

Workshop

Cooperation at Academic Informatics Education across Balkan Countries and Beyond

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ABSTRACTS

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EU Tempus project “Joint master in Software Engineering” How to enhance industry participation and cooperation

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It has all started with the Joint Course in Software Engineering, which was smoothly introduced in Berlin, and then launched in Novi Sad, Plovdiv and Skopje. It encouraged the Joint M.Sc. studies in Software Engineering, which started in 2005. With the mutual effort of the whole consortium, students from Novi Sad and Skopje experienced the power of attending international studies and having short mobility stays in the region. Several outstanding international teachers (alph.: Bothe, Burchard, Cortazar, Jurca, Stankovic, Zedan), together with the local teachers from Novi Sad and Skopje managed to educate hundreds and hundreds of successful master students, who became the pillars of local and international software engineering industry. The academic world has also benefited immensely, because most of the young PhD in both countries are former SE masters. The scientific opus of all the consortium members and their students exceeded the most optimistic expectations. It is really impressive, and it still continues.

How has this scholar success affected the industry cooperation? Master students imposed many new techniques to industry, starting from agile programming, efficient requirements engineering, implementation of patterns during software architecture and design, as well as many novel quality assurance approaches. Their awareness of critical systems, ethical problems and standardization increased, so the products they create are more mature than previously. Without the joint effort at joint master studies, this process could not be as efficient and effective.

Within its seven years of existence, Faculty of Computer Science and Engineering (FINKI) has become the leading technical faculty in Macedonia. FINKI has established a network of more than 100 friends from IT industry (<https://finki.ukim.mk/mk/prijатели>), who immediately absorb the graduates and the students from the last years. Due to their professional experience and frequent internships, students are almost ready to become active participant of the IT industry. It's very important to mention that IT industry nowadays offer thousands of new jobs, and the average income is much higher than the national average. Still, many SE masters decided to work abroad, particularly in Germany, Ireland and Netherlands.

The continuing cooperation with the IT companies, which benefited a lot from the young experts who did their M.Sc. degree at FINKI, suggested that namely software engineering is one of their priorities. As a result, starting from October 2018, FINKI will offer the new specialized undergraduate studies in software engineering and information sciences, with 280 prospective students attending the curriculum in Macedonian, and 80 in English (out of 1100) at the whole faculty (http://www.ukim.edu.mk/dokumenti_m/639_Konkurs%20I%20-%202018-19.pdf). Most of the courses are indeed those courses, which were launched in the joint master curriculum in 2005. Such achievement was definitely not expected when the master studies were founded.

Courses on Robotics by Guest Lecturing at Balkan Countries

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Understanding grows with active commitment: To "do" something, to master it, leads to a deeper understanding. Experiencing with own experiments is of course an important prerequisite for studies in Robotics and Artificial Intelligence. Simulated robots in simulated environments can be used as an alternative for complex hardware.

RoboNewbie is a basic framework for experiments with simulated humanoid robots developed at Humboldt University Berlin. It provides interfaces to the simulated sensors and effectors of the robot, and an appropriate control structure. The framework and the examples are implemented in JAVA with detailed documentations and explanations. That makes it useful even for beginners in Robotics.

RoboNewbie runs in the soccer simulation environment of the official RoboCup 3D simulator. The simulated soccer players are models of the humanoid Robot NAO. Thanks are due to the RoboCup community for continuous help and inspiration. Besides other examples, a simple soccer playing robot demonstrates the architecture and the features. Users are encouraged to extend it by different means, to develop their own methods for perception, create new motions, write programs for control, and experiment with strategies for collective behavior.

Since 2012, the framework was used during Robotic courses in different Balkan Countries. Students could make experiences in Robotics and AI as well as in programming in an agent oriented style. At the same time, the RoboNewbie framework was extended and improved according to the work and ideas of the students.

Proposal for A Multi-country Curriculum Mapping Effort – Presentation of IS Prototype and Mapping Technique

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Curriculum mapping is a known technique for fostering collaboration and aligning teaching efforts [4, 5]. Various scenarios of usage of the curriculum mapping technique at the level of a whole institution or at a departmental level has been presented by the author in [1, 2].

In this presentation the author proposes to extend this effort on a multi-country level to include all the partners of the project in order to create an extensive and easy to compare database of all the computing (especially software engineering) curricula across the region. Such a database will make it easier to find partner institutions working in the same area, will make it easier to find contacts for teachers teaching similar topics, will enable comparative analysis on curricula across the region, will enable comparison of course offerings, will enable locating possible student mobility targets, and other similar use-cases.

The author will present the required database model and the information system prototype development and demo the features of the system, with the aim to open-up discussion on extensions of the system that could be of interest to the audience, inclusion of their use-cases within the system and enablement of the proposed mapping effort.

The system was developed in an open-source process (see [3]) and can be easily customized for the benefit of any institution and their own purposes, but the biggest gain could be achieved in a joint action of multiple partner institutions such as the ones included in the workshop framework.

References

- Vangel V. Ajanovski. Evolutionary Curriculum Reconstruction: Process Model and Information System Development. In *Proceedings of the 18th Annual Conference on Information Technology Education, SIGITE '17*, pages 89–94, New York, NY, USA, 2017. ACM.
- Vangel V. Ajanovski. Information System for Mapping the Coverage of Reference Curriculum Guidelines in the Teaching Curricula of a Higher-Education Institution. In *Proceedings of the 14th International Conference for Informatics and Information Technology (CIIT 2017)*, pages 10–15, Mavrovo, Macedonia, April 2017. Faculty of Computer Science and Engineering.
- Vangel V. Ajanovski. Student Information Systems of the Next Generation, March 2018.
- Heidi Hayes Jacobs and Association for Supervision and Curriculum Development. *Getting results with curriculum mapping*. Association for Supervision and Curriculum Development, Alexandria, VA, 2006. OCLC: 73516036.
- Kay Pippin Uchiyama and Jean L. Radin. Curriculum Mapping in Higher Education: A Vehicle for Collaboration. *Innovative Higher Education*, 33(4):271–280, January 2009.

Software Engineering trends and challenges in Albanian Companies from the point of view of employed students

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The Software development has been increased in the recent years in Albania with the launch of new companies investing in this field and the rising interest of many businesses in different areas. In our country, the experience of foreign companies investing here merge with the passion of local ones bringing mixed methods of software engineering.

Our research targets most of these companies no matter the origin to gather data for the way they develop their software, how big the software is, what models they follow or if they follow a model at all etc. We are also interested in the number of team members working for a particular software and if the specialist are divided according to the phases of a certain model. For all the reasons above, we expect to get a better understanding of the software development in our country and compare it with European standard. After analyzing all the gathered data, we suggest some ideas about what can be improved in the way software is developed in Albania.

Students' opinions about faculties of informatics in Serbia

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The rapid development and influence of information and communication technologies on modern society lead to constant applications of various computer systems and services in almost all aspects of human life. The critical need of a high quality labor force in the Serbian ICT sector, prepared for life-long learning and continual professional development, motivates us to investigate the key factors influencing students to enroll informatics and computer science study programs offered at higher education institutions in Serbia. We created a questionnaire in order to collect students' opinions about faculties in Serbia offering informatics study programs. The questionnaire was designed to address various factors motivating students to enroll informatics including the impact of their close environment (parents, high-school teachers and friends, people employed in the ICT sector, etc.) traditional media, social networks and marketing activities performed by faculties, current satisfaction and expectations from enrolled study programs, as well as their plans for future professional development. The questionnaire was disseminated at four large faculties in Serbia belonging to the three largest Serbian state universities: the School of Electrical Engineering and the Faculty of Organizational Sciences of the University of Belgrade, the Faculty of Sciences and the Faculty of Technical Sciences of the University of Novi Sad, and the Faculty of Electronic Engineering of the University of Nis. In this talk we present the results of statistical analysis of collected questionnaire responses outlining students' satisfaction with informatics and computer science studies in Serbia and main motivating factors for choosing a particular faculty.

An accessibility evaluation of faculties' websites

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Nowadays the websites represent important source of getting information, also for students in education domain. The education institution (e.g. faculty) has to provide the accessibility of their websites for all students, including the students with special needs. This means that all students (including students with visual, auditory, physical, speech, cognitive, and neurological disabilities) can perceive, understand, navigate, interact and contribute to the Web. To ensure web accessibility, many guidelines and standards have been proposed, such as Section 508, Design for all, ISO/IEC 40500:2012 (better known as WCAG 2.0), etc. The object of this research was to investigate if the faculties' websites are compliance with guidelines of WCAG 2.0. In the research the websites of seventeen faculties of University of Maribor were included. The web accessibility was measured using automatic evaluation tool for verification of website compliance with WCAG 2.0. The results show a relatively good compliance with the WCAG 2.0, but none of the websites did not compliant with all WCAG guidelines.

Introduction of 1-year Master study in SW engineering and 2-year program in SW development as a support for local IT businesses

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In the last decade or so, local IT (SW development) businesses had various initiatives in organizing different student practices, programming courses and influencing local government officials and high education institutions to adopt their business interests as important parameter in defining new approach in compiling meaningful software related curricula.

In contrary to the basic rules of project management, they do not have clear vision, promising feasibility study, meaningful initial requirements specification, nor any resources allocated for the project!

At ETF-Sarajevo, proposed 1-year Master study in SW engineering is meant to be passage for pre-Bologna graduate students to Bologna third cycle (PhD) studies and 2-year program in SW development is proposed for “students” that would skip mathematical fundamentals of computing and stay away from most of computer science courses.

Initial assessment of both programs can indicate that the Master study will have low attendance in the first generation and even lower in generation(s) to follow, while “SW developers” would serve their main purpose – to lower the wages of bachelors and masters of computing and informatics.

The First Steps in Establishing Informatics PhD Studies in English at Faculty of Mathematics, University of Belgrade

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This presentation is aimed at describing the process of establishing the first PhD studies in Informatics in English language at the Faculty of Mathematics, University of Belgrade.

The Department of Computer Science of the Faculty of Mathematics, whose members initiated the creation of this PhD program, is the largest department of a kind in South-East Europe. Our research interests encompass wide range of domains and the results we achieved are recognized internationally.

The creation of the PhD program in English language is aimed at achieving better visibility of the research activities conducted at our Department, Faculty and University. Better visibility enables a series of benefits such as: easier communication, becoming eligible for participation in wider range of international projects, easier engagement of foreign researchers and experts. We used SWOT analysis to specify the objectives of the project and to identify the internal and external factors that are favorable and unfavorable to achieving these objectives. In this case, we used SWOT analysis to identify Strengths, Weaknesses, Opportunities and Threats for the project of establishing the first PhD studies in Informatics on English language.

Strengths and Weakness are frequently internally-related, while Opportunities and Threats commonly focus on environmental placement. Strengths are characteristics of the project that give it an advantage over others. Weaknesses are characteristics that place the project at a disadvantage relative to others. Opportunities are elements in the environment that the project could exploit to its advantage. Threats are elements in the environment that could cause trouble for the project.

This presentation will explain in detail process and obtained results of that analysis.

Since SWOT analysis has shown that PhD studies in Informatics in English language would be beneficial for all parts involved (from the Department, through Faculty and University up to wide academic and non-academic community), we started shaping the curriculum.

With the support of the Faculty of Mathematics and the Department of Computer Science, I've submitted a project proposal, related to developing the PhD studies in Informatics in English, to Serbian Ministry of Science's call within the Program for Development of Higher Education. Our project was approved for funding and we have just successfully completed its implementation.

Project results will be explained in detail in this presentation.

Introducing Python Programming in the “Algorithms Design” Course

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In this note we introduce our proposal for upgrading the former Programming Techniques course that is taught to first year, second semester students in Computer Engineering at the Faculty of Automatics, Computers and Electronics, University of Craiova, Romania. Two years ago, according to the new regulations of our national body for quality assurance and alignment of academic education curricula – ARACIS, this course had to be renamed as Algorithm Design. Moreover, taking into account the current trend in the evolution and diversification of programming languages, we decided to take this opportunity of title change, to also slightly upgrade the course content by incorporating some practical aspects of programming in Python. In this note: i) we motivate our decision; and ii) we outline the operated upgrades, drawing also some conclusions based on the educational experiences gained during the 2016-2017 and 2017- 2018 academic years.

The presentation is structured as follows. We first briefly introduce the place and structure of the Algorithms Design course in our curricula of Computer Engineering degree. Then we motivate the adding of Python programming elements to this course. One reference that we discuss is the Interactive Top of Programming Languages – an online application promoted by IEEE Spectrum that provides an adjustable data-driven ranking of programming languages. Thirdly, we briefly discuss the problems encountered to align Python programming to the requirements of our algorithms course that is partly inspired by the standard reference “Introduction to Algorithms” by Cormen et al. – also known as the “Algorithms Bible”. Note that this textbook uses a “pseudocode approach”, thus raising some challenges when presenting Python as an implementation programming language. At first glance, this pseudocode is more suitable for C/C++/Java implementation, rather than Python. Finally we discuss some conclusions based on our experiences and present ideas of how to further develop our course.

References

- *The 2017 Top Programming Languages*.
<https://spectrum.ieee.org/computing/software/the-2017-top-programming-languages>
- Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein.
Introduction to Algorithms, Third Edition. The MIT Press, 2009

Team software project – one of the steps students take towards career in software industry

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In this paper we present team software project within the Software engineering course. It is a course on the first year of graduate study of informatics at the Department of Informatics University of Rijeka. For several years, team software project is the main students' activity in the practical part of the course.

However, in the last academic year we implemented some novelties.

The paper describes assignments within the team software project and its evaluation process. It also analyses students' attitudes regarding the team project. Students are aware that during these assignments they come closer to their future career in software industry. We will present topics taught in the theoretical part of the course and explain activities in the practical part related to them. Special attention will be paid to the evaluation process for students' team projects and to assessment of their individual contribution in team software development.

For the next academic year, we have a plan to emphasize the connection with software industry by altering students' activities. The plan includes an active role of representatives from software industry in 2 segments: mentoring project's activities and participating in the specific process of evaluation of students' projects. With the support from industry experts, students will become more familiar with business environment and become more aware of the requirements which will be set for them in team software industry development.

Business process optimization – experiences of students' independent process examination in Institute of informatics, Maribor

Maja Pušnik, University of Maribor

Student's experience is an important factor, influencing their success rate and general wellbeing at the Faculty. Our objective included determining similarities and differences between students' perceptions of their learning experiences from 2010 to 2018. Statistical analysis was conducted for each student year, including the final presentation of the projects and 2 quizzes students have to take in order to successfully finish the subject. A total of 366 students was included in the research. All students were studying 1st year informatics, 2nd bologna level at Informatics and Technologies of Communication program. Within results, we provide their average grades and short survey results, each of them had the opportunity to fill out when registering for the final exam. Although the students were positive overall about their experiences, a number of them were dissatisfied with the approach and the timeline of getting feedback about their optimization progress. The research concluded that students prefer choosing their processes independently, however a more critical debate about the appropriateness of the choice with the assistant must be included and a week to week progress evaluation should be performed.

Towards the online system for automatic conceptual database design

Keywords: AD, BPMN, DSL, Database, Model-driven, UML

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During the last several years, our research was devoted to the automatic business process model-driven database design, particularly automatic conceptual database model (CDM) synthesis. We identified the semantic capacity of the business process models (BPMs), specified the formal transformation rules and implemented several tools for the automatic CDM synthesis. This set of tools includes: ATL-based CDM generator based on the single source UML activity diagram (UML AD), ATL-based CDM generator based on the single source collaborative BPMN model, as well as the Java-based CDM generator taking a collection of the source UML AD models. In order to obtain a platform independent and publicly available tool for the BPM-driven CDM synthesis, we performed the migration of these tools into a SOA application. The final result of the migration is the online tool for the automatic BPM-driven CDM synthesis. This generator is implemented as a web-based, platform-independent tool, in contrast to the existing tools that are dependent on some specific technological platform used for their implementation. Unlike the existing approaches, which are characterised by the direct synthesis of the target model based on business process models represented by a sole concrete notation such as BPMN, this generator uses an indirect two-phase approach, which is based on introduction of a simple domain specific language (DSL) as an intermediate layer between source and target notations. The DSL specification is based on the identified semantic capacity of BPMs for automatic CDM synthesis. With the intermediate layer, the synthesis is split into two phases: (i) automatic extraction of specific concepts from the source model and their DSL-based representation, and (ii) automated generation of the target model based on the DSL-based representation of the extracted concepts. The implemented online generator currently enables automatic generation of the target data model represented by UML class diagram, based on BPMs represented by two concrete notations: BPMN and UML AD.

Professional ethics: Overview, gender conflicts and resolution by cooperation

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The most influential companies worldwide belong to ICTs. With almost no exclusions, they are owned and lead by men. The most recognized ICT researchers, as a rule, are also men. However, Augusta Ada King-Noel, Kathleen Booth, and Grace Murray Hopper indebted the humanity more than most of the scientists of their time.

The gender related gap in research and technology is widening. France has recently elected a new governing board of the National Agency of Research, with no women. In the 21st century, only three women became CEOs of some ICT giant: Ginni Rometty (IBM), Meg Whitman (HP) and Marissa Mayer (Yahoo). They were all observed and criticized more than their colleagues and even alleged in accordance with the US Worker Adjustment and Retraining Notification Act for gender-based discrimination.

According to Deutsch (Deutsch, 2014), the motives of almost all conflicts are mixed, and they contain elements of cooperation and competition. Undoubtedly, competition can be a great motivation for future cooperation (Mayer, 2015). But, in many occasions it can cause serious troubles, bearing in mind that many workplaces are melting pots of diverse cultures, thus they need an increased attention to prevent the potential conflicts (Prause, 2015). Gender related stereotypes are frequently the reason for formal discrimination in employment (Leskinen, 2015). They usually end up with severe bullying at the workplace, resulting in psychological risks and perceived well-being (Baillien, 2016; De Sio, 2017). Third party consultation can be of great help (Fisher, 2016). However, it seems that the reconciliation is hardly ever achieved unless the management is highly ethical, and stimulates dialogue and cooperation, which can decrease frequent use of aggressive and avoidant strategies. Thus, in order to efficiently resolve all the conflicts, including the gender disagreement, modern ICT companies should encourage working environments capable of creating a cognition-based trust, which stimulates interpersonal cooperation and business objectives (Parolia, 2015). In such environments, gender conflicts will not be one of the major factors of implementation inefficiency.

Apart from that we are also witnesses that in ICT sector there are gender based differences in salaries for same positions/jobs and access to top level management. Additionally in educational environments it is evident gender based bias in student evaluation of Computer Science teachers.

Women's participation in STEM (science, technology, engineering and mathematics) is an important step for eliminating gender roles and stereotypes. According to EUROSTAT, Bulgaria and Romania are the last two in European Union regarding the number of women employed in science and informational technology. In 2016, Microsoft conducted at European level a research, questioning a number of 11.500 women (ages between 11 and 30) from 12 EU states, about their STEM skills and it turns out that girls become interested about STEM around the age of 11 and they lose it after 15. Possible causes for the lack of women in STEM would be the existence of gender stereotypes, the lack of support for girls that choose to follow a career in STEM and gender based discrimination on the labor market in STEM field.

In the presentation we will discuss all above mentioned aspects of gender differences in a systematical way. Additionally we plan to prepare and adequate questionnaire on the topic. The questionnaire will be distributed to ICT companies in Balkan region. Collect answers and data will be analyzed in order to identify current state in Balkan region and propose some possibilities for changing the situation.

References:

Baillien, E., Camps, J., Van den Broeck, A., Stouten, J., Godderis, L., Sercu, M., & De Witte, H. (2016). An eye for an eye will make the whole world blind: Conflict escalation into workplace bullying and the role of distributive conflict behavior. *Journal of business ethics*, 137(2), 415-429.

De Sio, S., Cedrone, F., Sanità, D., Ricci, P., Corbosiero, P., Di Traglia, M., ...&Stansfeld, S. (2017). Quality of Life in Workers and Stress: Gender Differences in Exposure to Psychosocial Risks and Perceived Well-Being. *BioMed research international*, 2017.

Deutsch, M. (2014). Cooperation, competition, and conflict. In P. T. Coleman, M. Deutsch, & E. C. Marcus (Eds.), *The handbook of conflict resolution: Theory and practice* (pp. 3-28). San Francisco, CA, US: Jossey-Bass.

Fisher, R. J. (2016). Third party consultation: A method for the study and resolution of conflict. In Ronald J. Fisher: *A North American Pioneer in Interactive Conflict Resolution* (pp. 37-71). Springer, Cham.

Leskinen, E. A., Rabelo, V. C., & Cortina, L. M. (2015). Gender stereotyping and harassment: A “catch-22” for women in the workplace. *Psychology, Public Policy, and Law*, 21(2), 192.

Mayer, B. (2015). *The conflict paradox: Seven dilemmas at the core of disputes*. John Wiley & Sons.

Parolia, N., Chen, J.V., Jiang, J.J. and Klein, G., 2015. Conflict resolution effectiveness on the implementation efficiency and achievement of business objectives in IT programs: A study of IT vendors. *Inf. and Software Technology*, 66, pp.30-39.

Prause, D., & Mujtaba, B. G. (2015). Conflict management practices for diverse workplaces. *Journal of Business Studies Quarterly*, 6(3), 13.

[Trotman, A. \(2017\) Why don't European girls like science or technology?
https://news.microsoft.com/europe/features/dont-european-girls-like-science-
technology/#sm.00000aolqsohr5ctmz5zrrrm5rgz1#wKOjJ1GfqVyoDcg4.97](https://news.microsoft.com/europe/features/dont-european-girls-like-science-technology/#sm.00000aolqsohr5ctmz5zrrrm5rgz1#wKOjJ1GfqVyoDcg4.97)

Ambient-Oriented Modeling Helps Disabled Students

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The Distributed eLearning Centre (DeLC) project implemented in the Faculty of Mathematics and Informatics at the University of Plovdiv aims the development of an eLearning environment. DeLC suffers from the shortcomings of the widely used eLearning systems ignoring the physical world which they operate in. The observing of the physical environment reveals opportunities for more effective support of the learning process and for adaptation and personalization of the system for various user groups especially for disadvantaged people. In order to improve the usability, DeLC was reengineered into a new infrastructure, known as Virtual Educational Space (VES), where users, autonomy and context-awareness are first-class citizens and which enables a uniform treatment and interpretation of information coming from both the virtual environment, as well as from the physical world. VES implemented as an IoT ecosystem integrates on the one hand a virtual environment that supports the processes of creating, publishing and sharing e-learning resources; to track the learning outcomes of each student; the exchange of messages between the different participants in the learning process; the holding of virtual meetings, seminars, consultations; the conducting of a tests and, on the other hand, the physical world in which the learning process takes place. Reporting events and changes in the physical environment provide new opportunities for helping all students and in particular disadvantaged students. Depending on the current educational scenario the components implemented in VES may interact differently.

Due to the hardware and software complexity, as well as heterogeneity, the development of an IoT ecosystem implies serious risks. It is inappropriate, inefficient, and financially disadvantageous to directly build such an application. Previous modeling would be of great help, where the system model being researched and analyzed to identify weaknesses and errors. Usually, events, time, and locations should be considered as fundamental concepts modeling the space.

The Calculus of Context-Aware Ambients (CCA) deals with location as a complex structure introducing the concept of ambient. An ambient is an entity describing any object or component (e.g. person, process, device, location, etc.) in a system is defined as a bounded place where computations happen. It has a name, a boundary, and can have built-in ambients. An ambient can be mobile and has the ability to communicate with other ambients. CCA is used to model ambients in terms of process, location and capability.

The role of the personal IoT assistant has been incredible increasing for students with motor difficulties who attend lectures with their wheelchairs. The wheelchair has different physical sensors to collect information about changing environmental parameters as current location, temperature etc., and interacts with educational environment via student's PA. We will look at the wheelchair (and the active area that it creates) as a separate ambient including two built-in ambients - the student (through his PA) and the mobile device for communication with learning environment.

Teaching Project Management at different levels of study

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Different approaches to teaching project management at undergraduate, graduate, postgraduate specialist and doctoral study are considered.

Some existent courses are briefly described including course description, learning outcomes, general competencies and forms of teaching: (1) *Management in Engineering*, (2) *Software Design Project* at undergraduate level; (3) *Project* and (4) *Project Management* at graduate level and (5) *Project Management and Doctoral Research* at doctoral study.

Within the scope of *Management in Engineering* students gain knowledge on business, legal, and project engineering environment. Main topics include engineering profession, engineering ethics, intellectual property, engineering approach to problem, solving, teamwork, projects and project management, project planning, risks in projects, management and managers, organizing, and leadership.

Software Design Project and *Project* are promoting cooperation between students and teachers in a team environment while creating practical solutions to specific problem. Students work in groups, under the guidance of teaching staff who suggests the topic. Project requires finding the necessary literature, analysis of similar problems and solutions, identification of project requirements, definition of technical objectives, planning and time management, creation of alternative solutions, decision making, solution implementation, writing technical documentation and presentation.

There follows a description of a short course (generic skill) *Project Management and Doctoral Research* at postgraduate doctoral study. The aim of the course is to strengthen the skills of doctoral students in the field of project management with a focus on research and scientific projects and linking best practices from the field of scope management, risk management, planning and execution of projects with doctoral research.

The number of students and groups, grading system, experience collected and lessons learned are given for each aforementioned course as applicable.

A new postgraduate specialist study *Project Management* is presented, including motivation, duration of study, enrolment conditions, and competencies obtained by the student at the completion of the study. The study programme structure with a list of mandatory and elective subjects is given. Special attention is paid to the process of creating a curriculum, the staff structure and the distribution of courses. The process of accreditation and plan of implementation are considered at the end of presentation.

[1] ECTS Information Package for Academic Year ... Course Catalogue – Undergraduate Study, University of Zagreb Faculty of Electrical Engineering and Computing, <https://www.fer.unizg.hr/issn/1848-3550> , Accessed January 8th, 2018

[2] ECTS Information Package for Academic Year ... Course Catalogue – Graduate Study, University of Zagreb Faculty of Electrical Engineering and Computing, <https://www.fer.unizg.hr/issn/1848-3550> , Accessed January 8th, 2018

[3] Directory of accredited study programmes in the Republic of Croatia, <http://mozvag.srce.hr/preglednik/pregled/en/pocetna/index.html> , Accessed January 8th, 2018

[4] PMI Curriculum Guidelines, <https://pmiteach.org/teaching-pm/> , Accessed January 8th, 2018

Problem based approach in teaching OOP courses

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The introductory programming courses (Structural programming and especially Object Oriented programming) are particular challenges for teacher and learner alike. The main goals of the introductory programming courses are developing generic skills of independent and reflective learning, problem solving, critical thinking. These courses develop basic skills and attitudes which are important for effective learning in later courses. At the same time, the lecturers should achieve increased learning of the technical aspects of programming using interactive approach as much as possible.

The OOP material contains concepts that are illustrated with adjusted real-life problems, but still robust and hard to follow. This talk describes some of these challenges and how to use designed Problem-Based Learning (PBL) approach that addresses some of the courses to address them.

PBL involves much broader problems which involve a larger set of problem solving skills. Critically, PBL places problem solving and metacognitive skills. Class time is devoted to generic problem solving skills as defining a learning plan, brain- storming to get started on a problem, reflection, articulation of problems and solutions, self- assessment, practice in active listening and other communication skills.

Importance of User Centered Design in informatics curricula: Is Design Thinking just another name for User Centered Design?

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Over the past nine years teaching the Human Computer Interaction course, we put a lot of efforts in making our students understand that visual design is just the tip of the iceberg. That User Centered Design is not about making UI look and feel smart, but taking care of users' needs starting with the conceptual design, following with extensive prototyping, and through the usability evaluations.

Contemporary engineering curricula, especially software engineering, are required to provide students with skills as entrepreneurship, product design, innovations, design thinking. After looking into more details on design thinking we have noticed that this approach is matching the process we defined for our students' projects with the sequence of deliverables, including assessing the user needs, task analysis, prototyping, project implementation and evaluation.

The origins of Design Thinking are linked to development of creativity techniques in the 1950s, but the approach gain in popularity in recent years, after the Hasso-Plattner Institute of Design at Stanford (d. school) introduced Design Thinking as a formal method in engineering curricula. Design Thinking is a solution-based approach to solving problems. It is primary advocated for complex and "wicked" problems, employing understanding of the human needs and solving the problem in human-centric way, and by adopting a prototyping and testing. According to d. school Design Thinking has five stages: (1) Empathize, (2) Define the problem, (3) Ideate, (4) Prototype, and (5) Test.

Without elaborating User Centered Design (UCD) in many details, typical UCD approach would include: (1) understand the problem, (2) analyze user, (3) create user personas and usage scenarios, (4) prototype, (5) deliver and evaluate design with user involvement. Repeat the last two steps until your user is happy.

Similarity is obvious, and makes difficult to illustrate the difference. Browsing through developers' forums, discussions favoring difference could be summarized as: "Design Thinking is a method to develop solutions which nail the actual problem, which are not mainly User Interface related" or "UX (UCD) has its clear focus on User Interfaces".

Instead of using the UCD as an approach in software development it was quite often reduced to UI only, and making UI smart and nice at the end of the development. It is good that popularity of Ideatons and Design Thinking brought attention to the UCD. It should not be important what name we use for our approach, as long as we pay attention to what our users really want, and utilize empathy and experimentation to deliver innovative solutions.

Hybrid Solution for Scalable Research Articles Recommendation: A Case Study in Computer Science and Neuroscience

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In text mining, clustering and classification are the most important techniques to extract information from textual data. These are techniques which allow us to identify similar groups of textual documents or build classification models based on some similarity. This paper presents a hybrid solution based on clustering and classification techniques to recommend research articles to researchers. Since the process of literature review is time consuming, our aim is to ease the process of recommending the most relevant research articles based on users' research field preferences. Researches spent too much time in reading others work and finding research questions. This process requires lots of effort in reading and classifying the relevant papers. The process of literature review is a challenge task for new researchers on different fields of study. Through this proposal we try to ease the process of literature review and speed up the time for defining the research problem.

The aim of our study is to collect/retrieve and analyze research/scientific articles by applying machine learning techniques to recommend research articles or/and research gaps to researchers based on their research fields. With research articles we mean scientific articles of any field where we take into consideration the following attributes: title, author, year of publication, abstract, keywords, content, contribution, results, future work, conference/journal, related articles, and bibliography.

Our plan is to propose a model which will be based on a large dataset containing research articles, which will use a hybrid model for recommending research articles to researchers. This approach will use the input parameters such as, an abstract, list of keywords, research articles or research field/s.

The reason why we consider this model as hybrid solution is because it is built on top of combination of supervised and unsupervised learning algorithms. The first phase of the proposed model is based on clustering and identifying similar data objects based on their content. For each cluster we will identify the labels or the list of labels for the cluster. The generated clusters will be considered as a training data set to build a recommendation model.

The second phase will continue by using supervised learning technique, we will generate a model based on the training dataset. In this part we will have to choose between various supervised learning algorithms. The training dataset will be used as basis for the recommendation system on our research work. The initial results will be to identify the most relevant research articles based on a research interest. The number of recommended research articles depends on the research field and research interest.

For validating our model, we will present a case study with experiments on a dataset with research articles on fields of computer science and neuroscience.

As result we will have metrics for the three phases of the proposed model, mainly 1) unsupervised learning part where the labeling takes place, 2) building the model based on supervised learning algorithm and 3) recommendation of relevant research articles and explorations on trends most recent research topics.

Women in Science and Informatics - Cross-border Cooperation in Balkan region

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Informatics is a relatively **young science discipline** in close connection with technology and it is **rapidly evolving**. In fact it is an original discipline with roots in STEM (Science, Technology, Engineering, and Mathematics). Informatics is **specific, pervasive area** and is affecting the way of research bringing new **interdisciplinary approaches** and perspectives.

With the development of digital technologies, informatics has a **high societal and economic impact**. Mastering our digital world and its evolution requires continuous progress of education, research and training in informatics. This is also true for more other disciplines due to the increasing role of informatics in them.

Unfortunately being such complex discipline, it is not too attractive for majority of women. Generally, key representatives in academia and industry, but also in whole society, often tend to underestimate women's contribution to today's digital world. Women remain underrepresented in many areas and their high potential is not fully included in the innovation processes.

In recent booklet created by working group - the Informatics Europe Women in Informatics Research and Education (WIRE), they intentionally compact to provide clear and simple best practices that will increase participation of women in informatics as both students and employees. The booklet details actions that can be taken to attract women to participate in informatics education and research and ensure their continued participation in the organization at commensurate ratios with their male colleagues.

The lack of women in Informatics and Information and Communication Science and Technology represents a serious treat not only to the discipline but also to the economic and social development of Europe.

The number of women in science and engineering is growing, yet men continue to outnumber women, especially at the upper levels of these professions. For example in elementary, middle, and high school, girls and boys take math and science courses in roughly equal number. Among first-year college students, women are much less than men and by graduation men outnumber women in nearly every science and engineering field. Also only 20 percent of women earn bachelor's degrees.

As it is well known that early programming was highly shaped by women in this presentation we will mention some of key female scientists starting from early computer science history up to nowadays.

We will further consider reasons why computing and informatics moved into the hands of men. Then we will deal with the culturally most differentiated participation of women in informatics and some differences between western/north-western and south-eastern countries.

Particularly we will concentrate on scientific and academic cooperation between women in Balkan region.

Also some possible strategies to recruit more women in informatics and computing will be considered.

Perspectives for development of the Croatian Research Information System (CroRIS)

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In Croatia, software support to scientific activities and higher education has been in variable focus over decades. Therefore, islands of computerisation have been developed and maintained, some of them successful, some poorly maintained or not recognised as relevant enough. There are currently serious plans to develop an integral Croatian Research Information System (CroRIS), covering research and development individuals and organisations, their activities and achieved results, all in order to improve their efficiency, transparency and applicability for prosperity and well-being of the country. An important part, but not the only one, is dealing with scientific publications, their retrieval, presentation and archiving. Nowadays, omnipresent are the scientists' and researchers' evaluation criteria based on scientometric indicators. However, using a simple Google search and manipulating with references under today's overproduction of scientific literature, practically anything can be proofed. For finding of adequate literature often can serve scientometrically not so sophisticated systems like Google Scholar, ResearchGate, LinkedIn and some others, which are user friendly, usually free of charge, and the authors are not forced to enter data about publications because they are retrieved automatically from the Internet.

However, this does not render more sophisticated bibliography systems useless. On the contrary, for serious analyses they are indispensable. The new CroRIS should achieve interoperability with the *Common European Research Information Format* (CERIF) and *Dublin Core* (DC) metadata formats [1]. An important task for CroRIS would be to improve the support of scientific and professional research and development to higher education, lifelong learning, and to help in successful application and activity in EU-financed and other international projects, enabling that the current information can quickly and easily reach the educators, students, other researchers, and prospective users. If implemented, the new CroRIS would enable data mining in connection with the long time operational Higher education information system [2] and probably challenge the current criteria for academic promotion [3], especially in the technical field [4]. Finally, the greatest expected benefit, would be to narrow the gap between science and community needs by popularising the available scientific resources that could help in solving or relieving the community needs.

Serious games - Usage in Civil Society: the Military, Health, Informal Vocational and Formal Education Settings

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Serious games are games that have a serious goal and not just the entertainment of players. Although serious games can have several forms, nowadays the term usually refers to digital games. The potentials of digital serious games in combination with the way that students in today's civil society receive and process information has given rise to this type of games. Digital serious games are considered ideal for educating and training the digital natives, as well as persuading and changing behaviors. The growth of interest on serious games was exponential the last years both as a research field in academia and a new market in the games industry.

Serious games are often considered to be equivalent to educational games or game-based learning. However, serious games are used in several sectors and for various reasons, besides formal education. These games are also widely used in military and health settings, as well as informal education and vocational settings. Some typical usages of serious games in the aforementioned settings are the following.

Military serious games are usually used as training simulations and are characterized by a high level of fidelity with real world events. Their advantages are numerous: they are cost-effective; time and labor effort to set up training is minimized; training is safe; training can be applied in large scale, while it can be repeated as many times as needed. Another usage of military serious games is for recruiting purposes. Health serious games, just like military serious games, are considered ideal for training purposes. They can be used by medical practitioners for learning and practicing, even on complex surgical procedures. They can also be used for patient education on effectively dealing with various - more or less serious - health problems, acquiring good health habits, and diagnosis.

Serious games are also used in informal education and vocational settings. Simulations and serious games are used for continuing professional development, corporate and executive training, skill development and various workforce programs. Informal educational serious games include, amongst others, location-based games for museums and guided tours in the historical center of towns. Usually, in informal learning serious games there is less direct assessment in comparison to vocational training and of course formal education serious games.

Educational games for formal education have attracted the interest of a great number of researchers and stakeholders. Several games have been developed for theoretical subjects like history, but for cognitively demanding subjects like problem solving and programming as well. A major issue in this type of serious games is how we can assess students' knowledge and also adopt the games to students' knowledge level, which has raised great interest on game learning analytics.

Besides the aforementioned categories of serious games there are games that lie in the crossroad of more than one category. An important category is serious games for people with intellectual disability and autism that aim to assist people in acquiring skills for their everyday independent living.

This presentation aims to present typical examples of each category of serious games, their special features and goals, as well as empirical results regarding their effectiveness. Issues on designing, implementing and assessing the impact of serious games will be critically discussed.

Through industry collaboration toward new curricula at the FCSE (FINKI), UKIM

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Since its establishment in 2011 FCSE has been committed toward strengthening the relationships with the IT industry in the country and in the region. Through various programs and projects, including memorandums for collaboration, direct involvement of companies' technologies and staff in the teaching process, jointly mentoring of student projects, invited lectures from the industry, sponsorship in the form of branding labs and lecture room, the requirements and the needs of the companies have been directly addressed at the FCSE. The latest process of curricula upgrade through establishment of new undergraduate and master study programs has been strongly driven by the needs of the IT industry. Using both direct contacts and surveys, the IT companies were able to present their current and projected staff qualification requirements, that served as the basis for the new study programs.

Towards a research and technology based innovation ecosystem

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We present the experiences of our university industry cooperation models, where we integrate education, research and innovation processes. We run joint RDI labs since 12 years, where team of master and PhD students are working on real industry initiated research and development tasks as part of their education. The labs are bringing together in working teams senior scientists, postdoctoral researchers, PhD and master students, professional from industry. The competitiveness of all stakeholders' increases in a win-win-win cooperation. The master students are involved for 4 semesters in such project work and they get about 40 percent of their 120 ECTS credits for learning by doing research. In the process students develop valuable soft skills from teamwork. We share the experiences, which topics and research questions are successful, how to build a win-win cooperation model with companies. The main benefit of this cooperation model is that master students, PhD students and postdocs get challenging and motivating tasks in multifunctional teams inside the university, profiting from a strong and daily connection with companies' research units. The model was successfully lifted to a pan-European level. A Deutsche Telekom (T-Labs, Berlin) supporting industrial Department of Data Science was established at the Faculty in 2016, and we started a Bosch initiated master program on Autonomous Systems in 2018. We recently joined a new model of PhD research initiated and supported by industry. Among the students we have EIT Digital supported PhD students, who receive additional industrial fellowship and EIT grant for 4 years. They also get entrepreneurial skills and should understand the business processes of the industrial partners. The main goal is for their work value to benefit from the influence of the industrial mindset. We publish both research results and open source prototypes, which are in use by several companies. We offer the students a 30 ECTS module on business development, where, among other things, they learn about customer centered development and open innovation. All analyzed use cases are about start-ups, scale-ups and corporates related to ICT. Students and professors having an innovative idea get support by coaches in our innovation lab to create their own companies and develop scalable business plans. Our vision is to build a third generation research university ecosystem around the Faculty.

Experience of a long-term multilateral educational project in software engineering based on the DAAD program “Academic Reconstruction of South-East Europe”

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The long-term project “Software Engineering: Computer Science Education and Research Cooperation” had been carried out from 2001 – 2016 under the auspices of the DAAD special program “Academic Reconstruction of South-East Europe”.

Within this period, there was a permanently growing network of participating universities, there were a lot of useful outcomes like joint teaching materials, the exchange of lecturers could be increased over the years, and there was an important forum of discussion and exchange of ideas and experience: annual workshops.

This presentation will summarize success factors and other features which were characteristic for that multi-country project.

Culture Historical Heritage - Inspiration for Enriching the Multi- Country Academic Cooperation

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The cultural and historical heritage of Bulgaria is part of the common European cultural tradition and history. This paper presents an intelligent tourist guide, which is part of the project developed at the Faculty of Mathematics and Informatics of the Plovdiv University “Paisii Hilendarski”– Virtual Education Space.

The tourist guide is being developed as an intelligent environment for lifelong learning. Its main task is to generate a tourist route for users according to their wishes and location. The route includes cultural historical objects and information about them. In this way, the user enriches his / her knowledge of the region for which the route is generated.

Currently, the knowledge base of the tourist guide is developed as a hierarchy of ontologies that include a large part of Bulgarian folklore. Folklore is an essential part of the soul of every country and should be studied and known. The presented tourist guide allows every user of the system to get acquainted with folk costumes in different regions of Bulgaria, to get a route according to what he wants to learn about or to visit.

Ontologies have been developed to include the requirements for cultural and historical objects described in the CCO (Cataloging Cultural Objects) standard, which allows information to be integrated into other systems. This ontology hierarchy can easily be extended to ontologies for cultural and historical objects and folklore of other countries, which will enrich the knowledge of those who want to learn in this field.

The cultural and historical heritage of every country is precious treasure and must be preserved and taught. The proposed project “Intelligent guide” is a good way to make the culture and historical heritage of each country part of lifelong learning.

Digital Schools Contest KA2 Project Experience Supported by the Erasmus+ Program

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Digital Agenda for Europe outline how the ICT provision and use in European schools is improving but several obstacles remain. Firstly, teachers still believe that insufficient ICT equipment is the biggest obstacle to ICT use in many countries. Secondly, whilst teachers are using ICT for preparing classes, ICT use in the classroom for learning is infrequent. Teacher training in ICT is rarely compulsory and most teachers devote spare time to private study. Thirdly, students and teachers have the highest use of ICT and ICT learning-based activities when schools combine policies on ICT integration in teaching and learning. However, most schools do not have such an overarching policy. Therefore it is not surprising that teachers generally believe that there is a need for radical change to take place for ICT to be fully exploited in teaching and learning. Despite the fact that having access and positive attitudes towards implementing ICT into their teaching and learning, teachers often find this difficult and require on-going support - not only technical but also pedagogical. The data also reveal how there are relevant differences in ICT integration in Education approach among European countries, for this reason European education community need room for debate good practices in the field of ICT in teaching and management of education activity. For this reason and to harmonize schools and policy approach the project is carry out internationally.

Throughout the planned activities the Digital Schools Contest (DISCO)project want to enhance the key competences and skills on ICT and learning performance of young people attending schools, through promoting quality improvements, innovation excellence at the level of education, in particular through enhanced transnational cooperation between education and training providers and other stakeholders in the field of ICT integration in Schools (teaching and management). Moreover the project intend to boost the emergence and raise awareness of a European lifelong learning area designed to complement policy reforms at national level and to support the modernization of education systems, in particular through enhanced dissemination of good practices and cooperation.

Enhancing digital integration in learning, teaching, at various levels: supporting ICT-based teaching, as well as ICT-based assessment practices. In particular, supporting teachers, educational staff in acquiring or improving the use of ICT for learning and related digital competences. To gain this goal the program foster a long term cooperation between schools and other research and training organizations with a view on ICT integration in education establishing exchanges of good practices, for the creation of a dedicated network; to do so the program proposes a set of activities for the establishing of a ICT Integration in School Distinction. Selected Schools will participate in several activities such as: studies of best practices, training workshops, dissemination events. DISCO is based on the use of a variety of equipment, tools, etc. provided by the partners involved in this project and will be available nationally and internationally, to end-users. At a local level schools will have better qualified and aware education staff regarding ICT in education, is expected that the products resulting from this project will be used not only by the end-users such by the entities participating in the project, teachers, non-profit organizations and local authorities working in the field of education and education provider directly through the website or by visiting the entities involved in the project, bearing in mind the objective of the project to help improve the quality of ICT education and ICT skills for young people. At the regional level DISCO will have an overall impact because of the participatory and integrated approach to all actors and stakeholders involved in promoting ICT education. They all contribute to the development, testing and evaluation of project results. At a national and European level the transnational cooperation between education and training providers and other stakeholders in the field of ICT integration in Schools, enhanced and booster awareness on the importance of education systems modernization, in particular through the enhanced dissemination of good practices and cooperation among European schools and education staff community.

A NEW MASTER MODULE IN HIGH PERFORMANCE COMPUTING AT FACULTY OF TECHNICAL SCIENCES

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In recent years, we notice a significant increase of an interest for learning wide-scope and highly-required knowledge for big data management and generating knowledge from available data, in various problem domains encompassing wide-range aspects from the scientific computations to the applications in various business systems. The area of High Performance Computing (HPC) is considered as an important support in the process of big data processing. A team from Department of Computing and Control at Faculty of Technical Sciences (FTS) implemented a project from the Program of high education improvement established by the Ministry of Education, Science and Technological Development of Republic of Serbia, with a main goal to create a new, contemporary module in HPC, and thus creating a new knowledge offer, for which IT industry in Serbia is significantly interested in. In this paper we give an overview of the new module in HPC at the master level studies, which is the main outcome of this project.

Many companies in their current business collect and store enormous data volumes, even more huge than ever before. A volume of data collected all over the world in various scientific research projects, as well as in business application domains grows rapidly, or even exponentially. Most often, those data are used in shorter time periods, and then they are archived and almost not used effectively. On the other hand, collected data are of a great value that can be utilized so as to reach the designed company goals. Therefore, in recent years we notice a significant increase of an interest for learning a wide range of highly required knowledge in the area of big data processing and knowledge generation from the available data in various problem domains, spanning wide range aspects from scientific computations to various business applications. The role of HPC is quite important to provide all other aspects of big data processing. The main value of our project from the Program of high education improvement established by the Ministry of Education, Science and Technological Development of Republic of Serbia is to provide a new knowledge offer to emerging IT industry in Serbia by a new module in HPC at the master level studies in two study programs: Computing and Control, and Information Engineering. By this, the intention of Department of Computing and Control at FTS is to be in line with contemporary world trends in academic education and create a new offer that is not widely present in the higher education in Serbia and neighboring countries. On the other hand side, the IT industry expresses an intensive interest for the areas of big data processing and HPC. By this, our intention is to further improve the visibility of FTS, both in Serbia and in a wider area.

The proposed module in HPC is a link between two quite important, contemporary research and education disciplines: a) Computing and Control and b) Data Science and Information Engineering. By establishing such link, FTS will provide for IT industry of Serbia such profiled engineers that are capable of addressing the most complex software development tasks in the course of creating well recognized and quantifiable business values in companies, based on the big data processing.

E-Learning Projects: New Potentials to Enhance Multilateral Cooperation in Informatics

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The importance of international cooperation in science and technology is recognised in several European Union initiatives, especially in the funding programmes for research and innovation such as Horizon 2020, COST, Erasmus+ and similar. These programmes are of great importance for research in Informatics as well, and one of up-to-date topics in this field is e-learning or Technology Enhanced Learning (TEL).

University of Rijeka, Department of Informatics (UNIRI) has been involved in several international TEL projects for more than fifteen years, such as: TEMPUS "EQIBELT - Education Quality Improvement by e-Learning Technology", FP7 "Mobile Game-Based Learning (mGBL)", European Tematic network

project „Future Education and Training in Computing: How to support learning at anytime anywhere

- FETCH“, Erasmus+ project "Creative Classroom". In that way UNIRI has established successful cooperation with experts from institutions in a number of European countries in research and teaching. Of special importance for smaller universities such as UNIRI are small scale funding schemes, for example the European Union's Erasmus+ programme that support activities in the fields of education, training, youth and sport, mostly “Key Action 2: Cooperation for innovation and the exchange of good practices”. The actions under KA2 make it possible for organisations from different participating countries to work together, to develop, share and transfer best practices and innovative approaches in all fields of education, including e-learning.

The purpose of this presentation is to introduce some possibilities of Erasmus+ KA2 programme in order to facilitate better multilateral cooperation between universities participating in DAAD workshop as well as from other institutions across Europe.

As an example of good practice in submitting and managing Erasmus+ projects in the area of e-learning, an ongoing project “Games for Learning Algorithmic Thinking – GLAT” (2017-1-HR01-KA201- 035362) is presented, as well as some possibilities to apply for similar projects with partners from countries participating in the DAAD Workshop, EU and beyond.

The GLAT project is funded by the Erasmus+ Programme of the European Union under the Key Action 2: Cooperation for innovation and the exchange of good practices (Action Type: Strategic Partnerships for school education). The coordinator is University of Rijeka, Department of Informatics and the partners are from Croatia, Slovenia, Estonia, Macedonia and Bulgaria.

The main objective of the project is encouraging the integration of computational and algorithmic thinking into the daily teaching through different subjects in students' younger ages in a fun and attractive way by using e-learning strategies that include Game Based Learning (GBL) and gamification.

Virtual Education Space for Lifelong Learning

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In the Faculty of Mathematics and Informatics at the Plovdiv University “Paisii Hilendarski” Virtual Educational Space (VES) is implemented as an intelligent, context-depending, personalized and adaptive environment for education, based on certain principles of Internet of Things and of Semantic web. The adaptation of VES for lifelong learning supposes the developing of a model for implementing education considering the necessities and possibilities of the learners and adapted to the contemporary ways of life and learning.

The idea of accomplishing such a model is prompted by the European and the National strategies for intelligent growth of our society where the lifelong learning is regarded as the most important factor for personal development and improvement, for successful professional realization, for active social position and for the creating of an intelligent, competitive and economically stable society. From the analysis made of these documents are systematized several general conclusions which present the essence and the basic possibilities for organizing the lifelong learning and these are:

- The lifelong learning integrates equally all categories of educational activities (formal, non- formal and informal) and affords an opportunity for education and training of the individual from the earliest childhood to the end of his entire conscious life. In this sense the lifelong learning assumes anthropological approach of education. This means a different approach of education and upbringing for every stage of the human life – pedagogical approach for the early and the youth age and ragogical approach (ragogy as a set of theories around how adults learn and what motivates them to learn).
- Providing the opportunity for intelligent growth of the society determines the mastering of educational key competences through the entire life according to the quickly changing needs of the labor market. This can be achieved through problem-orientated education.
- Granting information for the possibilities of education and training as well as for career orientation through the entire life is an important element of the conception of the lifelong learning.
- The institutions of higher education could implement non-formal education.
- Knowledge acquired through non-formal education can be validated and certified. In the European Union YOUTHPASS certificate is issued.
- The standardized European instruments can be used for comparing the acquired knowledge, skills and competences no matter how or when they are achieved.

EduCTX: A decentralized system for managing micro-credentials, based on smart contracts and the Ethereum blockchain platform

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The blockchain technology enables the creation of a decentralized and distributed environment in which transactions and data are not controlled by a central authority. Simultaneously transactions are secure, ubiquitous and trustworthy due to the used cryptographic principles.

This presentation will introduce a global decentralized blockchain-based platform and ecosystem called EduCTX that enables managing, assigning and presenting credentials for individuals and educational institutions as well as other potential stakeholders such as companies, institutions and organizations. Additionally, it enables the development of own digital services, which offers organizations the opportunity to automate the evaluation of individuals' skills and knowledge. The EduCTX platform is implemented on the blockchain platform Ethereum on a consortium-based network of Ethereum run nodes.

The platform enables a globally efficient, simplified and ubiquitous environment to avoid language and administrative barriers.

Android secure communication system, using Steganography

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Mobile devices are becoming one of the main sources of communication. More the importance of mobiles is growing more we feel unprotected while we use them for communication. Some of the application we use in our phones like Whatsapp use cryptography to secure the communication, but an innovative and interesting concept is hiding the fact that a secret message exists in a digital material. This is Steganography which is a method to hide data, but different from cryptography the secret information is hidden inside a digital carrier so a third party cannot detect it. This interesting idea is implemented in an android application, since android is one of the most used platforms for mobiles. This android application hide the message in an image and support the extraction of the message by the receiver. The message can be a text message or an image.

***We will present the phases of developing a mobile application from requirements to development, focus in testing.*

The Analysis and Development of an Application Server

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Nowadays, the use of web applications and the number of its end users has increased a lot, demanding more processing power, leading to the need of new developments in web technologies such as web servers. Software Engineers welcome new solutions in being able to handle lots of request in the servers when it comes to their applications. This project introduces the design of an application server built in C++ programming language, which uses threads technology in order to reach high performance when facing lots of requests at a time. It analyses current Web Servers technologies and suggests a new architecture that tends to use the best features of the existing ones, taking the best of both worlds of multi-process and event-driven architectures. Furthermore, it analysis the whole process of building the architecture from the Software Engineering point of view, from the specifications to testing the software. It shows test cases where the suggested architecture is compared with the ones being used currently. What is suggested in this project can be adapted and expanded due to the user's (developer's) needs and requirements, providing the right environment to develop web applications with high performance.

Re-design of Databases Course Curriculum and Students' Satisfaction

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This work presents an overview of a curriculum for a Databases course, held at the second year of an undergraduate study of informatics, at a University of Rijeka, Department of Informatics. Databases course continues on an Introduction to databases course (which covers all the fundamental database related topics, from early database development, relational theory, relational algebra, normalization, relational database management systems to practical work in SQL). Database course gives an in-depth overview of different types of databases (such as multimedia databases, distributed databases, NoSQL databases, cloud databases, analytical databases/data warehouses, etc.) as well as rapid application development (RAD) tools. On the practical side, students learn how to develop a business application based on a relational database, using a selected RAD software.

In this work, we present our curriculum for a Databases course, including a modification on the way we do lectures (theoretical part of a course). We describe how we eliminated classical face-to-face lectures and replaced them with 5 quiz competitions, in which all students take part in their teams. The goal was to make the lectures more interactive, competitive and fun in order to motivate students for studying and achieving better grades. A secondary goal was to promote teamwork and cooperation in order to better prepare students for future work.

At the end of semester students filled in a short questionnaire about their satisfaction with the course designed this way – we will briefly show those results too.

Lessons learned from an experiment with database professionals

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Abstract: This paper presents the results and lessons learned from an experiment we conducted with database professionals in order to more objectively evaluate an approach to automated design of the initial conceptual database model based on the bussines process model. The source bussines process model is represented by collaborative BPMN. The target conceptual database model is represented by the UML class diagram. The results obtained from the experiment with database professionals confirm the results of initial case study based evaluation of the approach, as well as the results of the previous experiment we conducted with undergraduate students at our Faculty. The evaluation results of the approach imply that the approach and the implemented automatic generator enable generation of very high percentage of the target conceptual database model with very high precision. In addition, the experiment implies that automatically generated conceptual database model can be used as a good starting point for manual design of the target model, since it significantly shortens the time required for the design.

Keeping Up with Software Development Industry Trends in Software Engineering Course

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During the last few years local software development companies have been organizing different student practice programs and have been offering job positions to students not only with a bachelor degree but to the undergraduate students too. The course of software engineering is planned for the last year of bachelor studies. The waterfall process of software engineering is practiced by doing different student projects. The idea of this course is not only to teach them the basic principles of software engineering but to prepare them for the real working environment especially for the communication with stakeholders and team members. During the three-month course students learn how to systematically approach the development and maintenance of software. This means to keep up with trends by organizing students into teams with more members, considering real industry problems, using different methods and, for industry, relevant technologies, which is not only challenging for students but for the teaching staff as well. This presentation covers the advantages and disadvantages of this approach from both student and the teaching assistant perspectives.

Future of Education – Preparing Our Students for the Age of Robots

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Today it is easy to observe that computers, robots and AI machines are getting smarter and are becoming able to do most of simple operations encountered in repetitive types of tasks. The next step is so near – machines will be able to execute most human activities, will be capable to make more complex correlations between knowledge elements from their memory or extracted from specialized knowledge data-warehouses. People with college degrees, even professional degrees, for example people like lawyers, are doing things that ultimately are predictable. A lot of those jobs are going to become susceptible over time.

So, education will face a strong challenge to prepare the students for tomorrow – a world with increasing presence of AI and intelligent robots. We must adapt our teaching methods and refine the knowledge transmitted because most of them are based on easy reproducible elements that can be better done by machines than any human. In many situations humans cannot compete against machines which are faster, more reliable, while becoming smarter and very precise.

We, teachers, must adapt our approach of preparing the students for this future, by focusing in our teaching curricula on how to be creative, how to better control these machines by focusing on creating unique values, that cannot be easily reproducible and computable by intelligent robots. The necessary attributes of humans must be based on values, beliefs, independent thinking, teamwork, freedom of creation and caring for others.

Education can become more successful by focusing on endowing students with reasoning traits that use a wide range of creation-oriented techniques such as brainstorming, mind mapping and project-based assignments. This provides students with a desire to seek out knowledge, create new ideas, and achieve more complex tasks. To give young people the tools they will need to prosper in the changing digital economy, such investment must focus on improving the quality of education. That may assume adapting curricula to focus less on rote learning or straightforward calculation and more on acquiring skills like critical thinking, communication, and leadership.

Partly or fully automated technology-driven services represent cheaper, more convenient, as well as more reliable options than entirely human solutions, thus contributing to the increase of profit margins of businesses. The AI-driven revolution might promote its winners and losers. To join winners is vital not just to avoid being replaced by the new technologies, but also to capitalize on their new emerging opportunities.

How can we do that? How we determine our students to learn to be different from machines? What kind of jobs is safer to follow? How do we educate people for an automated world? These are the questions that we propose to debate in this material.

Finding the root cause for PhD thesis completion delays by Doctoral Students at CST Faculty, at SEE University – Tetovo, Macedonia

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Universities around Europe, the last several years have applied the Bologna process model, in which the PhD programs are understood as the highest of three cycles of study at any given University. The South East European University followed the same model, therefore the Faculty of Contemporary Science and Technologies accredited the three year (180 ECTS) Doctoral Program in E-Technologies that usually covers many aspects of Computer Sciences and Technologies as core research.

The Doctoral School are planned as three year programs, where the PhD thesis should be completed within this time frame. A usual delay in PhD completion is related to PhD thesis and not the courses offered in the Doctoral School. This is likely undesirable for PhD candidates and it can also be detrimental to us as a University to termination of studies for “underperforming” students or as we call them students that have no significant progress in Doctoral School.

In this short paper we will address only the issues related to PhD thesis, mainly thesis definition as one of the biggest obstacles in Doctoral School at South East European University, the E-Technologies PhD Degree.

We have faced the last 4 years extreme lag from students perspective, as well as Faculty perspective in relation to the starting process as well as the completion of the PhD thesis. We argue that the root cause for this is the proper definition of the thesis and thesis objectives by candidates and further verification of these objectives by relevant peer reviewing bodies, such as councils, conferences, workshops and similar.

For verifying our argument and defining the root cause scientifically, we have collected 7 (seven) reviews from independent reviewers during the Doctoral Conference in Thessaloniki, Greece for 7 of our PhD candidates that are in the first phase of their PhD thesis.

These reviews, which in content are qualitative and narrative feedback is most valuable for students, but our intention in this paper is to identify several issues from the qualitative feedback and try to quantify them by using annotations that will later be used for classification purpose of the papers/reviews.

This way we will try to identify several factors that may have caused the delay in previous generations and thus at the end propose recommendations for future enhancements and improvements of the PhD program and potential mechanisms in order to assist PhD candidates and the Faculty to successful completion and “on-time” completion of the thesis.

University Labs as Carriers of Industrial Revival in Development Countries: A Software Engineering Case

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South-eastern Europe has been very sensitive region for years, or even decades. Intra- and international conflicts, economic sanctions, and reductions in industrial production and market exchange brought the region to the state of economic and social crisis. However, in the last decade, the region is a witness of reconciliation and gradual growth. One of root branches of this growth is software industry. The region is witnesses of a rise of different, mostly outsourcing software development companies, developing very different applications, using different languages and technologies, and often developing small parts of a bigger software products in a distributed way.

Educational system, especially universities have the responsibility to provide this machinery with the main power – employees who are well prepared to learn and grow together with challenges, the industry and the region as a whole. To ensure high quality of employees, education system needs unity and consistency across all levels of education, across disciplines, and across regions. Furthermore, good coordination with leading companies and mediation in collaboration and consulting are crucial, as from this communication, innovations, as an impeller of the development, originate.

University laboratories, as entities between educational system and industry might be the carriers of the initiated industrial revival of the region. In this presentation we describe an example of SQLab: Software Quality Laboratory founded as a part of the Department of Mathematics and Informatics, Faculty of Sciences, University of Novi Sad, based on models of successful University Laboratories in developed countries. However, having in mind specifics of the region, the SQLab also has essentials such are more general goals and activities.

More precisely, in the described circumstances of fast growth and lack of resources, a very weak quality control is conducted. If some quality control is done, it is applied too late in a form of testing. SQLab has an expertise to provide companies with the support in software quality monitoring and improvement, including the SSQSA, extensible and adaptable platform for quality analysis, and related projects. Furthermore, SQLab aims to take care of quality in the growing software industry in a broader sense. Thus, as additional goals we set: (1) work with pupils in elementary and secondary schools to promote software industry related disciplines, but also to select talents and participate in their progress, (2) work with actual students through workshops and projects to encourage their creativity and innovative potential, and (3) work with adults, who might be our former students, employees in the companies, but also with candidates with expertise in different areas but interested to potentially change their profession. In that way, preparing all the personnel according to requirements of the market we bring a new quality to the region.

Finally, we propose the model for building the network of Laboratories, covering the region territorially, but also involving all connected disciplines as a weft for weaving a strong and stable region.

CHALLENGES IN THE USE OF INDOOR NAVIGATION AND AUGMENTED REALITY IN COMPLEX SPACE

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This paper considers challenges for use of indoor navigation and augmented reality in complex spaces. The paper gives experiences and a possible implementation of a systems intended for indoor navigation based on using sensors, markers and beacons inside of buildings. In order to provide assistance to a person in some space (open and closed), it is necessary to determine the position of the person within the space, and then to find the path from the current to the target position.

When analyzing the problem, it can be noticed that the enclosed space imposes a number of constraints on outdoor navigation because of the obstacles that limit the propagation of the signals used to determine the position, GPS is usually not available in close space. When solving the above-mentioned problem of indoor navigation, it can be assumed that the structure of the observed space is known, as well as its characteristics.

The challenges are based on identifying characteristics of a space and translating them into the user's location. The user's position correlates with the map containing the location of the characteristics and the possible paths within the space. Identification of characteristics of a space could be based on recognizing existing objects or features, or on inserting new. Existing objects or features that could be used for navigation include pictures, existing markers, room numbers, stairs, elevators, or any other with distinguish and unique features. These features could be detected by using cameras, accelerometers, gyroscopes, or other sensors available on a mobile device. Inserting into the existing space new objects or features such as machine readable markers (e.g. barcodes, QR codes), or signals (e.g. Bluetooth Beacons, wireless access point) could also be used for navigation. These features could also be detected by using cameras, Bluetooth receivers, wireless antennas, or other sensors available on a mobile device.

The system for indoor navigation could include the development of four components: 1) an administrator application that is intended for the system management purposes; 2) a client application that allows the features of a space to be described; 3) a user application for indoor navigation; 4) a server component that is intended to integrate the previous three applications.

For the implementation of the user application, the technology of augmented reality could be used. The augmented reality combines a real world with imaginary computer elements. The introduction of augmented reality allows a user to find the way to its destination in a simple and fun way, and to receive additional information regarding space, and objects and features within the space. In this way an innovative principle for navigation in large complex spaces and buildings such as faculties, museums, shopping malls, supermarkets, hospitals, public institutions, fairs etc. can be realized.

An overview of key aspects in adopting Scrum in teaching process

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Computing study must equip students with enough practical knowledge to be skilled and competitive for professional work, consequently causing a teaching paradigm shift towards project based learning. Practical experiences in various real life projects would give students various benefits in a competitive and changing market, e.g. a portfolio to show to potential employers. However, it must be noted that problems in real life projects more often occur in the planning and managing phase, than in the developing phase. Thus, it is obvious that some other skills beyond programming and technical excellence are needed, and those soft skills are not always easy to learn or adopt. Extreme programming (XP) and Scrum are the two most dominant agile methodologies widely used in projects, and it would be desirable to introduce them to students, especially students of Software engineering. Relevant papers in this area suggest a capstone project as a place for teaching agile methodology to students. Although they give some overview on how a course should be structured opinions about duration, level (bachelor/master), and preparation for this course varies. Furthermore, opinions about who should be a Product and Scrum owner are likewise different and contrary (i.e. students vs staff vs senior students - teaching assistants).

Anna Karenina principle states that if there is a deficiency in any of key aspects, the family (in general the whole process) will be unhappy. This principle was used to explain various things in different areas, and it briefly describes problems that occur with the adoption of agile methodologies in software engineering education. There are many possible pitfalls to a successful introduction of agile methodologies in software engineering education. Firstly, human factors can accelerate, but they can also hinder the adoption of agile values in companies due to lack of knowledge, cultural issues, resistance to change, wrong mind set and lack of collaboration. In the same way those human factors can affect agile adoption in teaching process. Strong temperament and lack of interpersonal skills can undermine team effort, and sometimes even excellent coders do not adapt well in team. For instance, problems can arise if someone underestimates the importance of soft skills, or by having a bad attitude to technically less proficient users. Furthermore, there are some more aspects that usually do not occur in real-world. Students are usually distracted with other activities, they do not have a common working place, or are unable to attend meetings regularly, and could quit the project (fail the course). Furthermore, their “payment” is their course grade, thus making many students more interested in grades and deadlines than project quality and development process. Large classes and lack of staff further emphasize the problem.

An additional issue is created by the dilemma at what stage of their education should students be introduced to methodology. The problem of introducing some things too early is that students are not aware of the benefits as they did not experience problems that are solved with this approach. For instance, if a student didn't learn how to program mobile/web/standalone application(s) in previous courses it will create a paradox – a situation where they have to learn how to manage a development process without development skills.

Lastly after a review of the relevant literature and based on previous experience, the author's personal opinion is that the best approach is to use some kind of hybrid approach on the bachelor level. This approach should take suitable elements (e.g. weekly meetings, iterative releases...) that best fit the current context until full conditions for Scrum process are satisfied: enough staff or senior students available and willing to act as Scrum master, team coaches, and/or lead developers, and enough previous development knowledge from students.

A proposed model for peer assessment in the digital age: Leveraging social media platforms

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The issue of assessment is always a difficult one when we talk about University level education. Instructors have the traditional approach towards evaluation of their students and most of these approaches exclude the opinion of the students' peers.

Peer assessment in the other hand has been studied by several scholars whose aim is to include peer assessment by instructors/professors. The literature review is being conducted as part of this paper as well.

The peer assessment that we recommend in this paper is related to students as peers and not professors.

The motivation for this model of peer assessment is simply based on the emerging trends in technology and the use of digital means to conduct teaching & learning. In the digital age we live in, the students are "spending" their time in social media platforms, which is the new "place" to deliver knowledge to the new generations.

The purpose of this paper is by reviewing the research on current trends on the use of ICT in Education, in particular on peer assessment in e-learning, to propose a new peer assessment methodology using the social media platforms in digital environment.

Peer assessment model is introduced in this paper as well as the Technological aspect of the proposed methodology transformed into a prototype using the social media tools is further elaborated.

The peer assessment methodology that we recommend in the paper paper is based on the emerging trends in technology and the use of digital means to conduct teaching & learning. The modern students are "spending" their time in social media platforms, which is considered to be the new "place" to deliver knowledge to the new generations.

This approach both in methodology and technology solution aims at the end to increase student engagement in education, both in learning and in evaluation of their peers in transparent way.

Regional Cooperation at Research on Software Quality

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The so called “SQAMIA initiative” emerged after the 1st workshop on “Software Quality Analysis, Monitoring, Improvement, and Applications” held in Novi Sad as a satellite event to Balkan Conference in Informatics in 2012. Researchers from universities of Novi Sad, Budapest, Maribor, Rijeka, and Tampere, also knowing each other from previous events and activities, recognized the common interest in various areas in software quality and decided to continue with workshops as individual (not satellite) activities.

The main goal of SQAMIA workshop series is to provide a forum for presentation, discussion, and dissemination of the scientific findings in software quality, and the establishment and improvement of interaction and cooperation between scientists and young researchers. The workshop especially welcomes position papers, papers describing the work-in-progress, tool demonstration papers, technical reports, or other papers that would provoke discussions.

Besides that, the workshop is “non-profit” (conference fee usually covers only the real costs of workshops) and user friendly – deadlines tend to be very flexible if late papers are properly announced. Such a policy puts a significant burden to organizing and program committees but so far both were committed to the goals and policy of the workshops.

So far there were 7 workshops organized in Serbia, Slovenia, Croatia and Hungary, each was attended by 20 to 40 participants, having 12 to 20 accepted papers, and two to four invited lecturers / keynote speakers. So far the SQAMIA workshops gathers young people (master and PhD students) and experienced and well-known researchers (including keynote speakers).

The SQAMIA initiative and activities around the series of workshops were also initiators of various other activities and project applications. It is a starting point and “safe place” for most activities related to software quality in the region.