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Lifelong Learning Programme

Education, Audiovisual & Culture Executive Agency

E-Learning and Practical Training of Mechatronics and Alternative Technologies in Industrial Community (E-PRAGMATIC)

Progress Report Public Part

Project information

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Executive Summary

Maintaining an educated, high-performance workforce in the today's world of fast changing technology is a daunting task. The European researches have shown that technological hybridization, where electronics and mechanics are joined in the new interdisciplinary field mechatronics, is an important structural driver of change in the electro-mechanical industry. Therefore it is especially important to provide sufficient high quality, continuous education sources in this field. Up-to-date learning contents, delivered by using modern education methods and suited to the needs of practicing technicians and engineers, have to be available for this purpose. Traditional practice in EU enterprises is to provide training and retraining to their employees by means of the conventional in-company training (38 % of employees, EUROSTAT). Such in-company training can be therefore an efficient method to transfer the mechatronics knowledge from the educational institution directly to the professionals employed in industry. E-PRAGMATIC network was established in order to initiate and support this process.

E-PRAGMATIC network is an association of 13 regular and 4 associated partners from seven European countries. Included are educational institutions and end users which are chambers, enterprises and associations of enterprises. The network's main aim is to modernize mechatronics and engineering vocational training of the employed professionals, apprentices and trainees directly in the industry, by enhancing in-company training contents and education methods. The main target groups are practicing engineers and technicians from industrial partners, who need an additional education to keep up with the increasing demands of their jobs. Further target groups are apprentices and trainees who still need to obtain specific knowledge required in their company and teachers from secondary and high vocational schools, who are searching for additional educational sources to update their own knowledge in order to improve their teaching.

Currently, practically oriented learning modules with the remote experiments and an access to the remote working stations with industrial equipment, are currently under development. Contents of the modules are chosen in such way, that reported needs of professionals from industry and the enterprises are considered. For finding the needs, an extensive needs study was executed. The analysis was executed for each country separately and on general. All gathered data are available at the project web-page.

When the preparation of the learning modules will be finished, the modules will transferred to the multi-lingual, multi-functional learning portal with an efficient learning management system. Parallel to the development of the learning modules, also educational methodology for distance in-company training is being developed. To test and further improve developed modules and educational methodology, cross-over training with at least 100 participants will be executed in April-June 2012 in the national languages of the participants and in English. The pilot training participants will be able to put together their own training program by choosing up to three of all available modules, no matter by which participating institution those modules were prepared. Special training will be also delivered to the educators from the companies, responsible for in-company training. In the training they will learn how to execute distance courses and use functionalities of the modern learning management systems.

Further, E-PRAGMATIC international Community of professionals will be established. Within the Community, the information and expertise will be shared between the network's members and other stakeholders. It will support educational activities and cooperation between the industry and educational institutions on all levels.

More about the project can be found on the web page (http://www.e-pragmatic.eu/) and in E-PRAGMATIC Facebook page (http://www.facebook.com/epragmatic).

Table of Contents

1. Project Objectives

E-PRAGMATIC network works toward enhancement, modernization and establishment of in-company training methods of electro-mechanical industry. It introduces distance learning methods and modern learning contents with the remote experiments from mechatronics, general electro-mechanics and alternative technologies directly into industry. For this some e-learning contents and educational methods are currently under development. Developed educational methods will be applicable in in-company training in the enterprises from related fields throughout Europe. Further, E-PRAGMATIC community will be established in the continuation of the project. It will connect partners from industry and education and through this supports and strengthens industry-education cooperation.

The main group, who should profit from the project results are employees, professionals (especially from the older age group) who have completed the formal vocational or higher education in the field of mechanical/electrical engineering but their knowledge in either mechanical or electrical engineering often proves to be insufficient for their current jobs requirement. Further target group are apprentices and the trainees from industrial partners, who have recently acquired a formal education, however are not acquainted with the specialized knowledge and don't have skills required in their company. They will be able to acquire that knowledge by choosing the learning modules that will be developed based on the needs of that specific company.

The project objectives can be on general divided to educational and other objectives, as shown in Figure 1.

Project timeline is shown in Figure 2.

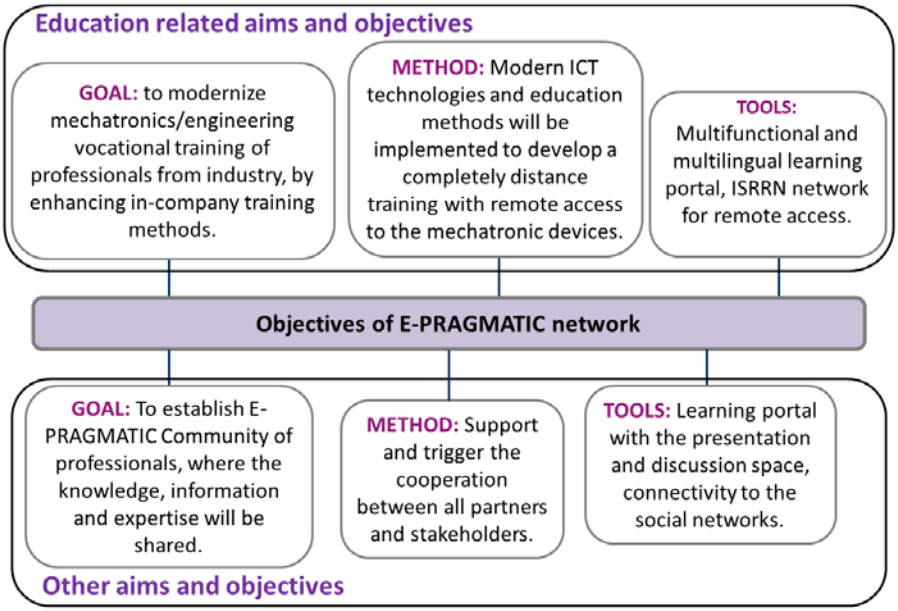


Figure 1. Objectives of the network, general overview

A. Education related objectives

Educational objectives were/will be addressed as follows:

- First an analysis what knowledge is needed by practicing engineers and technicians from the industry was executed. For this e-questionnaires were prepared and promoted, so that relevant number of responses was obtained.
- Development of e-learning contents: 20 learning modules with practical tasks and/or remote experiments are currently under developed. The contents correspond to the knowledge needs analysis. Each educational partner will prepare two industrial learning modules and one learning module from the alternative/emerging technologies.
- Multi language e-learning portal was set up. The portal will serve as a central point for distance education by providing (a) learning e-materials and tools for distance training with remote experiments; (b) space for Community of professionals; (c) connection to social networks such as Facebook and Twitter.
- International cross-over pilot training with at least 100 participants will be executed in April-June 2012. Each participant will be able to choose between all available modules and set hers/his individual training program. The training will be executed simultaneously in the national languages and in English. Training of at least 5 future tutors from industry will be also delivered.

B. Other network objectives

Other objectives were/will be addressed as follows:

- Open international Community of professionals will be established. Its main goal is to enhance training, to support all training related activities and to trigger and support cooperation between the partners from educational institutions and the partners from industry. A lively community will provide space for sharing the knowledge, experience and discuss ideas and will be open to all visitors. Community will be supported by all project partners.
- Developed products will be used in the in-house training of industrial partners and also offered to other enterprises. Commercialization of project products is planned after the project finishes. Development and execution of modules on demand will be offered to all stakeholders.

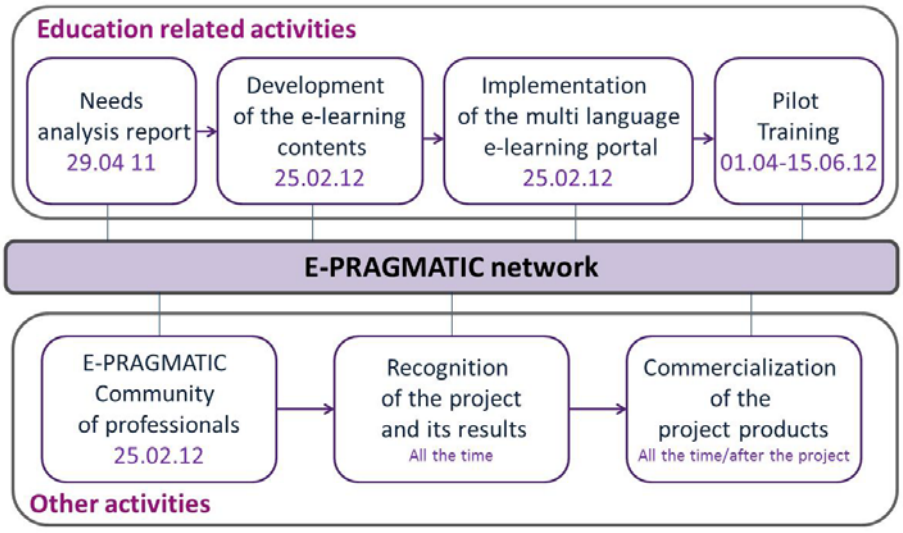


Figure 2. Project timeline

2. Project Approach

In order to achieve the objectives listed and described in the previous section of this report, here described approaches and methodologies are used.

A. Cooperation within E-PRAGMATIC network

As successful reaching of the project goals require a close cooperation of all network members, a cooperation of all partners within the network is especially important. Therefore the networks structure and cooperation levels are described first.

PRAGMATIC network consists of 13 partners and 4 associated partners from 7 European countries and Switzerland. From most of the countries there is one partner from an educational institution and one partner from the industry (a company, a chamber or an association of the companies). Because of the large number of partners it is very important to organise the network, so that it can efficiently achieve its goals.

The network operates at two levels. The closest cooperation is established between the working pairs of partners from the same country. Such working pairs are established in Austria, the Nederland, Poland, Slovenia and in Switzerland and present network's basic units. Each working pair is composed of one educational institution and one industrial partner. Partner from the educational institution develops two training modules, which are especially suited to the needs of his working pair partner.

The second level of cooperation is international, mainly within E-PRAGMATIC Community of professionals and connects network's members and other stakeholders. It will operate within the learning portal. However a provided connectivity to the social networks will facilitate development of the Community also over the borders of the learning portal.

Such organization allows establishing a very strong connection between industrial in educational partners from the same country, while Community facilitates establishing of the international connections. The structure of the network is shown in Figure 3.

B. Analysis of the knowledge needs of professionals employed in electro-mechanical industry

In order to build and enhance in-company training, the needs of the practicing engineers and technicians from industry have to be known. This analysis has been conducted based on the questionnaires' results and includes:

- knowledge needs analysis (what knowledge is required in the companies),
- educational needs analysis, (in which way the knowledge should be delivered),

To obtain necessary data, two e-questionnaires were developed, one for the employees and one for the companies' managements [7]. 285 responses were obtained from the employees and about 50 from the companies' management. Some most important results are described in section 3 (3.Project Outcomes & Results) of this report, while country related reports and general report are available at the project web page [1], on Adam database [3] and partially also discussed at the project Facebook page [2].

By considering the knowledge needs, each educational partner is currently preparing two learning modules for its industrial partner from the same country. The modules are mostly originally prepared in the native language of the country and then translated to English. The learning material include assessed e-test, multimedia elements and, when possible, remote experiments or remote working stations.

C. Education approach

Based on:

(1) the feedback obtained by the questionnaires,

(2) the experience of the educational partners and in-company training experience of industrial partners,

the educational methods will be tested, adapted and further developed during the training. Following concrete educational approaches/methods will be used:

- Before the training each participant will be contacted by the person, who will take care for the training organization in his country. Training flow will be explained and the participants will be put into contact with the mentors of their modules.
- Each participant will be supervised by tracking of his activities in the portal. Mentor will contact the participant in the case that no learning activities will be noted for a longer time or if the participant will spend a long time with studying a particular topic or doing the specific exercise or experiment.
- The participants will send solved exercises and experiments reports to the mentor, who will provide feedback and instructions how to proceed with the module.
- The participants will be encouraged to ask questions, which will be answered by the mentors. Their suggestions will be carefully considered and meet whenever possible. Communication will be mostly through the personal messages; however other communication pathways might be used too.
- A communication with other training participants trough forums and Community (described below) will be encouraged.
- In companies, where in company training already exists, a responsible person will monitor the training and provide additional comments and suggestions concerning development of educational methodology.

On general a very personalized training approach will be used and a lot of effort will be put into establishing the contact and maintaining motivation of the training participants. Here described approach will be further adjusted during the training according to the feedback from participants and from the people responsible for in-company training in the participating companies.

D. Triggering and supporting activities within Community

All project partners will participate in the Community. To facilitate the Community activities following functionalities will be provided:

- space for the presentation of all partners,
- discussion space for all participants,
- discussion space for the training related contents,
- connectivity to the existing networks of the partners,
- connectivity to the social networks such as Facebook and Twitter.

E. Promotion and exploitation of the project results

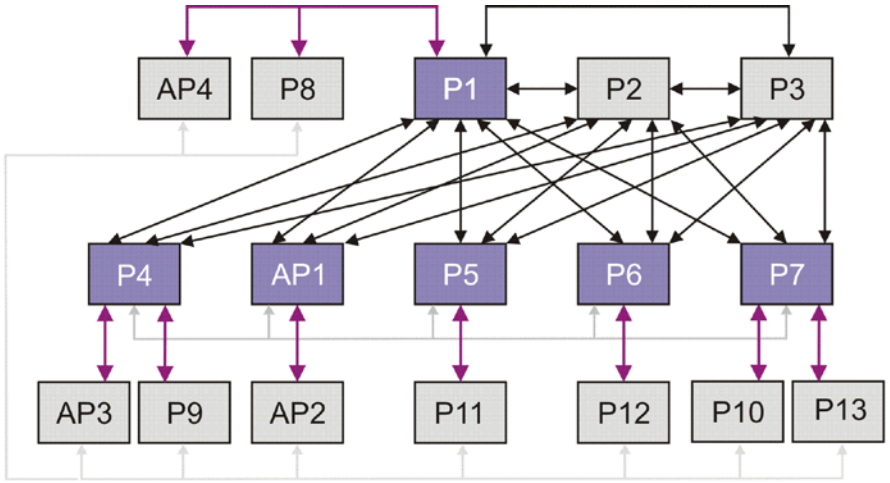
In order to promote project results a number of activities were/are executed by the project partners. Project web-page and Facebook page were established and are regularly updated. Employees and business partners of networks partners are informed through newsletters, e-

mail and by publishing the information about the project on the web-pages of the partners. Promotion material was designed (leaflets and posters) and is distributed. Material can be also downloaded from the web page and printed.

Few promotions at the fairs and exhibitions were already executed. The project and first results were presented at few international conferences (specialised exactly in the topics such as learning at the work place and distance learning) in order to inform other educators. List of publications is available in section 7 (Publications and further project information) of this report.

Developed learning modules will be used by industrial partners for in-company training of their employees. Educational partners will include parts of the developed modules into their regular vocational training in mechatronics/engineering.

Commercialization of project products: After project finishes its products will be partially commercialised in order to maintain the learning portal and remote experiments also after the project lifetime. Execution of modules on demand and development of the modules will be offered.



P1 University of Maribor, FERI, Maribor, Slovenia
P2 B2 EDUCATION AND INFORMATION SERVICES, Ltd., Ljubljana, Slovenia
P3 ECPE – European Center for Power Electronics e.V., Nuremberg, Germany
P4 University of Deusto, Bilbao, Spain
P5 Poznan University of Technology, Poznan, Poland
P6 Carinthia University of Applied Science, Spittal/Drau, Austria
P7 Delft University of Technology, Delft, Netherlands
P8 Obrtno podjetniška zbornica Slovenije, Ljubljana, Slovenia
P9 Elson Electrónica S.A., Zamudio, Spain
P10 Simulation Research, Alphen aan den Rijn, Netherlands
P11 Wielkopolska Chamber of Commerce and Industry, Poznan, Poland
P12 Flowserve (Austria) GmbH Control Valves – Villach Operation, Villach, Austria
P13 EXENDIS b.v., Ede, Netherlands
AP1 Biel Academy of Applied Science, Switzerland
AP2 Siemens, Schweiz AG Industry Automation and Drive Technologies, Zürich, Switzerland
AP3 GAIA, Spain
AP4 National Instruments

Figure 3. Structure of E-PRAGMATIC network

3. Project Outcomes & Results

Currently available outcomes of the project are:

A. Results of the needs analysis;
B. Specification on the learning modules.

Both are addressed in the continuation of this section.

A. Results of the needs analysis

E-PRAGMATIC learning modules and educational methodology is currently under development. The aim is to meet the concrete needs of electro-mechanical industrial sector. E-questionnaires were prepared and executed in order to make a survey concerning those needs between the professionals and trainees/apprentice from enterprises from electro-mechanical industry, especially industrial partners. Two types of questionnaires were prepared and executed:

- Questionnaires for professionals were executed in English, German, Spanish, Polish and Slovene.
- The questionnaires from companies' management were realized in English and Spanish language. Those questionnaires were prepared in order to consider also the needs and development plans of participating companies.

The questionnaires for the employees were divided to 5 sections:

1. General information;
2. Continuing education;
3. Motivation and training organization;
4. Interests;
5. Community needs.

Needs analysis reports which is based on the questionnaires' results can be found on the project web page, in Adam database and (partially) in the publications [7]-[12] listed in the section 7 of this report. In the continuation of this section only most interesting results are presented.

1. General information, general profile of the employees

(1) Education: About 25 % of the participants have secondary education. 41 % have Bachelor degree or technical post-secondary education, 20 % Master's degree and 4% Ph.D. Degree.

(2) Age: 39 % work in their current profession for more than 10 years and 34 % are over 40 years old. 68 % speak also English language. Only 4 % are females.

(3) Companies' activities and profile: Main activity of the company, in which participants are employed, is production 38% and services 22 %. Following fields are represented: electronics 25 %, electricity 20 %, heavy machinery 18 %, automotive industry 15 % and renewable energy 11 %.

2. Continuing education

Few questions were given in order to find out the current state of continuing education, which sources of such education are mostly used and what the attitude toward the distance training is.

(1) Did you ever participate in the in-company training?

72 % answered 'Yes' and 28 % answered 'No'. From those who didn't participate in the training, although it was available, following reason for non-participation were stated: 48 % replied that the organized training was not relevant for their work, 32 % didn't have time and 12 % judged, that continuing education is not required for their work at all. 4 % stated lack of interest and 4 % other reasons.

(2) 'What sources of continuing education do you use?

Vast majority use internet 83 %, 61% use professional journals, 47.6 % participate in the seminars and 47.3 % in the in-company training. 37.6 % participate in the training outside the company, which is paid by the company and more than 20 % in the modules for which they pay alone. Only 2.3 % reported that they don't use any source of continuing education at all. Higher deviations from here stated averages were observed in (1) Germany, where 77 % participate in the in-company training; (2) Switzerland, where 36 % participate in the modules, for which they pay alone; (3) Slovenia, where 85 % read the professional journals and 72 % participate in the seminars.

(3) Did you ever participate in any kind of organized distance training (training conducted totally over internet)?

32.4% replied with 'Yes' and 67.6% with 'No',

(4) Do you think that distance training can be efficient in acquiring of the professional knowledge in your field?

76.4 % replied with 'Yes' and only 23.6 % with 'No'. Higher deviations from the average were observed in Slovenia and the Nederland (94 %, respectively 90 % 'Yes' answers).

(5) Did you ever operate a mechatronic device through internet respectively execute remote experiments?

35.7 % answered 'Yes' and 64.3 % 'No'.

1. Motivation and training organization

With those questions the concrete needs of participants concerning time/length of the training and reason for participating were investigated.

(1) What are your reasons for participation in the continuing education?

29 % participate in the continuing education (also) to obtain new knowledge. 21 % are participating in order be more effective in use of the new tools, about 16 % to improve income and 14 % to get a chance to compete for another, better job. 13 % state as a reason a professional promotion and only 7 % 'To be less likely to use the job'.

(2) Available time for distance training:

On average the participants could devote 6 hours weekly to the training.

2. Interests

A list of 25 training modules was suggested. The participants were asked to rate each module between 0 = not interested and 5 = very interested. Free text answers, where the participants could suggest other training contents, were also possible. On general (overall trough all countries), the highest rated module was “Emerging/alternative technologies: Photovoltaic technology, Wind power, Fuel cell technology, Hybrid drives, Nano-robotics, Nano-materials, etc.”. Three highest rated modules for each participating country are shown in Table I. Also generally very high rated are modules ‘PC based control and measurement’, ‘Power electronics’ and ‘Engineering software: C, MATLAB, LabVIEW’.

Participants were also asked to share any other information that might be helpful at the preparation of the distance industrial training. Most of the answers stressed importance of delivering practical knowledge and using relevant industrial problems as case studies. Few answers:

- Theoretical materials should be supported by the practical examples. Even better it would be if theoretical part is provided according to the needs which origin from the practical problem.
- Theory should be included to such extend which is required to solve practical problems, this means from the problem to the theory and not from a lot of theory to the new problems.
- In case of training each person should be assigned to one experimental setup.

Table: Most requested modules according to the country

Country	**Rank**		
	1	**2**	**3**
Austria	Emerging, alternative technologies	Manufacturing technologies	Material sciences
Germany	Power electronics	Eng. software: C, MATLAB, LabVIEW	Emerging, alternative technologies
Netherland	Power electronics	Emerging, alternative technologies	Microcontrollers and embedded systems
Switzerland	Emerging, alternative technologies	Introduction to Robotics	Fundamentals of mechanical engineering
Spain	Microcontrollers and embedded systems	Eng. software: C, MATLAB, LabVIEW	Emerging, alternative technologies
Poland	Emerging, alternative technologies	PLC Controllers and industrial networks	PC based control and measurement
Slovenia	Emerging, alternative technologies	Applied control theory	PC based measurement and control

3. Community needs

Additionally the needs concerning E-PRAGMATIC Community of professionals were investigated.

The participants were asked 'Which functionalities/services of such community would be interesting to you?' The results show that the highest rated is 'Learn from the challenges of other members', and 'Obtaining information about the companies/products from related fields'.

B. LEARNING MODULES

Based on the results of the needs analysis the contents of the modules were specified. The modules are currently under development however summaries of some of them are already available (given below).

The access to the learning modules and remote experiments will be given when they will be ready to the registered participants. In order to get invitation to be included an e-mail request should be sent to info@e-pragmatic.eu.

List of the learning modules which are under preparation:

Industrial modules: PC based measurement and control; Energy efficiency; Introduction to LabVIEW; PLC controllers and industrial networks; Introduction to microcontrollers and embedded systems; Advanced peripherals with microcontrollers; Robot programming; Material science

Basic modules: Electrical drives; Applied control theory; Introduction to industrial robotics; Electrical circuits, Mechatronic devices

Alternative/emerging technologies modules: Solar electricity; Hybrid drives; Power electronics for electric cars; Charging of the electric cars; Introduction to remote and online engineering; Wheeled mobile robots - practical aspects of control and navigation; Low cost Platform for Providing LAN/WAN Connectivity to Embedded Systems

Summaries of some of the modules

The modules will be available in different languages (Slovenian, Spanish, German, Polish), however each module will be also available in English.

Introduction to microcontrollers

Main objective of this training module is to learn the fundamentals of 8-bit microcontrollers. The module covers generic aspects in relation to the market, architecture, peripherals and development of microcontrollers in recent years and delves into the architecture of the Microchip PIC microcontroller manufacturer, leader in 8-bit devices. This module includes real experiments through a remote laboratory in which students may modify the firmware of a mobile robot controlled by the PIC18F4520 microcontroller.

Material science (German language)

Der Kurs "Hochtemperaturkonstruktion" behandelt im ausgewogenen Verhältnis die werkstoffkundlichen und die konstruktiven Problemstellungen für Bauteile, Systeme und Komponenten welche bei hohen Temperaturen oberhalb der Kriechtemperatur eingesetzt werden.
Im werkstoffkundlichen Teil werden folgende Kapitel behandelt:

- Metallurgie und Stahlkunde für Anwendungen im Normaltemperaturbereich
- Thermisch aktivierte Vorgänge in Metallen
- Werkstoffe und Beschichtungen für die Hochtemperaturtechnik

Im konstruktiven Teil werden folgende Kapitel behandelt:

- Wärmelehre
- Festigkeitslehre

- Dimensionierung von Bauteilen bei hohen Temperaturen

PC based measurement and instrument control I
LabVIEW is well known graphical programming environment used by many engineers and scientists in developing measurement, test, and control applications. In this introduction module you'll become familiar with basic concepts of LabVIEW graphical programming environment. You will learn how to create, edit, and debugging LabVIEW programs, how to use programming structures, arrays, clusters, file I/O functions, and how to perform simple data acquisition. Data acquisition part of this module is realized using custom developed low cost USB data acquisition device. This device is offered to the user as a kit and is available at E-PRAGMATIC online store. The purchase of this kit is not obligatory hence the same kit is available to the users via remote workstation. This remote workstation is located at University of Maribor and contains all the necessary hardware and software components that are required to successfully complete this module.

PC based measurement and instrument control II
The purpose of this module is to teach you the basics of data acquisition (DAQ) and instrument control with LabVIEW. The module contains hands-on exercises with data acquisition and instrument control hardware and teaches you how to use data acquisition and instrument control software functions to build your application. After attending this module, you will be able to use DAQ Assistant and NI-DAQmx API to perform analog and digital acquisition and generation, create measurements with counters, and synchronize the tasks. You will also learn how to programmatically control instruments using Instrument I/O Assistant and Virtual Instrumentation Software Architectures (VISA) API, and how to find and use the instrument drivers. During the module you will use the NI Educational Laboratory Virtual Instrumentation Suite NI ELVIS II+, NI Instrument Simulator V2.0 and High-Performance Ethernet-to-GPIB Controller NI GPIB-ENET/1000.

Advanced peripherals with microcontrollers
The objective of this module is to deepen the concepts of the 8-bit microcontrollers through advanced peripherals. Resources such as timers, analog-digital converter and pulse-width modulator will be described in this module. The module includes real experiments through a remote laboratory using the PIC18F4520 microcontroller.

Introduction to industrial robotics
Although choosing and programming of industrial robots appears to be a pretentious task, it can be learned quite fast. This module gives a necessary basic expertise for this. Furthermore, it also gives a solid knowledge base, which allows additional self-study and, consequently, planning and programming of more complex industrial robot applications.
After short introduction to the general robotics, the module concentrates on the practical aspects of industrial robotics. Most common industrial applications are presented, main characteristics of industrial robots are explained, and guidelines, how to choose a suitable robot for a specific application, are discussed. Next, the basics of robot programming are given. One of the modern robot programming languages is presented in detail. Practical exercises, which are the most important part of this module, include choosing suitable robot for the specific application and writing of the robot programs for grinding and palletizing.

Electrical circuits
In the module first the fundamental elements of electrical circuits as well as operational amplifiers are presented. Frequency characteristics and its graphical presentation in form of Bode plot is discussed next. Further filters are presented in the details as one of frequently used electrical circuits in the mechatronics. Emphasis is put on the passive and active low-pass, high-pass and band pass filters. Switched capacitor filters and digital filters are also described. Basic operating principles and frequency characteristics of the filters are studied trough the remote experiments executed on the switched capacitor filters.

Mechatronic devices

In the module, the structure and operation principles of complex mechatronic devices are going to be described. First, mechanical elements, such as gears, belts and joints, are going to be considered. As a simple mechatronic device and building block for more complex devices, a joint drive system is presented. Next, it is going to be shown how joint drives are used to build a robot. The operation principles of the robots are explained in the case study. Finally, the real world problems in the control of complex mechatronic devices are demonstrated by executing the remote experiments with the SCARA robot.

Charging of electric vehicles

The module main topics are dynamics, energy storage systems and charging of electric vehicles. Also some general information concerning electric vehicles is provided and few other relevant issues are discussed.

First, the history, current state and trends in the development of electric vehicles are presented. Then a general dynamic model of vehicle is derived and explained. By using dynamic model the capacity of the required vehicle's energy storage system can be estimated and the vehicle's energy consumption for different driving conditions can be calculated..

Next, the energy storage systems are discussed including Lithium-Ion batteries and super-capacitors. Charging methods and underlying issues are presented. In a case study, a promising methodology for an inductive charging of electric vehicles is presented. Simulation and experimental results are given and discussed.

Hybrid drives

Electrical hybrid vehicles are one of the approaches toward more efficient utilization of fossil fuels respectively toward lowering fuel needs. In the module first the basic operation principle, possible configurations and components of hybrid drives are given. Further lithium batteries and super-capacitors as energy storage systems are described. Then the basic principles of energy flow control methods are presented. Finally a commercial hybrid vehicle is described and its performances are compared to those of the conventional vehicle.

Low cost Platform for Providing LAN/WAN Connectivity to Embedded Systems

Local area network connectivity has become a primary objective in the design of embedded systems. Most industrial facilities, not to mention other buildings, have a deployed local area network that facilitates the installation of new systems without requiring new communication infrastructures. In addition the use of communication standards guarantees the reliability of data transmission and allows the access to the system from different platforms ensuring interoperability. Besides, if the network is connected to the Internet embedded system can be remotely controlled or monitored from anywhere in the world.

Until recently, commercial modules for adding embedded systems connectivity to a LAN were complicated, expensive and demanded to add a large number of materials to the design that caused an increase in hardware size and made it difficult to supply. The proposed learning module reviews the operation of the TCP / IP stack provided for free by the MCU maker Microchip Technology©, which has been able to integrate into a single-chip device a high performance microprocessor and Ethernet controller breaking all the barriers mentioned above. This stack is compatible with the 8, 16 and 32 bits Microchip MCUs allowing access to a local area network using the IEEE802.3 (Ethernet) or IEE802.11 (WiFi).

This module includes access to a remote laboratory based on the 18F97J60 PIC microcontroller that will enable learners to experiment with all the theoretical concepts covered and build an application that allows remote monitor and control the environmental conditions of an intelligent building.

4. Partnerships

The network consists of 13 partners and 4 associated partners from 7 European countries including Austria, Germany, Poland, Slovenia, Spain, Switzerland and the Netherlands. The structure of network is shown in Figure 3 at page 16 of this report.

Profile of the project partners: six educational institutions; four SME enterprises; three large enterprises; one Chamber of commerce and industry; one Chamber of Craft and Small Business; an association which includes about 170 companies, mostly SME from relevant field and association whose network comprises 40 member companies and 53 European universities and research institutes.

Such consortium, composed of a variety of participants with different resources and wide network of contact, enables the network to address specific objectives of the network which require close cooperation of the educational institutions and industrial partners. From most of the participating countries there is one educational partner and one industrial partner. Those two partners work in a close cooperation and are therefore more efficient in addressing the project objectives, as the circumstances and needs differ from the country to the country.

From viewpoint of achieving the objectives of the project the participation of the Slovenia, Austria and in Spain is especially important. In those three countries the participation rate in the job related non-formal education for older age group is much below the EU average (EUROSTAT). This problem is specifically addressed in the project, therefore the project might improve the situation in those three countries.

Since 7 European countries are included in the project, it can be expected that some of the project results will be more generally applicable, as they would be in smaller partnership. For example the knowledge needs analysis (needs of knowledge an skills of professionals form industry) could be executed first locally in each country and then general conclusions could be drawn based on the merged results.

Partnership is still open for new associated partners, who are interested in joining the network’s activities.

5. Plans for the Future

Also future activities of E-PRAGMATIC network can be divided into education related activities and other activities.

Education related activities

The main future (and already currently running) activity is preparation of the learning modules. The modules can be divided into three groups:

- industrial modules, which deliver the knowledge requested specially by the industrial partners;
- basic modules which deliver the knowledge from basics of mechatronics;
- modules from alternative/emerging technology, with the stress on the modules from sustainable energy field.

The learning materials include: (1) lot of hypermedia elements (multimedia capable of the interactions with user); (2) the didactic parts that are short quizzes with instant feedback and scored questionnaires; (3) the real-time experiments (contextual multimedia parts that offer the learner practical experience) and (4) available free external tools, connection to the external social networks as Facebook and Twitter. The materials will be prepared by the educational partners, however industrial partners will provide continuous feedback also during the development.

To evaluate developed training contents and methods, a cross-over pilot training will be executed in April-June 2012. The training will be executed completely via internet. Each training participant will be able to set his own training program by choosing any of the available modules. There will be at least 100 training participants included, who will be able to choose the modules of their interest and put together their individual training program. The pilot training will be free for all participants. Invitations for the pilot training will be sent to the employees of our industrial members as well as also to other individuals, who are interested to participate in the training. The training will be executed under supervision of tutors from educational institutions, who are mostly also the authors of the learning materials.

After finishing the training the participants will be asked to provide feedback on training quality by answering e-questionnaires. By considering this feedback, the guidelines for further development and implementation of the developed educational methodology, specifications and learning contents for e-learning in the industry (in-company trainings) will be set. These guidelines will be applicable to distance education of the professionals from electro-mechanical and related field.

Other activities

Open international Community will be integrated with the learning portal in order to enhance learning and ease cooperation between the partners from educational institutions, the partners from industry and other stakeholders. The main goal here is to support a lively community of all participants and provide space for sharing knowledge, experience and discuss ideas. The Community will be open to all visitors. Active participation will require signing in, which will be free of charge and accessible to all stakeholders. Space for presentation of involved partners will be provided.

Community will be opened with end of February 2012.

6. Contribution to EU policies

The European researches have shown that technological 'hybridisation', where electronics and mechanics are joined in the new interdisciplinary field mechatronics, is between the structural drivers of change in the electro-mechanical industry (EU report: New Skills and New Jobs, Skills in Electromechanical Engineering Sector, April 2009). However, a market demand in the most European countries exceeds the number of formally educated professionals. As a consequence, the jobs that would call for experts in mechatronics are often occupied by the experts in the mechanical or electrical engineering, who do not have the appropriate education. E-PRAGMATIC training will deliver mechatronics knowledge directly to enterprises, respectively to the practicing technician and engineers.

Another important challenge in the European labour market is the education of adult professionals, especially the older ones, who are employed in those fields with a fast technological progress. Data shows, that the percentage of labour force with a medium qualification level until 2020, can increase for 36 % for the age group 55-59 and even for 62 % for the age group 60-64 (CEDEFOP, Future skills supply in Europe, Medium-term forecast up to 2020). Older workforce will need an additional education to keep up with the increasing demands of their jobs. However, the participation of adults in the education/training has reached the peak in 2005, and slightly decreased to 9.6 % between 2005 and 2008. As a consequence, it seems that the EU 2010 target, of 12.5 % of participation of the adult working force in the education and training, will not be achieved (CEDEFOP as above). This is especially the case in three participating countries (Slovenia, Austria and in Spain), where the participation rate in the job related non-formal education, for age group 55-64, is much below the EU average (49.9 %, 58.3 %, 56.9 % versus the average 70.7 %). E-PRAGMATIC training specially addresses older workforce group.

E-PRAGMATIC network enhances and modernizes in-company training in industry by incorporation of the contents and functionalities available within advanced learning platform and by utilization of distance learning methods. With these modern, flexible methods of knowledge delivery by using potentials of information and communications technology (ICT) will be introduced directly to industry. Herby one on the basic European educational challenges (The Bruges Communiqué on enhanced European Cooperation in Vocational Education and Training) is addressed. Further also the challenge of easily accessible and career-oriented continuing VET (C-VET) for employees is addressed (The Bruges Communiqué).

Educational institutions will directly cooperate with enterprise(s)/associations from their country by analysing current needs, preparing of learning modules according to their needs and by executing pilot training. International cooperation between the enterprises and educational institutions will be achieved through support of open Community of professionals, which will be integrated into learning portal and where all actors will be involved in discussing professional and business topics. Community will be open to all other stakeholders too.

The goals of E-PRAGMATIC network are also aimed directly to following challenges from 'New skills for new jobs': (1) Achieving better match between skills and labour market needs. Here part of learning contents and teaching methods will be developed based on needs of specific companies. (2) Meeting the demand for increasing and adapting skills of ageing workforce. Developed training methods will be time and place independent and can be easy incorporated in everyday life. Basic knowledge and specialized contents and individualized training will be suitable also to upgrade skills of older workforce.

7. Publications and further project information

Some further information about the project and results obtained up top now are available here:

[1] Project webpage: http://www.e-pragmatic.eu/

[2] Project Facebook page: http://www.facebook.com/epragmatic

[3] Adam database: http://www.adam-europe.eu/adam/project/view.htm?prj=6714&page=1

[4] J. Škrlec, A. Rojko, "OZS industrijski partner mednarodnega projekta E-PRAGMATIC", Avtomatika, Vol. 102, pp. 11-13, 2010 (in Slovene language).

[5] A. Rojko, "Izobraževanje iz mehatronike in alternativnih tehnologij namenjeno strokovnjakom iz industrije.", IRT3000, vol. 29, pp. 26-28, 2010 (in Slovene language).

[6] J. Škrlec, "OZS industrijski partner mednarodnega projekta E-PRAGMATIC", Ventil, Iss.6, pp. 509, 2010 (In Slovene language).

[7] A. Rojko, A. Pester, K. Jezernik, "International E-PRAGMATIC network for adult engineering education ", IEEE Global Engineering Education Conference (EDUCON), Amman, Jordan, pp. 34-39, 2011.

[8] A. Pester, A. Rojko, C. Maier, ″Distance training of Mechatronics and Alternative technologies in European industry″, International conference on e-learning on workplace, ICELW, 2011.

[9] K. Jezernik, A. Rojko, M. Španer, D. Hercog, ″Izobraževanje iz mehatronike in alternativnih tehnologij za strokovnjake iz elektro-mehanske industrije E-PRAGMATIC″, Elektrotehniška in računalniška konferenca, ERK 2011 (in Slovene language).

[10] A. Rojko, D. Hercog, K. Jezernik, ″Knowledge needs based online training for employees in electro-mechanical industry″, International Conference on Remote Engineering and Virtual Instrumentation REV 2011 - Remote Engineering & Virtual Instrumentation, pp. 1-6., 2011

[11] A. Rojko, D. Hercog, K. Jezernik, ″Distance mechatronics and alternative technologies training for practicing engineers and technicians ″, ICELIE (IECON) International Conference on E-Learning in Industrial Electronics , 2011.

[12] S. Chopra, P. Bauer, ″Distance Laboratory for Teaching Electrical Characteristics Measurement and Maximum Power Point Tracking of a Photovoltaic Module″, IECON 37th Annual Conference of the IEEE Industrial Electronics Society, 2011.

[13] A. Rojko, T. Zürcher, D. Hercog, R. Stebler, "Implementation of remote laboratories for industrial education" book chapter in the book Azad, Abul K.M., Michael E. Auer and V. Judson Harward. "Internet Accessible Remote Laboratories: Scalable E-Learning Tools for Engineering and Science Disciplines." IGI Global, 2012. 0-462. Web. 28 Oct. 2011. doi:10.4018/978-1-61350-186-3.