CREATING THE WEB-BASED COURSES FOR CONTROL ENGINEERING EDUCATION

Viktoriya Voropayeva, Alexander Sarichev
Donetsk National Technical University, Donetsk
Automatic and Telecommunications Department
E-mail: vita@fcita.dn.ua

Abstract:

Viktoriya Voropayeva. Creating the WEB-based courses for control engineering education. The main purpose of this paper is to inform about the activities within Donetsk National Technical University in the area of implications of IT for control engineering education. There are discussing problems using Web-based learning environment by students of technical specialties and creating virtual laboratories. There are proposed some approaches to virtual laboratory organization. There are described principles, structure and main facilities of intelligent computer-assisted instruction system.

WEB-based learning environment advantages

This article discusses the evaluation of the creating and implementation of a Web-based learning environment (WLE) at universities and other educational institutions of the Ukraine. The development and integration of WLE is demanding significant resources and meeting different problems.

But a lot of advantages and some good examples of WLE implementation gives a hope that Ukraine could join to the world information community.

Last time Internet has come in all spheres of our life – job, entertainments, banking, shopping, medicine and the last but not least – education. Using of the modern computer, information and telecommunication technologies, first of all – Internet, is the most perspective direction of educational system development. Web-based learning environment (WLE) as a base of distance education is a friend means for studying especially for continuing and life-long learning. It provide a lot of advantages to its customers (students). Here are some thoughts on studying on-line:

- Studying is easy.
- I learn as I surf.
- All of the study material is in the network.
- Access in any time.
- Personal involvement and motivation.
- Real life skills development.
- Flexible schedule.

The realization of all these advantages is ensured with different soft applications – special e-learning platform or specialized facilities.

A big list of e-learning platform is known. The most popular are: WebCT (University of British Colombia), BlackBoard, Learning Space (IBM), ToolBook (Asymetrix), Prometheus. Some of them (WebCT, BlackBoard, Learning Space) are integrated tools and provide learners with all the facilities and learning opportunities they would experience in a face-to-face teaching situation.

Besides these platforms allow the teacher easily to add a new course material (including image, sound files, movie clips, documents and files in HTML format) or to remove an old one, to use glossary, quiz, external links, personal annotations, calendar tool and bookmarks, to make individual or group assignments, to set up group of students and assign specific course material to students group, to grade student's work, to and maintain different types of communication: on-line

(chat) and off-line (forum, e-mail), to organize collaborative work through supporting group interaction in on-line and off-line discussions and data sharing, to attract experts and so on.

As with most online courses, another advantage in utilizing Internet-based technologies is the ability to offer programs and activities at any time and any place. Programs and activities are available to a more diverse range of instructors (graduate assistants, adjuncts, part-time faculty, junior and senior level faculty), covering a broad array of topics, and addressing different teaching and learning styles. As with students, not all faculty and staff have the same needs or learning styles at a given point in time.

The main applications of WEB-based learning environment in Ukraine

Thus, web-based learning environment has significant advantages. As result of deep understanding of importance these advantages in conditions of emerging new technologies, many organizations, companies and foundations in Ukraine have started different programs and projects on development of educational programs and training courses oriented on wide dissemination of the new knowledge and creation of critical mass of specialists for sustainable development of new technologies. That is why a lot of known and large Ukrainian universities and other study institutions apply WLE platforms in educational process for distant learning mostly. There are such institutions:

- National Technical University of Ukraine "Kiev Polytechnic Institute" (KPI);
- Kiev University;
- National University "Kiev Mohyla Academy";
- University "Lviv Polytechnica";
- Kharkiv Polytechnic University;
- Odessa Polytechnic University.

Special project on development of distance learning model for training on Internet Technologies and Services is supported by UNESCO (*http://www.dlab.kiev.ua/cop.htm*). Three projects with strict orientation on education and training in Internet related technologies are funded now in the fame of IRF Internet promotion programs. The projects are regionally located in Kiev, Kiev Polytechnic Institute, Kharkiv, Kharkiv Polytechnic Institute and Lviv, Institute for Condensed Matter Physics.

A good example of a broad range of programs and activities designed on WBE to support distance learning at all levels (graduate, postgraduate, corporative training) but in contexts most of all Business Management is Ukrainian Distance Learning (UDL) System http://www.udl.org.ua. Having begun in December 1999 with administrating of the International project "Distance Learning in the Field of Business Management and IT Management" in Ukraine, implemented in partnership with Loyola College, USA, now UDL preparing and leading different distance learning courses, organizing and conducting Internet conferences and on-line discussions between educational institutions and business organizations from various regions of Ukraine concerning the distance learning development.

As a baseline soft UDL uses WebCT. There are a big list of e-learning courses and some independent projects on the basis of UDL:

- e-learning platform of Kyiv-Mohila Business School;
- distance-module form of MBA in Lviv Institute of Management;
- training program for the Regional center for professional development of Lviv Banking Institute;
- inter-institutional educational program "Business Start-Up"

Many recent educational researches [1] demonstrate that more often distant educational complexes apply for teaching to humanitarian, computer (programming) or natural sciences. This can be explain by nature of educational materials (text files with some pictures) and educational process (reading the theoretic material, answering on test questions, discussing some problem, fulfilling individual or group project).

A list of courses any Ukrainian institution that deals with e-learning confirms this thesis: "Firm Start-up and Business Management", "Manager's Tactics", "Customer Service Management", "Business Plan Development", "Sales Management", "Business Idea and Business Opportunity Valuation", "Business Start-Up".

For these courses effective communication is very important and most of all next online communication methods are used during courses delivery:

- ask an expert - after analysis of an theoretical material is useful to have the experts online for the students questions;
- seminars; time limited for 1-2 weeks for one theme - tutor runs the discussion;
- team presentations - researching, reporting and posting a paper online, comments from other members of the teams and from the instructor (tutor);
- debates, debating teams - allow learners to deepen their analytical and communication skills;
- role plays and simulations - can be used also for engineering education.

An important role in e-learning teaching (especially in running online communications) belong to tutor. The duty of a tutor is to offer guidance and to make sure that the studies proceed as planned. He or she is not a teacher in the traditional sense. The tutor is not the only one responsible for the functioning of the group, but each member is responsible for his or her own learning as well as for the group. The tutor is also a channel of communication between the students and the school. He or she is the leader of the study group and also responsible for the following duties:

- getting acquainted with the subject of the course
- planning the work of the study group and
- giving individual guidance to students.

The newest technology also enables the construction of a tutorial network in which everyone involved in the process can give student support. This includes other students, tutors, guidance counselors as well as teachers. The network flexibly enables both individual tutoring (e.g. private near) and group tutoring (on-line conferences, forums, electric mailing list, telephone).

Existing problems WLE introduction in Ukraine

The introduction of web-based learning environment in Ukraine and particular in Donetsk National Technical University is faced with number of problems caused by technical, organizational, methodological, legal and funding reasons. Some of them can be discussed more detailed.

Technical problems include low speed of existing Internet links that demands special buffering and mirroring of the main popular information resources at educational server to avoid unnecessary traffic via very slow external link of Campus network. Another technical problem is absent or lack of special equipment for traffic separation between different segments of departmental LAN and efficient students' account access management.

Severe problem for Ukraine is the absence of a sufficient amount of computers at schools, universities, house at the potential users. For a solution of this problem the determined operating is undertaken. So, in Donetsk within the framework of the program "Distance Education" the corporation AMI in 2002 arranged with computer classes 15 schools. But this is only a first step on a long way to introduction of computer based technologies in secondary and high school.

Methodological problems include first of all lack of experience of creating and teaching of modern courses, based on web-based learning environment, absent of instructional materials and handbooks on Russian or Ukrainian languages and a small number of tutors with practical experience that can cover all items of prospective curriculum.

Legal problems are connected to absence of statutory base of distance education in Ukraine. The applicable laws are designed and discussed now. In result demand for such services especially in high education yet is not formed.

Funding problems including shortage and lack of necessary funding for proper implementation of modern e-learning platform and creation WLE educational project. One of way of a solution of this problem - looking up of funds or grants, which one could financed these expenditures. For example UDL system was organized with support of International Renaissance Foundation.

Besides, at present moment Ukraine has not Academic and Research networking infrastructure integrated into Internet that could serve non-commercial users from Educational, Academic and Research communities. As well as there is not defined state policy and coordinating Program on development of Academic and Research networks and distance learning in Ukraine. But is now considered by all interested faces.

In a consequent of all these problems the introduction of distance learning systems at the Donetsk National Technical University is bounded while to electronic lecture and books on the university site.

Approaches to virtual laboratory organization

As was noted earlier, the basic application WLE courses discover in humanitarian, management and economical education.

For engineering education (and particular control education) the technical training of the specialist has the large value. But called e-learning platforms have no built-in possibilities for support of a removed laboratory practical work. So own software production or existing software choice for control education purposes is the relevant problem for technical universities.

It is possible to offer some approaches to virtual laboratory organization:

1. Simulation of physic processes. This approach is suitable for such courses of control engineering education as classical and modern control theory, identification, mathematic modeling, CAD system, etc. For these purposes can be used standard soft applications (such as MathLab).

2. Removed control by experiment. This approach is suitable for courses of mechanical, electrical or chemical states measurement, system automation and control and others.

According to fulfilled researching [3], there is an interaction between the development of distant educational complexes in Ukraine and the development of the telecommunication means. The structure of the distant educational complex or of the learning space is the scheme of the students' links with tutors and the methodical complex with the environment support.

From the viewpoint of the distant space model, the conception of the communication environment is one of the key concepts in the scheme of distant education.

Communication environment and the technical efficiency of the educational and methodical complexes can be described by parameters of system network recourses, such as productivity (the possibility of the simultaneous service of the number of users given), reliability (the stability and the stableness concerning physical interfaces) and the speed of the data exchange and the service of the clients' users platform of students and tutors.

The second approach to virtual laboratory organization (removed control by experiment) demands on real-time connection. Certainly it provides higher requests to network recourses, especially to the speed of the data exchange. Practically it cannot be realized at existing telecommunication infrastructure (in sense of junction network) in Ukraine.

That is why, using of simulation is more suitable for called purposes. Depending on speed of users' information bearer channels it is possible to select:

- on-line mode, which based on client-server technology and realized through CGI-scripts, JAVA-scripts, JAVA-applets or GUI (Graphic User Interface) objects;
- off-line mode with using any mail protocol for delivering laboratory task and results.

On-line mode allows to make interactive modeling and simulation and to correct simulation process according to a students level of understanding. Good example of these approach realization can be laboratory works on courses "Electronics", "Electrodynamics" and "Fundamentals of a television" in the Russian state institute of opened education of Ministry of education of Russian Federation (www.do.sssu.ru/rcdo/labor/lab.shtml). Here are used on-line and off-line mode for imitation simulation of physical processes.

Intelligent computer-assisted instruction system

The educational potential of computer based technologies is wide-ranging. The introduction of WLE can not only deliver interesting materials at a distance, but enable students to explore and interact in ways which exploit visualization and constructive modes of learning. Enabling computer based systems not only to manage student interactions, but also to interpret and support differences in learning paths and styles, allows them to accommodate more effectively a wider range of student experience and preferences.

Such intelligent teaching systems include:

- content that can be used adaptively with different learners;
- appropriate learning resources with different user profiles and navigation rules;
- assessment items directed at the specific competencies of users;
- personal value system;
- personalized access and management of the learning materials.

The most of an intelligent computer-assisted instruction (CAI) system, that utilizes the Internet, use on-line mode. Individuals using the World Wide Web (WWW) can access a multimedia CAI service that is geared to meeting their own needs. A CAI process running on the server takes care of each individual on the WWW client, adjusting the contents and pace of learning based on their progress and preferences.

Nakabayashi [4] pointed that using multimedia viewer control mechanism in intelligent tutoring system CALAT teacher can support interactive simulation environment. Naturally, CALAT is not alone CAI system. But all of them have a high price and require a good quality information bearer channels.

For the development of a such system it is essential to engage persons with different expertise such as end-users, pedagogues and software developers in different fields (Virtual Reality, databases, computer networks, intelligent agents, on-line text translation, etc.). According to Goransson [2], an iterative and incremental development process specifies continuous iterations of design solutions together with users. An iteration includes:

- a proper analysis of the user requirements and the context of use,
- a prototype design phase,
- a documented evaluation of the usability of the prototype.

The first iteration is the prototype design in order to ensure early user feedback about the application. The output of the second iteration will be developed within two phases. These phases will have as results two intermediate versions of the system – open and functional prototypes.

Open Prototype: This version of the system is the first intermediate system, which integrates basic functionality that can be used in order to support collaborative e-learning services. This functionality could be text chat, application sharing, users' representation and simple user-system interaction through intelligent agents that provide help for the system usage. The creation of the

open prototype is necessary, because it will act as the basis for the end-user evaluation, which is focused on "how the users can learn using a WBE". The results of this evaluation will be used in order to produce the second intermediate system (Functional Prototype), in which specific e-learning scenarios will be realized.

Functional Prototype: This version of the system is the second intermediate system which will provide full functionality in order to realize collaborative and tutor-centered e-learning scenarios. This prototype will be the basis for end-user evaluation, which is focused on the real usage of the system, according to specific e-learning scenarios.

The final version of the system integrates the necessary changes according to end-user evaluation. This version of the system will be evaluated by end-users and experts in order to prove the market potentiality of the system.

Usability engineering starts with the assessment of user-requirements and from that the deviation of system specification. This step guides the technical development and is not at all technically d riven. T he usability e valuation f ollows a f ormative a pproach b y a ssessing p roblems and end-user-requirements with the existing system. However, the results of the evaluation indicate directions for further improvements of the design and the technical development. In each phase new functionality will be added to the system according to the users' demand. Each phase of the previously described system development process is very critical for the successful production of a user-centered system.

Conclusion

In this paper I h ave attempted to inform a bout the activities within Ukraine in the area of implications WLE and to discuss problems of Distance learning. There are discussing problems using Web-based learning environment by students of technical specialties and creating virtual laboratories. There are proposed some approaches to virtual laboratory organization. There are described principles, structure and main facilities of intelligent computer-assisted instruction system.

References

1. Antonyuk J.M. (2001) Problems of distant educational complex system support. In *Telematic and Life-Long Learning, International Workshop TLLL-2001*, Kiev, 2001
2. Goransson, B. (2001). Usability Design: A Framewotk for Designing Usable Interactive Systems in Practice. *IT Licentiate theses 2001-06*, ISSN 1404-3203, Department of Human Computer Interaction, Information Technology, Uppsala University, Uppsala, Sweden.
3. Lobachev S.L., Popov A.V. and Semenichin I.N. (2001) Internet-technologies in distant and opened education. In *Educational Technology & Society 4(2) 2001 ISSN 1436-4522 pp. 194-204*
4. Nakabayashi, Maruyama, Koike, Fukuhara and Nakamura, Y., (1996). An intelligent tutoring system on the WWW supporting interactive simulation environment with a multimedia viewer control mechanism. In *Proceedings of the WebNet 96.*