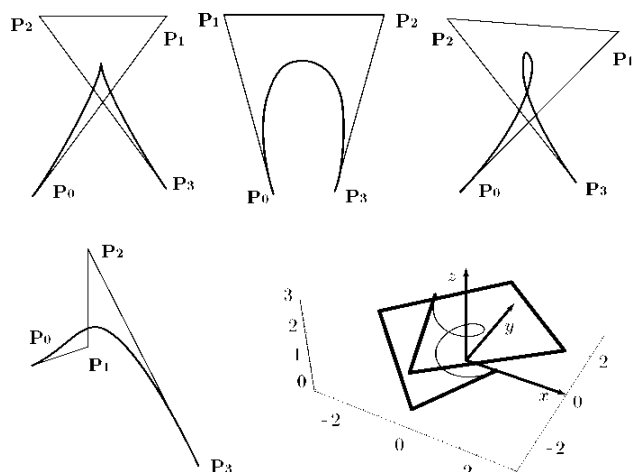

Figure 1. Bezier curve

III. EXAMPLES OF BEZIER CURVES IN MEDICINE

Using of Bezier curves in medicine is a very wide term. The practical implementation of Bezier curves has first found its place in medicine in the field of radiology, where its use has stayed the most important so far. It can also be used for modeling of organs that have been damaged due to illness to help the clinician to restore the damaged tissue or organ.

A. Modeling of the intestines

For example for the modeling of the intestines, Bezier curves have been used to define first the direction of a curve, as shown in Figure 2 (left). For the case of the colon, and later the surface surrounding that curve applying the blender tool, displayed in Figure 2 (right) [2].
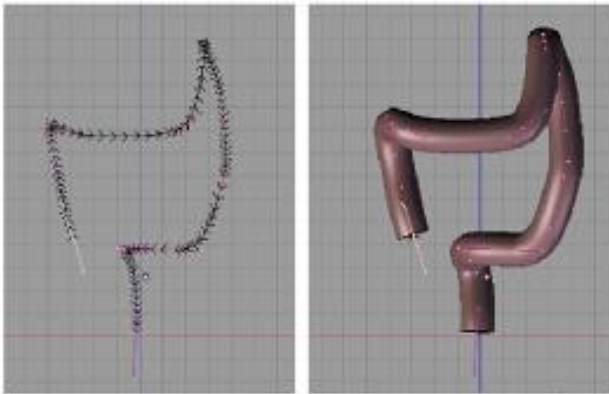

Figure 2. Modeling of the intestines [2]

B. Outline of the obturata foramen

Using Besier curves in magnetic resonance (MR) using multiple images filming bones. For example the outline of the knee cartilage (Figure 3) was manually segmented using Besier curves from a set of MR images [3].
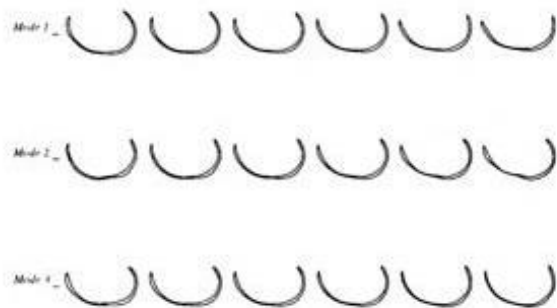

Figure 3. Using Besier curves in MR using multiple images filming bones - the knee cartilage [3]

The outline of the obturata foramen (Figure 4) was manually extracted from 20 radiographs using Bezier curves [3].
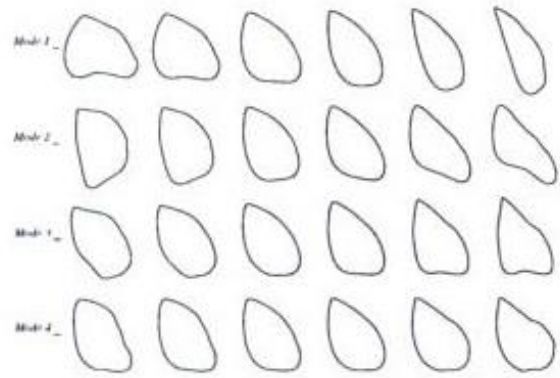

Figure 4. Using Besier curves in MR using multiple images filming bones - the obturata foramen [3]

C. Segmentation of knee bones and cartilage from magnetic resonance

Paper [4] has first described the use of Bezier curve, with the aim to improve the contrast between the different tissues on the example of imaging (MR) of the knee joint (with the ostoarthritis). On the example of the diagnostics in question, the contrast methods used by standard in radiology are insufficient to make the clear segmentation of the knee cartilage. The BBCE method (bihistiogram Bezier curve contrast enhancement) helps the radiologist in the interpretation of the image. This method usually uses the Bezier curves of the second and third degree.

Figure 5. Original MR knee image [4]

Figure 6.   BBCCE enhanced MR knee image [4]

D.   Modelling of the artificial hip

[5] describes the use of the Bezier curves in designing of the artificial hip. These prostheses need to be custom-made for every individual patient, according to their dimensions. This achieves the greatest success. Cross-sections of the prosthesis are established on te basis of the tomographic images (CT) and the corresponding cross-sections of the femur and its medullary canal. Finally, the surfaces of the prosthesis are formed.

Figure 7.   Computer model of the femur (up) and the endoprosthesis body (down) [5]

Given that around 800.000 of these surgeries are done every year on the world level, both prolonging the patients' life and improving its quality, it is easy to see the importance of improvement of this method.

E.   Ultrasound of aorta

Unlike CT and MR, which require robust equipment, the ultrasound is the diagnostic method with an advantage of being able to be used during the operation as well, and given that it is noninvasive, it is also used with pregnant women. Its disadvantage in comparison to the two previously mentioned methods is that it does not give the clear image. There is an attempt to solve this problem

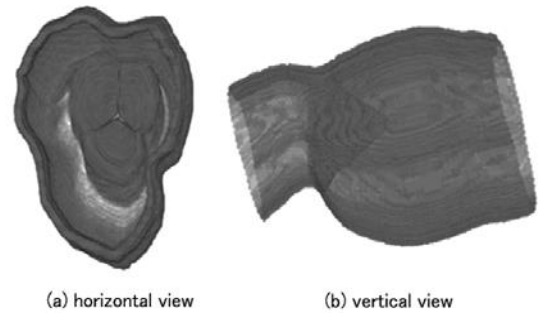through using the 3D ultrasound, where Bezier curves have found their practical use [6].

Figure 8.   Constructed 3D aorta shape model [6]

The figure shows the aortic body with valves, where the 3D image can be used to follow the pathological enlargement and possibly start the treatment. The condition in this case can endanger the patient's life.

Until now, the surgeries like stenting were controlled by RTG, which exposes not only the patient, but also the medical staff to radiation. If ultrasound were enabled during this intervention, the negative aspects of RTG would be avoided. The ultrasound could be used only if it were improved, which actually opens the way to use of Bezier curves.

F.   Visualization of LV wall motion of heart

Similarly to the previously mentioned methods, MR which uses Bezier curves can be used to show the agility of the heart muscle, actually the heart wall. For example, this can confirm the localization of the myocard infarct, diagnosed with ECG [7].
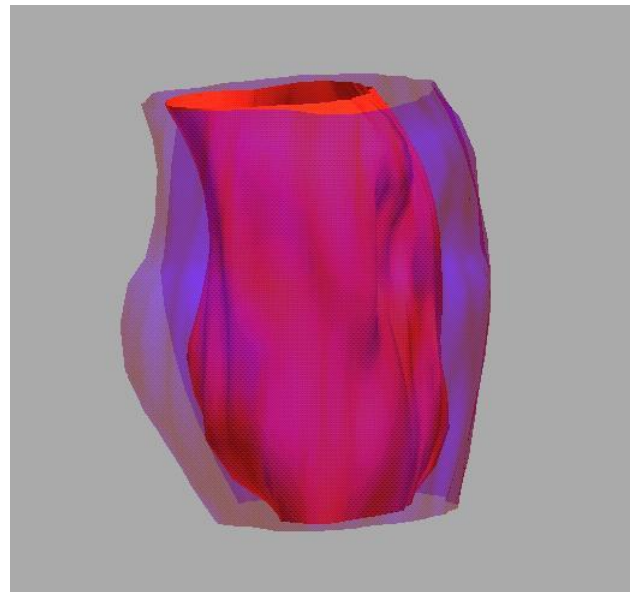

Figure 9.   Endocardial and epicardial surfaces [7]

G.   CT of brain

Furthermore, CT of brain with e.g. traumatised patient, is necessary to follow the condition and estimate if the surgery is needed. The estimation is done on the basis of the movement of the medial line (the one that separates

the hemispheres of the brain and which moves to one side if hematoma occurs. The brain compression caused by hematoma growth within the limited cranial space can depress the vital centres, leading to the death of the patient). This moving of the medial line is te parameter that can be quantified and the prognosis depends on it. The new method, including the use of Bezier curves, enables the automatic detection of the medial line movement on only one slice, helping the clinician to decide if the surgery is needed [8].
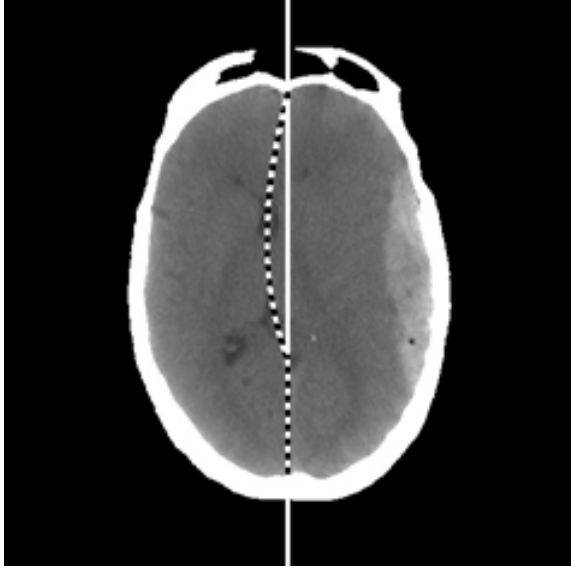

Figure 10.   CT slice from a patient withtraumatic epidural hematoma causing midline shift [8]

IV. CONCLUSION

As we can see, Bezier curves are broadly used in medicine, diagnostic procedures, as well as in the modeling of different organs in the human body. Constant development of information systems in medicine leads to an increase of the cure in certain patients, as well as the new significance, and importance in medicine.

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Cryptographic Criteria for Boolean Functions

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Abstract – This paper presents the rule of Boolean functions in cryptography. The algebraic normal form and the Walsh-Hadamard transform of Boolean functions are shown here. Balance, Correlation immunity, Resiliency, Nonlinearity, Algebraic degree and Algebraic immunity are important in designing Boolean functions. In this paper, the basic properties of these characteristics of Boolean functions are presented.

I. INTRODUCTION

The fundamental objective of cryptography is to enable two people to communicate over an unsecure channel in such a way that any other person is unable to intercept and read, or even modify, their messages during transmission. The transformation of the message, the plaintext, to information sent in its place over the channel, the ciphertext, is called encryption. The encryption algorithm takes the plaintext and an encryption key as input, and it outputs the ciphertext. If the encryption key is secret, then we speak of conventional cryptography, but if the encryption key is public, then we speak of public-key cryptography. Decryption is the reverse process, i.e. decryption algorithm transforms the ciphertext to the plaintext using a secret decryption key. Thus, in public-key cryptography, everyone can easily encrypt a plaintext using the public key, but the other direction is difficult. Public-key cryptography is preferable to conventional cryptography, since it allows to securely communicate without having previously shared keys. But, on the other hand, public-key cryptosystems methods require more complex computations. They also need much longer keys to ensure the same level of security and are less efficient than conventional cryptosystems. This is why conventional cryptography is still widely used and studied nowadays.

Boolean functions play basic and important role in cryptography:

- Every code of length 2^n, $n \in N$, can be interpreted as a set of Boolean functions, since every n-variable Boolean function can be represented by its truth-table and thus associated with a binary word of length 2^n; and vice versa.

- Cryptographic transformations, e.g. S-boxes in block ciphers, can be designed by appropriate composition of nonlinear Boolean functions.

In cryptographic framework, the number of variables is often small, in practice, because of the length of the code. Despite that fact, studying and determining Boolean functions which satisfies the required conditions is not feasible even through an exhaustive computer investigation. So, the study of Boolean functions for constructing or studying codes or ciphers is essentially mathematical.

II. BOOLEAN FUNCTIONS REPRESENTATION

Mostly, a Boolean function is a function with n variables:

$$f : F_2^n \to F_2 \qquad (1)$$

Multiple-output Boolean functions (also known as S-Boxes or vectorial Boolean function) is a function:

$$f : F_2^n \to F_2^m \qquad (2)$$

where $F_2 = \{0,1\}$.

A. The algebraic normal form

Among representations of Boolean functions, one of the most used in cryptography and coding is the n-variable polynomial representation over F_2, as follows

Definition 1. Form

$$f(x) = \bigoplus_{I \in P(N)} a_I \left(\prod_{i \in I} x_i \right) = \bigoplus_{I \in P(N)} a_I x^I \qquad (3)$$

where P(N) denotes the power set of N = {1, 2, ..., n}, n∈N, is called the Algebraic Normal Form (in brief the ANF) of Boolean function f [1].

Variables x_1, x_2, ..., x_n appear with exponents smaller than or equal to 1, because they represent bits. This representation exists and is unique for every Boolean function and belongs to the quotient ring $F_2[x_1, x_2, ..., x_n]/(x_1^2 \oplus x_1, x_2^2 \oplus x_2, ..., x_n^2 \oplus x_n)$.

Example.

Let us consider Boolean function f whose values are given in truth-table below (Table 1.). It is the sum of the atomic functions f_1, f_2 and f_3, whose truth-tables are given in Table 2. The function $f_1(x)$ takes value 1 iff

$$(1 \oplus x_1) x_2 (1 \oplus x_3) = 1.$$

Analogously in cases of the functions f_2 and f_3 we finally get that the ANF of function $f(x)$ is

$(1 \oplus x_1) x_2 (1 \oplus x_3) \oplus x_1(1 \oplus x_2) (1 \oplus x_3) \oplus x_1 x_2 (1 \oplus x_3) =$
$x_1 x_2 x_3 \oplus x_1 x_2 \oplus x_1 x_3 \oplus x_2 x_3 \oplus x_1 \oplus x_2.$

TABLE I.   FUNCTION F TRUTH-TABLE

x_1	x_2	x_2	$f(x)$
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

TABLE II.   FUNCTIONS F_1, F_2 AND F_3 TRUTH-TABLES

$x1$	$x2$	$x2$	$f_1(x)$	$f_2(x)$	$f_3(x)$
0	0	0	0	0	0
0	0	1	0	0	0
0	1	0	1	0	0
0	1	1	0	0	0
1	0	0	0	1	0
1	0	1	0	0	0
1	1	0	0	0	1
1	1	1	0	0	0

Form

$$f(x) = \bigoplus_{u \in F_2^n} a_u \prod_{j=1}^{n} x_j^{u_j} \qquad (4)$$

is equivalent representation of the same ANF, using an indexation by means of vectors of F_2^n instead of subsets of N , where for any such vector u we denote by a_u what is denoted by $a_{supp(u)}$ (supp(u) denotes the support of u). The monomial $\prod_{j=1}^{n} x_j^{u_j}$ is often denoted by x_u.

1) Relationship between a Boolean function and its ANF

The product $x^I \neq 0$ iff $x_i \neq 0$ for each $i \in I$, that is if I $\subseteq$ supp(x), hence for the Boolean function f we have

$$f(x) = \bigoplus_{I \in P(N)} a_I x^I = \bigoplus_{I \subseteq supp(x)} a_I \qquad (5)$$

Respectively, we get that

$$f(x) = \bigoplus_{u \in F_2^n} a_u x^u = \bigoplus_{u \prec x} a_u \qquad (6)$$

where u $\prec$ x means that supp(u) $\subseteq$ supp(x). The following relation between the ANF and the Boolean function hold (cf. [2]):

$$\forall I \in P(N), a_I = \bigoplus_{x \in F_2^n / supp(x) \subseteq I} f(x) \qquad (7)$$

2) Algorithm

There is a simple algorithm to compute the ANF from the truth-table, called the Fast Möbius Transform. For every u = $(u_1, u_2, \ldots, u_n) \in F_n$ the coefficient a_u of x_u in the ANF of f equals:

$$\bigoplus_{(x_1, x_2, \ldots, x_{n-1}) \prec (u_1, u_2, \ldots u_{n-1})} \left[f(x_1, x_2, \ldots, x_{n-1}, 0) \right]$$

if $u_n = 0$, or

$$\bigoplus_{(x_1, x_2, \ldots, x_{n-1}) \prec (u_1, u_2, \ldots u_{n-1})} \left[\begin{array}{l} f(x_1, x_2, \ldots, x_{n-1}, 0) \\ \oplus f(x_1, x_2, \ldots, x_{n-1}, 1) \end{array} \right]$$

if un = 1. Hence if, in the truth-table of f , the binary vectors are ordered in lexicographic order, with the bit of higher weight on the right, the truth-table of the ANF equals the concatenation of the ANFs of the (n −1)-variable functions f(x_1, x_2, . . . , x_{n-1}, 0) and f(x_1, x_2, . . . , x_{n-1}, 0) $\oplus$ f(x_1, x_2, . . . , x_{n-1}, 1). We deduce the following algorithm:

1. Write the truth-table of f, in which the binary vectors of length n are in lexicographic order, with the bit of higher weight on the right.

2. Let f_0 and f_1 be the restrictions of f to $F_2^{n-1} \times \{0\}$ and $F_2^{n-1} \times \{1\}$, respectively. Then replace the values of f1 by those of $f_0 \oplus f_1$.

3. Apply recursively step 2 to the functions now obtained in the places of f_0 and f_1, separately.

When we reached the functions of one variable, the algorithm ended. The obtained table gives the values of the ANF of f. The complexity of this algorithm is O(n2^n) [3].

3) The degree of the ANF.

Definition. The algebraic degree (or the nonlinear order) of Boolean function f , denoted by $d^o f$, is the degree of the ANF:

$$d^o f = \max\{ |I| / a_I \neq 0 \}$$

Remark. The algebraic degree is well defined because of the existence and uniqueness of the ANF.

B. The Walsh-Hadamard transform

Let F_2^n be the vector space of dimension n over two-element field F_2. For two vectors in F_2^n, $a=(a_1,...,a_n)$ and $b=(b_1,...,b_n)$, the scalar product

$$a \cdot b = a_1 \cdot b_1 \oplus a_2 \cdot b_2 \oplus \cdots \oplus a_n \cdot b_n$$

where the multiplication and addition $\oplus$ (xor) are over F_2 [4].

An affine function $l_{a,c}$ on F_2^n is a function that takes the form $l_{a,c}(x)=a \cdot x \oplus c = a_1 \cdot x_1 \oplus \cdots \oplus a_n \cdot x_n \oplus c$, where $a=(a_1, ..., a_n) \in F_2^n$, $x=(x_1, ..., x_n) \in F_2^n$ and $c \in F_2$. To each Boolean function f: $F_2^n \rightarrow F_2$ we associate its sign function defined by $g(x)=(-1)^{f(x)}$.

The Walsh transform of a function f on F_2^n (with the values of f taken to be real numbers 0 and 1) is the map W(f): $F_2^n \rightarrow R$, defined by

$$W(f)(a) = \sum_{x \in F_2^n} f(x)(-1)^{a \cdot x}, a \in F_2^n \qquad (8)$$

For any Boolean function f its Walsh Transform W(f) can be computed as follows:

$$W(f)(a) = \sum_{x \in F_2^n} (-1)^{f(x) \oplus a \cdot x}, a \in F_2^n \qquad (9)$$

Walsh Transform is the Discrete Fourier Transform of the sign function which is used as an indicator instead of Boolean function itself [2].

Hadamard matrix H_n in each row contains one linear function $a \in F_2^n$ [4]. Let $WH_1(f), WH_2(f),...WH^n(f)$ be the values of W(f)(a) when a is the linear function from the first, second,...,2^n-th row of Hadamard matrix respectively, then we can calculate Walsh transform coefficients of g by:x

$$H_n \cdot f = \begin{vmatrix} WH_1(f) \\ WH_2(f) \\ \vdots \\ WH_{2^n}(f) \end{vmatrix} \qquad (10)$$

III. CRYPTOGRAPHIC CRITERIA OF BOOLEAN FUNCTIONS

In Cryptographic, the following six factors are important in designing Boolean functions:

- Balance
- Correlation immunity
- Resiliency
- The nonlinearity
- The algebraic degree
- Algebraic immunity

A. Balance

An n-variable Boolean function f is said to be balanced if $wt(f) = 2^{n-1}$, where wt gives the Hamming weight and f is considered to be represented by a binary string of length 2^n [5]. (The Hamming weight of function f is the number of ones in its truth table.)

Remark. The public key value used in RSA is typically chosen to be a number of low Hamming weight.

B. Correlation Immunity.

An n-variable Boolean function $f(x1, ..., xn) \in F_2^n$ is said to be correlation immune (CI) of order m if for every m indices $1 \le i_1 \le i_2 \le \cdots \le i_m \le n$ and for every $(a_1, a_2, ..., a_m) \in F_2^m$, we have [6]:

$$\text{Prob}\big(f(x)=1 \mid (x_{i_1},...,x_{i_m})=(a_1,...,a_m)\big) = \text{Prob}\big(f(x)=1\big)$$

By the probabilistic identity

$$\text{Prob}\big(f(x)=1 \mid (x_{i_1},...,x_{i_m})=(a_1,...,a_m)\big) \cdot \text{Prob}\big((x_{i_1},...,x_{i_m})=(a_1,...,a_m)\big)$$
$$= \text{Prob}\big((x_{i_1},...,x_{i_m})=(a_1,...,a_m) \mid f(x)=1\big) \cdot \text{Prob}\big(f(x)=1\big)$$

the above implies that if f(x) is m^{th} order CI, then the following equation must be true provided that f(x) not $\equiv 0$:

$$\text{Prob}\big((x_{i_1},...,x_{i_m})=(a_1,...,a_m) \mid f(x)=1\big)$$
$$= \text{Prob}\big((x_{i_1},...,x_{i_m})=(a_1,...,a_m)\big) = \frac{1}{2^m}$$

C. Resiliency

Let $f : F_2^n \rightarrow F_2^m$ be an (n, m) Boolean function. Function f is called an (n; m; t) resilient function if, when t of the input bits are fixed and the other n − t bits are chosen randomly, each of the 2^m possible outputs occurs equally likely [6].

When m = 1, an (n; 1; t) resilient function is actually a balanced function in Fn with correlation immunity of

order t. A balanced m[th] order correlation immune function is called m-resilient.

D. Nonlinearity.

The nonlinearity of an n-variable Boolean function f, denoted by nl(f), is the minimum Hamming distance of f from the set of all n-variable affne functions [5].

We denote by nlmax(n) the maximum possible nonlinearity of n-variable functions. It was shown in [7] that the maximum possible nonlinearity of n-variable, 1-resilient functions is $2^{n-1} - 2^{\left\lceil \frac{n}{2} \right\rceil}$.

Remark. Any Boolean function with nonlinearity $2^{n-1} - 2^{\left\lceil \frac{n}{2} - 1 \right\rceil}$ is bent function.

E. The algebraic degree

All cryptosystems using Boolean functions for confusion (combining or filtering functions in stream ciphers, functions involved in the S-boxes of block ciphers, ...) can be attacked if the functions have low degrees [2].

It is easy to see that the maximum algebraic degree of an n-variable balanced function is n − 1.

F. Algebraic immunity

Algebraic attacks recover the secret key, or at least the initialization of the system, by solving a system of multivariate algebraic equations [2].

IV. CONCLUSION

This paper has shown the basic cryptographic criteria of Boolean functions: Balance, Correlation immunity, Resiliency, Nonlinearity, Algebraic degree and Algebraic immunity. It is important in understanding of cryptography. Of course, all characteristics cannot be optimal at the same time, and trade-offs must be considered.

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