First Informational Bulletin

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The most common form of computer in use today is by far the embedded controller. This controller, combined with embedded software, is referred to as an ***embedded system*** (ES). These systems are built into a product for control, monitoring and communication without human intervention. There are some 30 embedded microprocessors per person in developed countries with an average of 250 million lines of code. In a new premium car 20 to 70 electronic control units can be found. A modern cellular phone has an increased number of features compared to a laptop from a few years ago.

Billions of embedded processors are sold every year and annual market share is around 160 billion Euros with growth rates of around 9% depending on the domain. In the Ukraine, Georgia and Armenia the lack of equipment and old educational technologies have resulted in courses in ES being removed from the educational curricular. The main effort is attributed to the design of desktop based software, as this does not need a lot of investment. Embedded systems however are used in more critical domains of human life, such as medicine, automotive and aerospace applications. This poses strong demands on quality issues of the embedded hard- and software, so a skilled workforce is necessary to make this a success. More so, education in innovative embedded control systems doesn't need big investments, because controllers and tools are cheap compared to other machinery. So well-trained, highly motivated employees can benefit from ever increasing demands for labor in this sector.

This project ***544091-TEMPUS-1-2013-1-BE-TEMPUS-JPCR "Development of Embedded System Courses with implementation of Innovative Virtual approaches for integration of Research, Education and Production in UA, GE, AM"*** [**DesIRE]** means to bring all partners HEI's involved up-to-speed with modern tools and embedded platforms. To come to efficient and effective implementation of the developed curricula, the basic ideas are working with a logical educational-pedagogical approach, widely available tools for development, easy accessible course material with different levels of entry, life-long learning for graduated students and a thorough quality assurance scheme. All of this is done in a practice oriented way with the embedded end-product as an ultimate goal. There are important preconditions for efficient learning, motivation and ready-to-use practical tools being some. The appearance of new teaching approaches (virtual and remote methods of teaching and e-learning) can increase the interests of students in embedded system development and will increase accessibility to state-of-the-art tools. In the DESIRE project, the ambition is to develop theoretical and practical curricula with dedicated embedded platforms and PC tools, which are bought within the project, in sufficient numbers to service enough trainees. To ensure availability of embedded tools to students and private stakeholders, remote laboratories are set up.

The DESIRE consortium consists from 12 partners with required expertise, educational skills and business connections. At the same time every partner has its own and clearly delineated area of responsibility, the international organizational structure ensures that decision-making and conflict resolution will be effective, workflows and exchange of information and results between partners will be smooth and fast.

The target groups are defined as follows: students, graduates, teaching /administrative staff, top management of industry enterprises, Chambers of commerce, inside and outside the consortium of the proposed project, governmental organization for welfare and unemployment care.

Wider Objectives

1. To change the theoretical type of learning in the Ukraine, Georgia and Armenia to practice-oriented competence-based approaches.
2. To speed up integration between HEIs and business in target countries.
3. To establish cooperation between EU and target countries in education and research.

Specific Project Objective

1. To create practice-oriented curricula and modules in Embedded Systems Engineering.
2. To create remote laboratories in Embedded System in UA, GE, AM .
3. To form the competences necessary for the Labor Market in Embedded Systems.

Activities:

1. Analysis of curricula on ECTS for Embedded Systems.
2. Analysis of competences required at the LM.
3. Developing conceptual approach to the curricula construction.
4. Modification of the modules & courses

1 ***Module "Hardware for Embedded Systems"(***150h (5 ECTS) + 120h (4 ECTS) practical exercises with new equipment): Microcontrollers 30h; Digital Electronics 30h; Digital System Design 30h; Embedded Communication 30h; Sensors, Actuators and Interfacing 30h.

2 ***Module "Software for Embedded Systems"*** (180h (6 ECTS) + 150h (5 ECTS) practical exercises with new equipment): C for Embedded Systems 30h; Embedded Software Development 30h; Embedded Operating Systems 30h; GUI development 30h; Multicore Programming 30h; Software Testing 30h.

3 ***Module „CAD/CAM/CAE for Embedded Systems"*** (80h (3 ECTS) + 80h (3 ECTS) practical exercises with new equipment): ECAD electronic design, ALTIUM, 40 h; MCAD structural design, Pro Engineer, 40 h.

4 Seven additional Modules: Digital Signal Processing 60h (2 ECTS), Remote Labs and Virtualization (60h (2 ECTS) + 45h (1,5 ECTS) practical exercises in the remote labs), Legislation on and Certification of Embedded End-Products 30h (1 ECTS), Management and Marketing of Embedded End-Products 60h (2 ECTS), Quality Engineering (36 h (1, 5 ECTS) + 18 h (1 ECTS) practical exercises): Quality management incl. ISO 9000 family, 18 h ; Quality Engineering, 18 h + 18 h practice, New teaching approaches in Engineering 45h (1,5 ECTS), Soft Skills for engineers 45h (1,5 ECTS)

5. Prepare modules guidebooks in UA/AM/GE/EN
6. Establishing LMS platform in AM/GE/UA
7. Construction of virtual and remote laboratories and ESD laboratory
8. Retraining in "New teaching approaches in Eng.", "RL for ESD","ESD Engineering"
9. Master Classes in "Embedded System Design","Remote Laboratory usage for ESD" in TC
10. Teaching the teachers and researchers in TC
11. Educate of the pilot student groups in TC
12. Monitoring and Evaluation of the processes and products
13. Assessment at the regional and national level
14. Seminars in target HEIs for industry workers

CONSORTIUM

Grant Holder:

P01:Thomas More University College (BE)
http://www.thomasmore.be/

Thomas More is the largest university college in Flanders, offering over 50 bachelor and master degree programmes in the province of Antwerp.

Thomas More was created by joining the strengths of Katholieke Hogeschool Kempen, Lessius Antwerp and Lessius Mechelen.

The University College wants to play an important strategic and international role in Flanders.

The Academic Bachelors and Masters are KU Leuven@Thomas More courses as of July 2013. This means that these courses are KU Leuven courses, organized on the campuses of the new Thomas More University College. They work together closely with related professional bachelors. As a result, Thomas More is a fully fledged knowledge center and engine for regional innovation.

With Thomas More (1478-1535) the university college follows in the footsteps of the English humanist, scientist and author. In addition, the name "More" also refers to more course programmes, more regional spread more cooperation agreements, more horizons.

More than 17,000 students

More than 1,800 staff members

More regional spread with campuses in: Antwerp; Geel; Lier; Mechelen; int-Katelijne-Waver; Turnhout; Vorselaar

More than 30 Professional Bachelors in 7 study areas.

More than 20 Academic Bachelors and Masters in 4 study areas.

Partners:

P02:Ilmenau University of Technology (DE)
http://www.tu-ilmenau.de/

Created in 1992, the IUT is one of the youngest universities in Germany. However, engineering education enjoys a more than 100 years old tradition. In addition to intensive basic research, applied and industrial-oriented research – the associated knowledge and technology transfer to industry and the economy has become a trademark of the university. In joint projects with industry, the conditions required for the introduction of new technologies and the development of new products are created. This is especially true in fields such as mechatronic, microelectronics, microsystems engineering, image processing, medical technology, information technology, communication technology, and environmental engineering. Current developments in international research form the basis for research profiles. The departments of Electrical Engineering and Information Technology, Computer Science and Automation, Mechanical Engineering, Natural Sciences and Economics currently have about 6750 students.

P03: Constantine the Philosopher University in Nitra (SK)
https://www.ukf.sk/

Constantine the Philosopher University (UKF) is situated in the city of Nitra, Slovakia. It became a successor of Pedagogic Institute founded in 1959 and Faculty of Education (1964). UKF consists of five faculties: Faculty of Arts, Faculty of Education, Faculty of Natural Sciences, Faculty of Social Sciences, Faculty of Central European Studies. Over the course of time, UKF has secured its position in the Slovak higher education system while transforming itself into a university – an advanced educational and research institution meeting the criteria imposed on European university institutions. UKF provides education not only in traditional teacher training but also in many other professional study programmes at three levels of study: bachelor, master and doctoral. About 12 000 full-time and part-time students are enrolled at UKF nowadays. International relations are based on bilateral agreements between UKF and foreign partners as well as on mobility programmes and research and educational projects. UKF is a member of a number of international organizations such as European University Association, Magna Charta Universitatum, Association for Teacher Education in Europe, and Eastern European University Network.

P04: Zaporizhzhya National Technical University (UA)
zntu.edu.ua

Today Zaporizhzhya National Technical University (ZNTU) has IV level of accreditation of educational activities and prepares students according to 34 bachelor degree programs, 52 engineers degree programs,45 master degree programs.

The University consists of six institutions: Engineering, Physics and Technology, Computer Science and Electronics, Economics and Humanities, Management and Law, continuing education, 12 faculties: Transport, Engineering, Engineering Physics, Electrical Engineering, Radio Engineering, Computer Science, Economics and Management, Humanities, department of physical culture and sports, tourism and international human resource management, humanitarian law, prevocational training, and 5 colleges (Berdyansk Machine Building College; Zaporizhzhya Electrotechnical College; Zaporizhzhya Radioelectronics College; Zaporizhzhya Humanities College; Tokmak mechanical technical school). There are 60 university departments, including 36 manufacturing.

Total number of students on January 1, 2014 amounted to about 12 thousand people, including about 7 thousand people in full-time education.

On January 1, 2014, the teaching staff was 838 people. Among the 460 people full-time teachers with academic degrees and titles, 29 persons have honored ranks of distinguished scientists and education workers, including State award laureates.

P05: Crimean Engineering and Pedagogical University (UA) kipu.crimea.ua

Republic Higher Educational Institution "Crimean Engineering and Pedagogical University" was created in June 1993 to meet the needs of the educational system of the Republic and the people, returned from the deportation. Nowadays it is a large regional scientific and educational complex, carrying out trainings for future specialists on educational levels "Bachelor", "Specialist" and "Master" in 24 different areas: pedagogics, economics, engineering, philology and art education.

Rector of the University – Fevzi Yakubov, doctor of technical sciences, professor, Hero of Ukraine, Honored Worker of Science of Uzbekistan, Honored Worker of Education of Ukraine, winner of the National Prize T.G. Shevchenko.

The University has about 7000 undergraduate and graduate students, employs over 400 highly qualified scientists and teachers, including more than 200 candidates and doctors of sciences, professors and associate professors. Crimean Industry and Educational system annually receives approximately 1500 graduated specialists. The University holds highly productive scientific activity. The scientists and young specialists of the University's departments annually publish more than 1000 scientific papers, dozens of monographs and textbooks, patents for invention; the University holds and participates in numbers of international and republican scientific conferences. Each year more than 800 students participate in conferences at various levels and publish about 300 to 400 scientific papers.

P06: Donbass State Engineering Academy (UA) http://www.dgma.donetsk.ua/

Today DSEA is the IV accreditation level educational institution and it provides training of Specialists and Masters in 18 specialties. Totally Baccalaureate is carried out in 13 areas.

The main structural units of the Academy are full-time faculties of: Automation of Engineering and Information Technology, Integrated Technologies and Equipment, Mechanical Engineering, Economics and Management; Office of Correspondence and Postgraduate Studies; Training Center, Technical School and College. The Academy also conducts training in Teaching and Counseling Centers in several town of the Donetsk region.

There are 29 departments in the Academy, including 16 graduate ones.

The total number of students on January, 1, 2014 amounted to about 4765 people, including about 2030 people in full-time training.

On January 1, 2014 the teaching staff amounted to 368 people. Among them 244 are full-time teachers with academic degrees and titles.

The Academy, apart from Technical School and College, has 6 educational and laboratory buildings with the total area of about 84,000 square meters. The academy has a library, Center for Information Technology, publishing department.

P07:Borys Grinchenko Kyiv University (UA) http://partner.kubg.edu.ua/

Borys Grinchenko Kyiv University is a modern and successful classical higher educational institution of the highest accreditation level. It is the only University in Ukraine which is subordinated to Kyiv City Council and primarily meets the needs of Kyiv educational system. University trains highly competitive specialists based on the international standards in Bachelor, Specialists, Master and PhD (Aspirantura and Doctorantura) programs and in-service training for teachers of educational institutions of the capital of Ukraine.

Borys Grinchenko Kyiv University consists of: Institute of Society, Humanitarian Institute, Institute of Human Sciences, Institute of Arts, Pedagogical Institute, Institute of In-Service Training, University College.

Nowadays Borys Grinchenko Kyiv University has over 7790 students; the teaching stuff amounted to 1227 people, including 283 PhD candidates and 67 Doctors of Sciences.

Borys Grinchenko Kyiv University is the member of the European University Association (EUA), International Association of Universities (IAU), European Association for the Education of Adults (EAEA) and a signatory of the Magna Charta Universitatum

P08:State Engineering University of Armenia (Polytechnic) (AM)

State Engineering University of Armenia is the legal successor of Yerevan Polytechnic Institute, which was founded in 1933. At present SEUA has over 10 thousand students. The number of the regular academic staff of the University exceeds 900, most of them with Degrees of candidate or Doctor of Science. With its developed research system and infrastructure the University is nationally recognized as the leading center in technical sciences.

Today the University in its central campus located in Yerevan and the Branch Campuses – in Gyumri, Vanadzor and Kapan, accomplishes 4 study programs of vocational, higher and post-higher professional education, conferring the qualification degree of junior specialist, bachelor, master and researcher. Besides the degree programs, the University also offers extended education courses by means of its faculties and a network of continuing education structures. The specialization scope of the university includes all the main areas of engineering and technologies represented by 43 Bachelor's and 26 Master's specializations in Engineering, Industrial Economics, Engineering Management and Applied Mathematics

P09: National University of Architecture and Construction of Armenia (AM)

National University of Architecture and Construction of Armenia (formerly YSUAC) is the legal successor of Yerevan State Institute of Architecture and Construction.

At present NUACA has over 3,5 thousand students. The number of the regular academic staff of the University exceeds 350, most of them with Candidate and Doctoral Degrees of Science. With its developed research system and infrastructure the University is nationally recognized as the leading center in architectural, constructional and technical sciences.

Today the University in its central campus located in Yerevan accomplishes 4 study programs of vocational, higher and post-higher professional education, conferring the qualification degree of junior specialist, bachelor, master and researcher. Besides the degree programs, the University also offers extended education courses by means of its faculties and a network of continuing professional development structures. The specialization scope of the university includes all the main areas of architecture, construction, engineering and technologies represented by 25 Bachelor's and Master's specializations in Architecture, Industrial Economics, Engineering Management and Information Technologies and Computing Systems.

P12:Yerevan Telecommunication Research Institute CJSC (AM) http://www.yetri.am/

The Yerevan Telecommunication Research Institute was founded in 1978 as a branch of Moscow Scientific Research Institute of Radio Communicationand is specialized in the field of creation of the means and units of space communication.

Today our company develops and realizes radio engineering devices with the expanded spectrum, TV-transmitters, communication equipment for conferences and meetings, SAW devices, hybrid-integrated microassemblies, functional devices and units of communication facilities, control -measuring complexes, advertising-information boards and etc.

P10:Georgian Technical University (GE)

Georgian Technical University (GTU) is an accredited Higher Educational Institution.

GTU was founded in 1921, as one of the faculties of the Tbilisi State University (TSU). GTU is a leading Higher Educational and Research & Development (R&D) institution in Georgia. Scientists and professors at GTU are working on the most up-to-date solutions to existing problems, innovations, new educational and research approaches and methodologies, etc. As the modern innovative technology is a core of the economical wealth in every country, GTU contributes a lot in the process of economical growth with the R&D activities, directed to the demands of the production and employment market.

GTU consists of 10 faculties and 12 R&D centers. In particular: Faculty of Civil Engineering; Faculty of Power Engineering and Telecommunication; Faculty of Mining and Geology; Faculty of Chemical Technology and Metallurgy; Faculty of Architecture, Urban Planning and Design; Faculty of Business Engineering; Faculty of Informatics and Control Systems; Faculty of International Design School; Faculty of Agriculture Sciences and Bio-systems; Faculty of Transportation and Mechanical Engineering; Georgian Technical University has successfully participated in substantial amount of

European and International projects and has quite rich experience of cooperation with different European institutions.

Today GTU is one of the largest university in Georgia with 10 faculties, 12 research centers and more than 19 000 students.

P11: Ivane Javakhishvili Tbilisi State University (GE) http://www.tsu.edu.ge/en/

Ivane Javakhishvili Tbilisi State University (TSU) is an accredited Higher Educational Institution.

Today TSU is the largest university in Georgia with 6 enlarged academic units (faculties) and more than 22 000 students. There are 1,772 full- and part-time academic staff at TSU. TSU has eight campuses, 16 scientific-research institutes, 81 scientific-research laboratories and centers, 161 study laboratories and rooms, clinical hospitals, diagnostic centers and libraries.

The governing body of TSU is Academic Council with the Rector as the head of the Council. There are 17 administrative departments at TSU: Quality Assurance Office, Department of Scientific Research and Development, Department of Academic Affairs, Office of Information Technologies Services, Department of Foreign Relations, Department of Human Resources, Department of Internal Audit, Department of Finances, Department of Logistics, University Scientific Library, TSU Publishing House, Museum Service, Department of Sports and Culture, Chancellery, Department of Academic Advancement and Life Long Learning, Department of PR, Department of Legal Services and Security and Safety Service.

There are 6 faculties at TSU: Faculty of Humanities, Faculty of Economics and Business, Faculty of Law, Faculty of Exact and Natural Sciences, Faculty of Social and Political Sciences and Faculty of Medicine.

WP1 Analyses of current curricula and competences in Embedded Systems in TC

According to the project plan, analyses of current curricula and competences expected at the labor market in ***Embedded Systems*** were conducted in target countries (TC) in the period from March to May 2014. Each partner presented a detailed report.

Analyses of the reports can be summarized as follows:

- all universities in each partner country (Georgia, Armenia and the Ukraine) decided to closely collaborate;
- each partner university has the necessary human, educational, informational and logistical support for a high-quality preparation of students in the field of ES;
- teachers organize the educational process to be aimed at the implementation of specific objectives of educational reforms and the Bologna process;
- analyses of the labor market show the importance of preparation of specialists in embedded systems;
- university students are familiar with contemporary approaches in education, however, they are rarely used, and, in general, virtual labs are more known than remote experiments.

The main data about the situation in each university involved are presented below.

Ukraine

P04 ZNTU

In ZNTU there were conducted analyses of existing curricula/courses of preparation of 8 specializations/49 disciplines related to Embedded Systems.

Specializations in ZNTU related to ES

Specialization	Faculty	Department
Electrical machinery and apparatus	Electrical Engineering	Electrical apparatus
Electromechanical automation systems and electric	Electrical Engineering	Drive and automation of industrial installations
Computer systems and networks	Information Science and Computer Engineering	Computer-Based Systems and Networks
Specialized Computer Systems	Computer Science and Engineering	Computer-Based Systems and Networks
Software Engineering	Information Science and Computer Engineering	Software Tools
Micro-and nano-electronic devices and equipment	Radio Engineering	Micro-and nano-electronics
Radioelectronic devices and tools	Radio Engineering	Design and manufacture of radio technology
Information Technology of Design	Information Science and Computer Engineering	Software Tools

The structure of existing training curricula and masters meets the standards of the Ministry of Education of Ukraine.

List of professionally-oriented disciplines agreed with educational-methodical commission of the Ministry of Education in the relevant areas of training and relevant educational qualification characteristics (EQC), and educational and professional programs (EPP) of preparation of masters, which have been approved in the appropriate order as ZNTU standards.

When compiling the list of disciplines curricula considered specificity domain needs Zaporozhzhya region as a whole, as well as specific industrial base - employers.

For analysis to labor market requirements were involved representatives from 9 companies and local enterprises.

From their opinion:

- 80% consider that its necessary to involve courses in ES in the preparation in the HEI;
- 75% consider that there are lack of specialists in ES in Zaporizhzhya region;
- 73% show their interests to collaborate with ZNTU in the field of professional training of specialists in embedded systems;
- the mostly important competences from their point of you are “to Implement and test software components of ES”, “to use modern software tools for modeling and studying production systems” ; “to create programs in high level programming languages to build and use models of modern manufacturing systems”, “to analyze, theoretically and experimentally investigate the methods, algorithms , programs of hardware and software complexes and systems”, “to analyze and choose the computational methods for solving problems of embedded systems design by criteria minimizing the computational cost, resistance and complexity”, “modern means of design automation for enterprise problems solving”.

There were conducted survey for students, in which took part 92 student (45% 4th year of bachelor study, 15% - 2 year of master study, 15% - 3d year of bachelor study). And it show following results:

- 76% know what is embedded systems;
- 18% know and work with learning management system Moodle; 33% heard about it; 49% - didn’t hear about it;
- 56% heard about virtual laboratories, 27% - never heard, 17% - used virtual laboratories in their study;
- 49% - only head about remote laboratories, 25% - used it in their study; 26% - never heard about it;
- more students voted for what teachers sometimes use multimedia and virtual instruments. In second place answers

frequent use of multimedia, virtual instruments. Minimal number of votes given for not using the tools in the providence of lectures.

P05 CEPU

To fulfill the goals of the project were choosed the team from the Information and Computer Department – ICT; Laboratory of Multimedia Systems and Learning Software – LMS&LS; Department of Mechanical Engineering.

The Information and Computer Department is issuing on direction 6.040302 "Computer Science" (educational qualification "Bachelor"), a specialty 7.04030201, 8.04030201 "Computer Science" (educational qualification levels of "specialist", "master"). Department is preparing to postgraduate study on specialty 13.00.02 – theory and methodology of instruction (computer science), 13.00.04 – theory and methodology of training, 08.00.11 – Mathematical Methods, Models and Information Technologies in the economy.

Currently 230 students, including 77 students of correspondence courses learn in CEPU on direction 6.040302 "Computer Science" (educational qualification "Bachelor"), a specialty 7.04030201, 8.04030201 "Computer Science" educational qualification levels of "specialist", "master").

For analysis of labor market requirements were involved 16 representatives of employees of the region. The answer of the survey are following:

- courses in ES are urgent – 57%; Further specialization "ES" is required – 29%; Is not necessary – 0%; Hard to say – 14%;
- there is a definite need in additional specialists in ES – 57%; Almost no specialists – 43%;
- would accept for employment a technical University graduate with specialization in "ES", as a young professional – 36%; would send your own employee to acquire a part-time education – 7%; would send your employees to special training courses for specialists in the field of ES – 28%; would organize training courses and master classes at your enterprise with the involvement of experts and university professors – 29%.

In student survey took part 148 respondents (78% of the total students of the Faculty). The distribution of the students are following: I year of study – 44%; II year study – 11%; III year of study – 13%; IV year of study – 20%; V/VI years of study – 12%. Their answers are following:

- 72% know what is ES; heard something – 22%; never heard before – 6%.
- 40% - know what is Learning management system Moodle; Yes, heard about it – 6%; Never heard before – 54%.
- 20% - used virtual laboratories it during study; 57% - heard about it; 23% -never heard before.
- – 16% - used Remote Laboratory during their stud, heard about it – 53%; Never heard before – 31%.

P06 DSEA

Training of Masters of Embedded Systems is performed by three graduate departments (see Table), as well as the departments of General Language Training, Political Science and Law, Foreign Languages, Health and Environment, Economy and Organization of Production, Philosophy.

Departments in DSEA involved in the project

Specialties	Faculty	Graduate Department
Information Technologies of Design	Mechanical Engineering Automation and Information Technologies	Computer Information Technologies
Electromechanical Automation Systems and Electric Drive	Mechanical Engineering Automation and Information Technologies	Electromechanical Systems of Automation
Automated control of technological processes	Mechanical Engineering Automation and Information Technologies	Automation of Production Processes

DSEA has the necessary stuff of professors for quality training of Master's educational qualification of the analyzed specialties. Tutors of the departments, which carry out training of Masters in vocational disciplines have academic degrees, actively carry out their own research, the results of which are regularly published and reported at national and international scientific, technical and scientific conferences.

In survey took part representatives from the 9 enterprises of the region. There were achieved such results:

- there is a certain need in specialists in ES in Donbas region;
- the companies are ready to employ specialists in ES and ready to retrain their staff in ES;
- training in ES is extremely needed.

The competences analysis show the most valuable to the employees of the region: understand physics of the phenomena and process, which underline the functioning of ES; know and use methodological and technical foundations of computer design; seize opportunities of local networks and internet technologies In system design; integrate software systems and programs and ensure their interoperability, ensure routing of tasks and resource planning, build project knowledge database.

Student opinion analysis showed that:

- 65 % know what is embedded system; 28% heard smth; 6% - never heard before;
- 4 know what is Learning management system Moodle; 36% heard smth, 60 – never heard;
- 38% never heard what is virtual laboratory; 60% heard about it; 2% used it;
- 55% never heard about remote laboratory, 43% - smth heard, 2% used it;
- 10% suppose that their teachers often used innovative technologies during lections ((multimedia, virtual tools); 68% - only sometimes, 11% suppose that don't use

P07 BGKU

The University provides training students for who can be embedded in disciplines related modules with embedded systems in only one institute - Institute of society in the specialty "Informational Sciences" (bachelor, specialist, master) and "Social Informational Sciences" (master).

University does not provide training programmers.

For the students training in specialty «Informational Sciences» and «Social Informational Sciences» is responsible the department of Computer Sciences and the Department of Information Technology and mathematical disciplines.

Department of Computer Sciences was established in December 2003. At this department taught more than 30 disciplines within the information and communication technologies and programming.

Performed analysis of curriculum areas of training «Informational Sciences», specialties «Informational Sciences», «Social Informational Sciences», ", as well as working with the curriculum disciplines permit conclusions:

1. BGKU prepares masters in informatics and can fragmentary training of specialists in the field of embedded systems to implement the software in general educational institutions, to develop specialized courses in embedded systems, virtual laboratories, software for schools, in University conducted a series of activities with the aim of presenting the project and its tasks

2. For the results of the surveys necessary to develop and implement specialized courses on integrated systems, virtual laboratories, software, PTC Creo according to the plan.

About 24 Kyiv Institutions who are interested in the students competent in the field of embedded systems, participated in the survey, only 17, namely Sinerion, INTEL, company intellectual technologies "KINT", HS Osvitoriya, INTEKHSERVIS-B, IT-Solutions, IntellectTechnologies, Lanet Network, SteelInStyling, DataArt, Microsoft, Infopuls, Ukrainian Federation of Informatics, LLC "Folgat", N/ A, Octave Electronics, Infocom.

The results of the survey:

- 24% consider courses in ES urgent; 53% - suppose that further specialization "Embedded Systems" is required;
- 12 % suppose that there are there enough experts on embedded systems in enterprises of Kyiv region; 42 % suppose that there is a definite need in additional specialists.
- 35% - prefer to send employees to special training courses for specialists in the field of ES, 32% - prefer to organize training

courses and master classes at their enterprise with the involvement of experts and university professors

The competences which are required by stakeholders (more than 50% agreed): to analyze, theoretically and experimentally investigate the methods, algorithms , programs of hardware and software complexes and systems; to determine the design objectives, criteria of efficiency and limiting the application of BC, to choose the best design decisions on the basis of morphological and targeted approach ; to create and explore mathematical programming models of computing and information processes connected with the operation of objects of professional activity; to implement knowledge extraction from databases and data warehouses for the development and use of mathematical models and software by processing the data using statistical techniques , computer-aided learning and artificial intelligence; to perform a systematic analysis of the subject area of ES and semantic description of the data and knowledge about them using specialized languages, high-tech methods for planning experiments, simulation and artificial intelligence; to analyze and choose the computational methods for solving problems of embedded systems design by criteria minimizing the computational cost, resistance and complexity; to create the projects of Reengineering business and technical processes; to analyze the results of the use of re-engineering to solve specific problems; to integrate design automation systems with automated systems of technological preparation of production and engineering calculations automation systems.

To learn students opinion the survey involved students of the Bachelor (4th year), specialists (5th year) and Masters (5-6 courses) specialties «Informational Sciences», «Social Informational Sciences».

The survey showed following results:

- 79% know what is ES; 24 – smth heard, 4% - never heard;
- 88% know what is LMS MOODLe, smth heard 8%, hear first time 4%;
- 58% - know what is virtual laboratory, 38 snth heard, 4 % - heard first time;
- 29% know what is remote laboratory, 29 snth heard, 42 % - heard first time;

Georgia

P10 GTU

Departments involved in the project: Department of Electrical and Electronics Engineering, Department of Computer Science, Department of Scientific R&D.

GTU has established a new curriculum for embedded systems design based on a modern design flow using the Hardware Description Language VHDL. Lectures on this topic are accompanied by a laboratory using a FPGA and Zedboards as the main implementation platforms. While lectures are already in place to cover basic topics of Computer Architecture the practical lab work is restricted to classical topics of digital design such as basic combinational logic circuits and simple finite state machines. A basic lab on embedded system architecture and assembler programming is also in place. However, it is organized in terms of well-defined student tasks to train basic skills. It does not cover more advanced topics related to advanced hardware architectures and system software and it does not solicit independent project work by the students.

In order to establish a more advanced education in Embedded Systems additional teaching topics must be covered from one or several of the following areas:

- Advanced Hardware Architectures
- System-on-Chip design methodology
- System Software (e.g. real-time operating systems)
- Applications of Embedded Systems (e.g. automation & control, signal processing).

P11 TSU

Summarizing data presented in analysis, it should be noted that courses related to Embedded Systems exist in the Bachelor Program only. The Master and Doctoral programs are focused on RF and Microwave Engineering, Computational Electromagnetics, Electrical Engineering CAD. The last one implies specifics of software engineering in the field. So, we plan to develop some curricula's at Master and Doctoral program level within the TEPUS-DESIRE (experience of San Diego State University will be also taking into consideration).

In scopes of Millennium project full analyzing, development and enhancement of TSU Bachelor program of Electrical Engineering is planned in order to get the ABET accreditation. We are going to develop the Embedded Systems (curricula's and laboratories) in synchronization with the Millennium project and close cooperation with TEMPUS-DESIRE partners.

Analysis of LM showed that:

- 100% suppose that courses in ES are urgent;
- 67% suppose that there are no specialists in ES in Georgia region; 33% suppose that there is definite need of such specialists;
- 67% - prefer to send employees to special training courses for specialists in the field of ES, 33% - prefer to organize training courses and master classes at their enterprise with the involvement of experts and university professors;
- 67% - prefer to collaborate with Ivane Javakhishvili Tbilisi State University in the field of professional training of specialists in embedded systems; 33 % - hard to say/

Student opinion analysis showed that:

- 44 % know what is embedded system; 32% heard smth; 24% - never heard before;
- 67% know what is Learning management system Moodle; 18% heard smth, 15 – never heard;
- 27% never heard what is virtual laboratory; 44% heard about it; 29% used it;
- 32% never heard about remote laboratory, 40% - smth heard, 27% used it;
- 35% suppose that their teachers often used innovative technologies during lections ((multimedia, virtual tools); 47% - only sometimes, 18% suppose that don't use

Armenia

P08 SEUA

Taking into consideration did analysis of current curriculum and competences in Embedded System in State Engineering University of Armenia (Polytechnic) the summary are:

The universities have no special curriculum on Embedded Systems.

The Universities programs involve different parts of Embedded System curricula in the curriculum of the different Faculties for some specializations.

The University curriculum related with Embedded Systems should be used and modified.

Faculties involved in the Project are: Cybernetics; Computer Systems and Informatics; Electrical Engineering; Machine Building; Vanadzor branch; Gyumi branch; Kapan branch.

Related with embedded systems there are following master programs in the university:

- "ELECTRICAL ENGINEERING, ELECTROMECHNAICS AND ELECTRICAL TECHNOLOGIES" - the program concerns to industrial electric systems, efficiency control and maintenance of electrical technology. It includes: electromagnetic conversion of energy, electrical, electronic and microprocessor devices, automated electrical complexes, modern electrical technologies, electrical insulations, cables and capacitors.
- "TECHNOLOGICAL MACHINES AND EQUIPMENT" - the program aims at preparing specialists in the field of design and building of technological machines.
- "ELECTRONIC ENGINEERING" - the program present electronic and nano-electronic systems and devices are widely used in computer engineering, computer aided design and becomes a part of everyday life. Electronic gradually engineering areas, from integrated circuit design to signal control and processing, as well as in nanotechnologies and nano-electronic device.
- " AUTOMATION AND CONTROL" - the program focuses on design and development of automation and control systems. The course is aimed at presenting a mature overview of several important design techniques for control systems, varying from classical to "post-modern".
- "INFORMATION SECURITY"- the program is designed to prepare qualified systems engineers and experts in sphere of information protection.

- "INFORMATICS AND COMPUTER SCIENCE" - graduates are able to perform the following professional work: design of the architecture of hardware-software complexes and their components; design of mathematical, linguistic, information and software support of computing and automated systems on the basis of modern methods, means and technologies of design, including computer aided design systems; testing and debugging of hardware-software complexes; development of mathematical models, methods, computer technologies and systems of decision-making support in research, design activity, management of technological, economic, social systems; installation, adjustment and service of systems, support and applied computer software and automated systems
- "INFORMATION TECHNOLOGY" - the activities of the engineer of Information Technologies (IT) includes: development and operation of information processing, management and automated design systems.
- "INFORMATICS AND APPLIED MATHEMATICS" - this broad-based program deals with mathematics and its application in engineering and science. Its solid theoretical core is a good base for our graduates to adapt to fast-paced developments in the professional market. The informatics component of the program makes the gained knowledge applicable to virtually every sphere of activity in today's information society and innovative economy.

49 companies and organizations participated in the survey for study skills required in the labor market in the field of Embedded Systems.

The analysis shows that companies share the same opinion on several issues connected with ES (Embedded Systems): a)necessity of ES course and b)sufficient specialists in ES about 60%, b) need for ES specialists about 80% and d) cooperation with engineering universities for ES specialists about 100%.

The mostly high ranked competences are: to analyze, theoretically and experimentally investigate the methods, algorithms , programs of hardware and software complexes and systems; to create and explore mathematical programming models of computing and information processes connected with the operation of objects of professional activity

To understand the physics of the phenomena and processes that underlie the functioning of embedded systems; to analyze and choose the computational methods for solving problems of embedded systems design by criteria minimizing the computational cost, resistance and complexity; to optimize the use of resources in the implementation of project activities; to know and use the hardware and methodological basics of computer design; to apply a standard way of describing (modeling) of industrial products at all stages of their life cycle; to use the achievement of computer graphics and geometric modeling in computer aided design; modern means of design automation for enterprise problems solving; to Implement and test software components of ES; to develop and transform mathematical models of phenomena , processes and systems for their effective software and hardware implementation; to develop criteria for the quality of designing ES, models of systems and processes, to apply mathematical optimization techniques in the process of ES design.

Within the project opinion analysis questionnaire has been filled in which about 100 students of SEUA participated.The results are summaries as following:

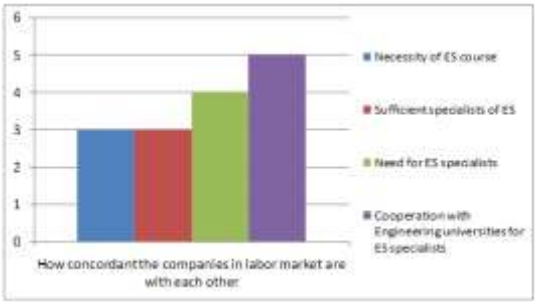
- 65% of the students are aware of the embedded systems, 30% of them have heard something about them, and only 5% hears for the first time;
- 60% percent of the students have heard about it, and 40% of them have never heard before and none of the inquired students have used during their studies;
- 70% percent of the students have used it during their study, 20% of them have some knowledge about it, and only 10% has never heard about it;
- 70% percent of the students have never heard about it before, and only 30% is aware of it and, finally, none of them used at their studies;
- 50% percent of the students have mentioned that their teachers often use innovative technologies during lectures, 40% of them has underlined that teachers sometimes use innovative technologies during lectures and 10% has only mentioned that their teachers don't use them
- 10% percent of the students have mentioned that their teachers often use innovative technologies during lectures, 50% of them has underlined that teachers sometimes use innovative technologies during lectures and 40% has only mentioned that their teachers don't use them

P09 NUACA

In the NUACA the Department of Management and Technologies, Faculty of Computer Engineering and Management; and the Chair of Informatics, Computing Technologies and Management Systems were chosen to work on project goals.

Currently the most close to the curricula of the embedded systems is curricula in Informatics and Computing technologies. Its includes such disciplines as Microcontrollers, Digital electronics, Digital System design, Testing, Sensors and Interfacing, Digital Signal Processing.

In survey of importance of ES curricular took art 15 enterprises and local companies. The results are shown at the chart.



1 NUACA. The result of survey for enterprises and companies

Student opinion analysis questionnaire has been filled in which about 25 students of NUACA (formerly YSUAC). The main result of the survey:

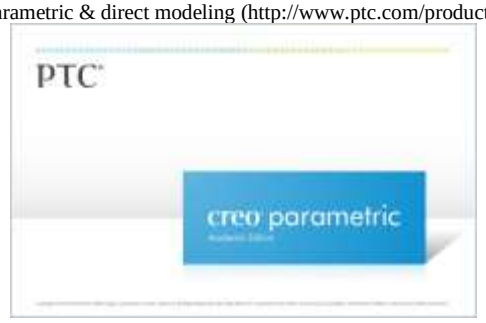
- 65% of the students are aware of the embedded systems, 30% of them have heard something about them, and only 5% hears for the first time. Besides, the students of NUACA have rather a good practical experience having their practical, laboratory tasks on embedded systems in Yerevan Telecommunication Research Institute;
- 100 % percent of the students knows what distance learning is;
- 60% percent of the students has heard about LMS, and 40% of them has never heard before and none of the inquired students has used during their studies;
- 70% percent of the students has used virtual laboratories during their study, 20% of them has some knowledge about it, and only 10% has never heard about it;
- 70% percent of the students have never heard about remote laboratories before, and only 30% is aware of it and, finally, none of them used at their studies.

Yerevan Telecommunication Research Institute appears to be the supporter of practical work at the universities.

WP 3 Implementing a (virtual) learning environment in ESD eng. Establishing remote and ESD labs.

In the first phase of the project, each university received 500 licenses for CAD / CAM / CAE-system PTC CREO (expiration date in December 2017) and 20 licenses for ECAD-system Altium Designer with full technical support.

PTC Creo is a scalable, interoperable suite of product design software that delivers fast time to value. It helps teams create, analyze, view and leverage product designs downstream utilizing 2D CAD, 3D CAD, parametric & direct modeling (http://www.ptc.com/product/creo).



Altium Designer combines Schematic, ECAD Libraries, Rules & Constraints, BoM, Supply Chain Management, ECO Processes and World-Class PCB Design tools in one easy to use, Native 3D enhanced, Unified Environment, increasing your entire team's productivity, efficiency and reducing your overall costs and time to market. (http://www.altium.com/)

WP6 Quality Assurance and Quality Control

In partners universities there were conducted the survey for students if they consider the new Embedded system courses necessary for the region. Each discipline should be rated with 5-point scale, which shows the importance of those disciplines in terms of students (a scale that corresponds to the evaluation: 0 - does not matter, 1 - a minimum score of 5 - the maximum score).

For **ZNTU (P04)** the most important point counted 54 votes: GUI development

Second place gets the point with 49 votes: New teaching approaches in Engineering

Third (39 votes), fourth (38 votes), fifth (30 votes) and sixth (29 votes) respectively occupy: Multicore Programming, Soft Skills for engineers, Digital Electronics, Digital System Design,

4 points overall:

Further items are placed in descending order: Embedded Operating Systems, Management and Marketing for Engineers, Quality Engineering, Embedded Software Development, Testing, Microcontrollers, ECAD- electronic design system ALTIUM DESIGNER,. MCAD- structural design system PTC CREO

The ratings of the 10 most popular disciplines in **CEPU (P05)** is listed in the table:

Table – CEPU course rating

No.	Course/Module	Average
1	GUI Development	4.46
2	Multicore Programming	4.18
3	Embedded Software Development	4.11
4	Embedded Operating Systems	4.04
5	Testing	4.04
6	Soft Skills for Engineers	4.03
7	Digital Electronics	4.00
8	New teaching approaches in Engineering	3.98
9	Digital System Design	3.95
10	Quality Engineering	3.89

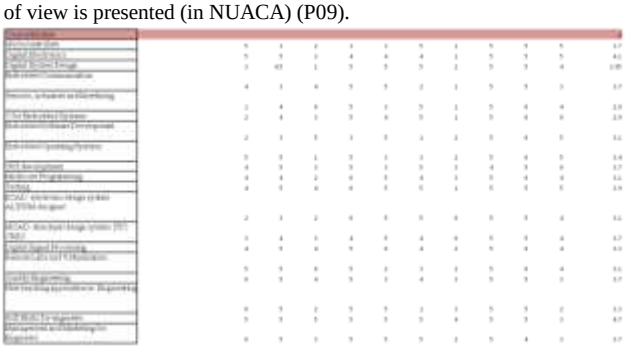
Among the most popular disciplines among students in **DSEA (P06)** are: GUI Development, Multicore Programming, Embedded Software Development, New teaching approaches in Engineering.

In BGKU (P07) among the disciplines the mostly high ranked by students are: Digital Electronics (42% - rank as 4; 17% - rank as 5), C for Embedded Systems (33% – ranked 4, 29% - ranked 5), Embedded Operating Systems(38% – ranked 4, 21% - ranked 5), Testing (42% – ranked 4, 33% - ranked 5), MCAD - structural design system PTC CREO (53% ranked as 4).

Top 10 disciplines in **SEAUA (P08)** are

Course/Module	Average
S18-Soft Skills for engineers	4,70
S2- Digital Electronics	4,10
S11- Testing	3,90
S3- Digital System Design	3,90
S1- Microcontrollers	3,70
S13- MCAD- structural design system PTC CREO	3,70
S16-Quality Engineering	3,70
S19-Mmanagement and Marketing for Engineers	3,70
S4- Embedded Communication	3,70
S9-GUI development	3,70

In the table the importance of coursers and modules from students' point of view is presented (in NUACA) (P09).



WP7 Dissemination and Enterprise Collaboration

Within dissemination activities and enterprise collaboration each partner country:

1.Setup university-enterprise contact group (UECG)
2. Developed dissemination plan
3. Developed local web-resources
4. Conducted meetings with target groups and stakeholders

Dissemination through web-resources

The web-site of the project were developed:
http://tempus-desire.thomasmore.be/

Group in Facebook were created:
https://www.facebook.com/groups/DesIRE.TEMPUS/
Partners in target universities provide local web-resources:

Partner	Local web-resource
P04	http://zntu.edu.ua/?q=node/2198
P05	http://cepu.edu.ua/index.php?option=com_content&view=article&id=493
P07	http://tempus.kubg.edu.ua/en
P10	http://gtu.ge/News/2652/?phrase_id=6089
P11	http://rp.tsu.ge/index.php?option=com_content&view=article&id=352%3Adesire&catid=32%3Anews&Itemid=112&lang=en-GB
P12	http://www.yetri.am/partners/105-partners-ads/241-desire.html

Web-site of the project

Meetings with target groups and stakeholders

Inter-tempus coaching in ZNTU

ZNTU. Dissemination among students

Dissemination in the DSEA

Dissemination in DSEA

Dissemination in BGKU

TSU. Internal kick-off meeting

Dissemination in NUACA

Yetri. Dissemination events

GTU. Internal kick-off meeting

CEPU Dissemination events

WP8 Management of the project

Kick-off meeting

In Tomas More University College at the Campus Carolus Antwerp, Belgium 28 – 30 January 2014 there were held a kick-off meeting of the consortium.

28.01.2014 Meeting of the EU partners, establishing plan and the budget of the project.

29.01.2014 Meeting of all partners. Each partner presents their country, region, university and department. There were made additional reports: Documents/Procedures/Methodology/Budget (Dirk Van Merode, TMM), Usage of the remote labs (Karsten Henke, IUT), Preparation of the Work Packages / Individual Roles Partners (Galyna Tabunshchyk, ZNTU).

At the meetings were pointed out that:

- Language of courses: English or local language
- Material should be developed in English, but target countries may teach in their own language.
- Teaching the teachers will be in English.

EU partners presentations

Consortium

Approving plan and establish working bodies in partners countries

Local Project Plans were prepared by each partner and established working bodies.

Table – Project coordinators in target countries

Partner	Local Project Coordinator
P04 ZNTU	Galyna Tabunshchyk Associate Professor of Software Tools Department e-mail: galina.tabunshchik@gmail.com
P05 CEPU	Seidametova Zarema Head of the Information and Computer Technologies Department e-mail: z.seydametova@gmail.com
P06 DSEA	Oleksandr Tarasov Professor, Doctor of technical sciences, Head of the Computer and information technology department e-mail: tarasov50@inbox.ru
P07 BGKU	Nataliia Morze Vice-rector on Information and Communication Technologies e-mail: n.morze@kmpu.edu.ua
P08 SEAUA	Amalya Mkhitaryan Cybernetic Cheir "Control System" e-mail: m_amalya@seua.am
P09 NUACA	Gohar Avetisyan Deputy Chairholder of ICTMS, e-mail: avetissian_goga@yahoo.com
P10 GTU	Prof. Dr. Tamar Lominadze A Head of e-Learning Center Georgian Technical University Email TLominadze@yahoo.com
P11 TSU	Giorgi Ghvedashvili Professor of Department of Electrical and Electronics Engineering, Faculty of Exact and Natural Sciences, TSU; Head of Department of Scientific R&D e-mail: giorgi.ghvedashvili@tsu.ge
P12 YeTRI	Mher Markosyan, Professor, Doctor of technical sciences, Head, responsible for the organization of internal quality control, e-mail: mark@yetri.am

Regional meeting in Kiev

In Boris Grinchenka Kyiv University. (P05) 13-15 May 2014 was held a regional coordination meeting of the consortium.

The meeting was attended by representatives of all Ukrainian universities - Zaporizhzhya National Technical University, Crimean Engineering-Pedagogical University Donbass State Engineering Academy, Kiev University. Boris Hrinchenka, who reported on the results of the first phase of the project in Ukraine. Partners from Georgia and Armenia took part in the event mode webinar.

Elena Orzhel who represents Tempus/ Erasmus+ Office Ukraine actively participated in the event and suggested some ways of solving the problems of the project and described the requirements for ensuring the sustainability of the project and the characteristics of their distribution.

Representatives at the ua regional meeting

Calendar of future activities

Summer courses "New teaching approaches in Engineering "in UKF (P03) (15-20 September, 2014, Nitra)
Purchasing and delivering equipment to the partners (October-December, 2014)
Preparing courses materials by European Partners and delivering it to target partners (September-November, 2014)
Master Classes in Armenia (February, 2015)
Web-conferences of the consortium – 14:00 by Brussels each last Thursday of a month (28.08.2014, 24.09.2014, 30.10.2014, 27.11.2014)
1st project meeting in Armenia (February, 2015)

Contact information

Ing. Dirk Van Merode
MSc. Research Engineer EmSys

http://tempus-desire.thomasmore.be/
Adress:
Thomas More | Campus De Nayer
Technology & Design J. P. De Nayerlaan 5
2860 Sint-Katelijne-Waver Belgium\
tel : + 32 15 31 69 44
e-mail: dirk.vanmerode@thomasmore.be