VIRTUAL LABORATORY OF ROBOTICS

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Abstract:
In frame of the project KEKA 027STU-4/2014 at our institute, we are building a virtual laboratory of robotics. The main objective is to build a laboratory together with a set of training modules in the field of automation and industrial robotics that will serve to teach the principles of automatic control of manipulation and programming of industrial robots, which are now increasingly implemented in production practice. Built laboratory will develop the knowledge and expertise of students in the field of automated and robotic systems, application of innovative educational program and methodology of using modern technologies, including CA and e-learning.

KEYWORDS: VIRTUAL LABORATORY, ROBOTICS, TEACHING, PROFESSIONAL COMPETENCIES

1. INTRODUCTION

In these days globalization, social, political and economical situation create special environment in which only the best can survive. Important requirement of potential employers is a right relationship between professional competences and key competences. Key competences can be represented as universal complex skills which overreach level of specific professional knowledge and skills. Key competences are skills which inform how will particular person behave accordingly to the situation. While professional competences are very important for high skilled work, key competences are helping to put better use of professional competences to practice.

- Professional competences ensure good managing of working tasks
- Key competences are widely usable skills such as decide ability, ability of solving problems, team working, communication in foreign language, ability to learn, information working ability, etc.

The aim of whole project is creating a virtual laboratory of robotics which would be used to learn designing of creation of robotized workplaces and their simulation. Creation of such laboratory will lead to the quality increase of teaching process of subjects belonging to our study branch such as manufacturing devices and systems (industrial robots, automation and mechanization, automate theory, and so on...). Students which will go through courses in these kind of laboratory will receive required professional skills and competences. These competences and skills will strengthen their abilities which are very important for designing processes of such devices. The students will also learn the methodology of creating several types of systems, which will lead to increase of their value at the labour market.

2. VIRTUAL LABORATORY OF ROBOTICS

New created virtual laboratory of robotics will be used for teaching of robotized workstation design principles. Various manufacturing systems can be implemented based on robotized workstation. In virtual laboratory, the students will create the virtual models of robotized manufacturing systems and they will also be able to simulate the function of such device (Fig. 1). Students will be able to create their own virtual robotized workstation systems as well as to test them. Based on this fact they will be able to verify the proper function of the system by using of the simulation. Students with help of such laboratory will be able to create projects from various kinds of subjects while operating on the robotized system.

![Fig. 1: Simulation of industrial robot working cycle](image-url)
the real laboratory will increase the number of tasks and it's teaching effectiveness. The teaching process will be more effective and thanks to the virtual laboratory, there will be less mistakes and possible dangerous collisions between the robot and other devices. Such collisions could lead to the damage of devices installed in the laboratory. Based on fact that time consuming part of laboratory work will be concentrated only to the correct solutions, the students will have more time for realization of their examples. Expected contribution of realization of this project can be seen in these steps:

- Education process enhancement
- Education process will be more attractive for the students
- Student will improve their technical knowledge and skills
- Before the real realization all practical tasks and examples will be simulated in virtual laboratory and only correct task wills be realized in real laboratory
- Costs reduction in real laboratory, because non correct tasks will not be realized
- More students can work in the same time
- Virtual laboratory will be accessible for the students through internet, which makes the use possible for external students,
- Work in the virtual laboratory will increase professional skills and competences of technicians
- The labour market's price of our graduate will grow

3. E-LEARNING AND VIRTUAL LABORATORY

Information and communication technologies present new dimensions in education at all levels. Education becomes the primary factor of national prosperity. New education technologies offer a wide space for further learning and life-long learning; remove barriers and ruin national frontiers, supporting at the same time advisability of learning with the main emphasis on utilization in practice and global way of thinking.

E-learning, as a new didactic method, facilitates distance learning and provides new possibilities for other education forms. Teachers become authors of educational, instructional documents with a specific mission – to transform the quality of all attendance forms of study into rationally configured documents in electronic form. Computers and other facilities gave rise to world wide communication network – internet. In present time internet represents the most extensive and most massive information and communication technology that enables both general and addressed bidirectional communication.

If we are looking to the e-learning as to the effective using of information technologies in education process, we can say that we are talking about two new possibilities, which can be used in education process.

Classical teaching leaded by a teacher is realized from the beginning of history. This type of teaching in not possible to change, for some kinds of teaching. Educating only with help of a teacher has many disadvantages.

E-learning is created for improvement of these disadvantages and it is an optimal solution for complex education. To create interesting, address, individual and interactive education process which can be integrated in to the everyday life, we have to combine proper methods of classical and e-learning education style. Also in areas in which is personal contact with teacher necessary, the students can be study before the class through electronic system. Then the students will be coming to the lectures with new amount of information and questions. After such process teacher is able to speak only about interesting or difficult fields of study. Also the time of lectures can be reduced.

A convenient combination of „classical“ and electronic education (e-learning) creates new possibilities to implement ideas of the teacher and demands on students. This is a new look on university education method in which proficiency and experience of the teacher unite with advantages of information communication technologies. The result of their bilateral action consists not only in human activity improvement but makes the education process more interesting, effective and more addressed.

E-learning brings many communication ways such as emails, video conferences, which allows teacher to individual access to individual students. Following to the backward information about the lectures, teacher has exact information about the student. Information such as: how good were the students in single lectures, how many points did students reach in single fields of study or how much time does it take to understand for students. Thanks to the number of communication ways, the teacher is able to communicate with his students more intensively than before by typical classes.

Instead of constant repeating of the same information in the lectures, teacher will be able to work more intensively on preparation of new lectures or he can update lectures.

E-learning gives to the teacher new useful tools which can be used for simple and rapid transfer of his/her own knowledge and skills in to the form which will make these information more accessible for everyone who needs them.

E-learning is a solution designated for education process, but is
shows education in other context. E-learning is not restricted only for student education, but it is also a method of information passing and sharing. Such sharing and passing of information is important in field of whole life education process which is very important for technician. Classical information technologies and systems are dealing with information searching and searching in the exact time. E-learning gives emphasis on kind of information passing. Today not only reaching of the information in exact time is important, but it is also very important to understand the information and give this information in wide coherences. And these accomplishments are coming with e-learning.

E-education as a new progressive way of education and it brings new possibilities. This education form can be used in all degrees of formal education and can be also used in whole life education process.

Content of e-learning is showed at Fig. 3.

E-learning Structure for Distant Education:

- Takes full advantage of IKT: real time,
- Makes use of several education methods: a virtual classroom, simulations, interactive texts
- Includes also supporting administrative functions: tutoring, evaluation, testing, registration, payments, records

E-learning Structure for Distant Education:

- Basic information about the course (teacher, annotation, syllabus,...)
- Respective education materials (text, pictures, diagrams, graphs, animations, video, audio,...)
- Students’activation (tests, tasks, homeworks,..)
- Communication – synchronous (chat,..) and asynchronous (e-mail,..)
- Feed-back (delivery of solved tasks, questionnaires, inquiry,..)

3.3. Manuals and learning materials

Manuals will be created within the frame of this project and they will be accessible through the internet. Solved tasks will start with simple layouts and will end with more complex tasks. Every task will include detail device function description and standard connection scheme. These descriptions will serve as supplementary study literature for students of internal and also distant study form. Experiences gained by creating of such teaching system will be implemented into the distant study system by help of e-learning.

4. CONCLUSION

Researches of employers' requests and also researches of students' opinions about the university preparation are indicating that there is small connection between university education schedules and practice requirements. There is a number of competences, knowledges and skills which have to be learned by universities. Key competences are very important and integrating category, which influence to the quality student requirements. Such requirements are very important in the price of graduated on the labour marked. Most preferred employers' requirements are for example, solving problem's ability, determine ability, team working, team leading ability, etc.

Amongst the most important requirements influencing the future employees (technical engineers) belongs:

- Creativity
- Foreign language skills
- Independence
- Computer working skill
- Responsibility
- Flexibility
- Knowledge of actual trends in the branch
- Willingness of other education
- Communication

All these competences can be achieved by the students working in virtual and real laboratory of robotics.

Graduates of study gets the needed skills, experiences and they will have knowledges about a methodology of robotized manufacturing systems design. They can simulate the working of designed devices. For simulation realization will be installed specialized software at out intranet. By this software we can supervising every parts of designed manufacturing system. This system include only real industrial parts (PLC, stepper driver, servo driver, sensors and other...).

Systems and their functions which are thought in virtual laboratory can be found in real industrial environment. Knowledge and skills with those systems are highly reputable and are also demanded by wide number or employers, like huge international technical industries and concerns such as PSA, Kia, Volkswagen, and others.

In last phases of laboratory building we would like to create internet access to this laboratory, because we would like to allow work in laboratory also for students of distant forms. We would like to allow the access to laboratory not only during classes so student will be
able to fulfill their tasks not only in reserved time. Knowledge acquired by process of creating of this kind of virtual laboratory will be also used in other projects and will be also used by creating of new modern kind of teaching process by e-learning.

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6. REFERENCES