

## RUSOS-ROBOTICS FOR TEACHERS OF SECONDARY VOCATIONAL SCHOOLS

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### Abstract

Project RUSOS is focused on educating of teachers of secondary and vocational schools in the field of robotics. The topic of robotics was chosen as it is widely used in automotive industry in its cutting edge form and automotive industry is the one most developing and growing industry in the Slovak republic and in Europe as well. However, the businesses suffer a great lack of professional operators of these robotized assembly lines and technologies. The lack is significant at the fresh graduates who graduated vocational and secondary schools. The main lack of skills considers inability to operate, program, control, and handling robotized systems. After the state of the art analysis evaluation there were certain conclusions gained, showing lack of information from the field of robotics among graduates.

The lack is caused by low level of education at vocational schools. Low level of education in the field of robotics is caused by poor material and technical facilities at secondary schools as well as by poor level of theoretical and practical experiences of teaching staff. Therefore the staff is not able to pass on important and satisfactory level of education in the field of robotics. Due to above mentioned information the project RUSOS is focused on teaching staff and it is aimed to create an educational system RUSOS based on ICT platform. Up to date information from the field of industrial and service robotics will be processed and available to the learners in this platform in the form of e-learning lessons.

**Key words:** E-learning, Erasmus +, RUSOS, secondary vocational schools

### INTRODUCTION

Focus on selected priorities is based on development of robotics in all areas of industry with regard to Slovak Republic, where need for a professional resource is especially in businesses of automotive industry. In automotive sector are most required after employees with secondary vocational education, who work in sphere of service of

automated and robotized equipment and at production lines. Existing graduates for these activities are insufficiently prepared. Employers for profiling their robotic positions will provide short-term courses in supply robotic companies for training at universities; respectively they themselves provide such course. Lack of these courses is their specialization too narrow and shallow depth idea of robotics system. Way to improve this situation we see in the introduction of such main robotics subjects at secondary vocational schools, which today is missing. Robotics is only part of certain subjects, without a coherent view. The need to resolve this problem should begin at substance of case and it is in teacher training at secondary vocational schools in the field of robotics, to have relevant, innovative, high-quality and timely information from robotics. Primarily, RUSOS project focuses precisely on them, that they were then able to transmit to their students' knowledge of robotics at the professional level [1].

Development of robotics is documented also by changing of the ratio for use of robots in various industries. In 2005 it was in automobile from total number of robots deployed 41% in the plant production of components, for automotive industry it was 27%, concerned in metal industry 10% and in the other 22%. In 2013 relationship has changed to: automotive 27%, subcontracting for automotive industry 29%, 11% of metalworking and other industries increased to 33% (food, plastics, electronics, etc.). The topic of robotics has been selected as a priority, because from the analysis of use of robotic systems in production it was found that top level is currently used in automotive industry. The automotive industry in Slovakia is one of the fastest growing in Europe and is among the most important industries in Slovakia.

The automotive industry generates directly and indirectly, 12% to 17% total gross production of Slovak economy. Production of automobile industry, i.e. cars and modules, systems and components for automobiles, Slovakia directly employs 60,828 people, representing 2.7% of total employment in Slovakia. Another 140,000 jobs generated by indirectly in Slovak Republic, i.e. that more than 200,000 employees (9% of total employment) is linked to automobile industry. More than 50% of occupational structure in automotive industry consists of "machinery and equipment", which are employees with secondary education, which operate with robotic and automated manufacturing and assembly equipment. In view of these numbers and for huge benefits for

Slovak economy, it is necessary to educate young people at appropriate level in the field of robotics, which is achieved by appropriately educated and their teachers.

### AIMS OF THE RUSOS PROJECT

The project aims to have an impact and benefits on three areas - the target group:

- Teaching staff of secondary vocational schools. Teachers (mentors) from different institutions dealing with education will be the third and final group of users of RUSOS portal. They will be provided training materials about mentoring and their role will be to help students to establish the successful cooperation with coaches from companies,
- Production businesses from companies looking for the new workers especially those just entering the labor market will be the second group of the RUSOS portal users. They will be supported by training materials about coaching and will be in direct contact with students interested in establishing cooperation with their company,
- Students of vocational schools. Students from vocational schools and universities, entering in the near future the labor market will be the main user of RUSOS portal.

The target group – teachers – will benefit in terms of gaining the latest information and knowledge from the field of industrial and service robotics, which is now highly popular and attractive giving them the benefit of professionalism. This will give them the chance to be promoted or find a good position at labor market. In the long term point of view the businesses will benefit from having educated graduates of vocational secondary schools. The graduates of secondary schools will possess a high quality education level in the field of programming, operation and handling robotic devices which will give them perfect opportunity to get a job in one of the production businesses which provide high number of vacancies and working positions in the field of automotive production using robotic devices.

The second part of educational system will consist of virtual laboratory containing 3D virtual models of robotized and automated devices which can be used in the virtual laboratory [2]. On top of that the project RUSOS will provide teaching staff of secondary vocational schools (the target group) with review of robotic competitions containing conditions and rules for submission. As these robotic competitions are widely spread and popular with business and educational providers in many countries we want Slovak republic to take part in




these activities in greater scale for the purpose of increasing its positive image among other EU countries.


The main goal of the project is to create learning materials for teachers of technical subjects at secondary vocational schools to be established at the basis and also at the latest knowledge of robotics.

- Create teaching-training materials in e-learning for industrial and service robotics,
- Enhance the preparedness of graduates of secondary vocational schools,
- To incorporate profiling subjects of robotics at secondary vocational schools,
- Educate teachers of secondary vocational schools in the field of robotics,
- Establish educational ICT platform and virtual laboratory,
- To strengthen the links between education, training and the world of work.

There will be seven project partners from three different countries: The Slovak republic, Romania and Poland. Project partners (Tab. 1) represent and unify wide range of professionals in the field of robotics, production, such as education and a partner of cluster type.

Tab. 1 Project partners

Logo of project partner	Description of partner	Type of institution
	Department of Robotics at Faculty of Mechanical Engineering, Košice is focused on research and development in field of automation, robotics, and production systems.	University
	On 3.3.2010, an Automation Technology and Robotics (AT+R) Cluster was founded in Kosice in the form of an association of legal entities, Cluster AT+R z.p.o.	Research institute
	PIAP is the public research institute, which belongs to the Top Ten of Polish research institutes.  The University of Bucharest is one of	Research institute

	the most important universities in Romania and in the South-East of Europe.	University
	Lublin University of Technology (LUT) is a major educational and consulting center in Lublin, where he studied more than 10,000 students.	University
	MANEX deals with projection and production of complex solutions for automated production lines in the field of transport, handling, packaging and fulfilment and these solutions are on a high level with the implementation of the latest robotic systems.	Small and medium-sized enterprise
	Secondary School polytechnic as a branch of the common school of Juraj Henisch educates students in engineering, construction, electrical engineering.	Secondary vocational school

## PROJECT RESULTS

The most important result of project is the fact that in Slovakia will accelerate the process of innovation, technical subjects in the field of robotics. The project plans during solutions to actively promote robotics. As an important project results can be considered RUSOS providing education and a training-ICT platform, which will also include a virtual laboratory. These results provide for training based on e-learning and virtual reality, which brings unlimited opportunity to study according to their own needs and their own pace, anytime, anywhere. Other results of the project also include a strong strategic partnership established between the project partners. Solving of project will strengthen cooperation partnership and this partnership will be able to perform other actions related to vocational education and training.

The project is scheduled for creating of project promotional materials, which will be used for dissemination activities. These include a project website that is available in all languages of partnership and in English. Also will be prepared leaflets, newsletter and brochure about project and its results, which will be distributed to target group,

whether within-person meetings, dissemination seminars or training, but also in addition to participation in other events such as conferences that is focused on area of robotics and education. Newsletters and brochure will be available in all languages of the partnership and in English, and will also be available online.

## INTELLECTUAL OUTPUTS OF RUSOS PROJECT

Project outputs consist from:

1. Analysis of requirements of engineering companies for newly recruited employees - graduates of secondary vocational schools - O1. The aim is making off depth analysis and identification of needs and requirements of the target groups. The intellectual result consists of two parts, namely an analysis of requirements engineering companies to newly recruited employees - graduates of secondary vocational schools and secondary school teacher's needs analysis on training in robotics.
2. A set of training materials for training of secondary school teachers in robotics - O2. Educational materials (lessons), based on which the project will be generated among the educational-training ICT platform will be based on two areas:
  - Industrial Robotics - basic concepts and definitions, parameters, control and programming of industrial robots, safety of industrial robotic systems, visual and camera systems for industrial robots, industrial robots sensor equipment.
  - Service Robotics - basic concepts and definitions, parameters, control and programming of service robots, safety of service robotic systems, visual and camera systems for service robots, service robots sensor equipment.
3. Educational-training ICT platform for the training of secondary school teachers in robotics - O3. Educational-training ICT platform is main intellectual output of RUSOS project. It is an educational platform based on e-learning, the main advantage is its availability strictly according to actual needs of its users time and space indefinitely. This educational platform allows controlled and continuous access to study materials as well as the opportunity to exchange their knowledge and experience with other course participants through the implementation of various communication modules such as forum, chat and other [3].

## RUSOS PROJECT WEBPAGE

Project web page was established at the beginning of the project. At month 4 it was available in English language at the following address: <http://rusos.sjf.tuke.sk/index.html>. The main aim of the website is to be the main source of information on the project, activities and documentation to the target communities outside of the consortium, as well as to publish information on important activities undertaken by the consortium. All partners can access the website and upload relevant information concerning the dissemination of the project as well as access to a documentation related to the project's implementation and activities [4]. The website is divided into different sections:

- Home - the main page of the project, with general information concerning the purpose of RUSOS project,
- Project background – this section contains more detailed information about the project,
- Project Partners – contains short description of project partners with links to their web pages,
- News and events – containing project news and information about events,
- Project outputs – contains leaflets, newsletters and brochures,
- Links – links to interesting / useful web sites,
- Contact with us – contains contact data to project coordinator.



Fig. 1 RUSOS website home page

## CONCLUSION

It is expected that at the end of project the resulting education system RUSOS tested the target group and, if necessary, adjusted and ready for commercial use by the project partners. The project partners them; their professional profiles and experience guarantee high sustainability of project results [5]. Specific parts and aspects of the project, which will be available after completion of the project, are:

- ICT education platform for RUSOS - All partners will maintain educational portal for needs of their educational activities within their country. Costs associated with maintaining the portal, domains, servers, software updates will be covered from

own resources partners. The project partners will continue to use this platform as support of its educational activities which will extend portfolio of offered training programs and learning services,

- Learning materials from robotics area - As they will form the basis of educational ICT platform, it is clear that their use will be ensured by the use of ICT platforms. These materials will be available in PDF format, so that they can be printed and used as a textbook,
- Virtual laboratory – will be a part of educational system RUSOS - ICT platform.
- International partnership - a partnership of project RUSOS will seek further opportunities for cooperation either within other projects or other opportunities for cooperation and will also seek to implement additional new partners in the partnership for strengthening its structures in various areas of expertise.

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