Adaptive Web Based Modular System for Distance Learning with Web Service

ZLATKO ĆOVIĆ  
Department of Informatics, Polytechnical Engineering College  
Marka Oreškovića 16, 24000 Subotica  
SERBIA  
chole@vts.su.ac.rs, prowebing@gmail.com  

BILJANA RADULOVIĆ  
Department of Informatics, Technical Faculty Mihajlo Pupin  
Dure Dakovića BB, 23000 Zrenjanin  
SERBIA  
bradulov@tf.zr.ac.yu, bradulov@ptt.rs  

VANJA VOSKRESENSKI  
Department of methodology of science and technology in education,  
Technical Faculty Mihajlo Pupin  
Dure Dakovića BB, 23000 Zrenjanin  
SERBIA  
KOSTA VOSKRESENSKI  

Abstract: - This paper presents the development of adaptive web based modular system for the needs of distance learning. The capabilities of this system and development phases of the new version of system are described. This web system is developed by the use of the following techniques: XHTML, CSS, JavaScript, PHP, AJAX, MySQL, XML and Python. XML-RPC web service will be realized to make better communication with the new desktop application and teaching system. The information system will be available at the following web address: www.webprofa.com.

Key-Words: - adaptive, php, xml, distance learning, web, internet, self-testing, web service

1 Introduction
The growth of the Internet has brought on great changes in business and communication between people. With the use of the Internet distances are diminishing and everything is accessible to everyone. E-learning can be defined as instructional content or method of learning by use of electronic technology. It can be realized through storing and distributing education material on CD-ROMs, IBT (Internet Based Training) and CBT (Computer Based Training).

This paper presents the development of personalized web based modular information system for the needs of distance learning. The first part of the paper describes the reasons why distance learning is so important. The second part describes the existing system and its possibilities. The next part gives information of improvement of system. After that used techniques are described shortly and expected results of future system are listed in the last section.

2 E-learning and distance learning
E-learning can be defined as instructional content or method of learning by use of electronic technology. It can be realized through storing and distributing education material on CD-ROMs, IBT (Internet Based Training) and CBT (Computer Based Training).

Distance learning is an integral part of e-learning, it allows present-day students to acquire an education without having to move out of their offices or away from their home computers. Communication is achieved by way of an electronic teacher, and in specific cases there is a possibility for real-time communication to take place. The
electronic teacher is an application hosted on the web server. It contains a number of questions to which the student sends their answers. Communication happens via the student’s web browser.

2.1 Why is e-learning important?
Everyday people are faced with the inefficiencies of the teaching process. In the region where we live and work there is a need to be competent in information technologies and to be prepared to accept innovations. A number of colleges and schools still use a classic way of teaching. One of the students’ problems arising during their studies is that, when they have a question for the teacher, often the teacher is not at hand. In such cases the solution may be to refer to the teacher via e-mail, but if the answer is needed immediately, this is not the optimal solution.

Because of the isolation, war and economic crisis of the past decades Serbia has yet to catch up with the developed world from a technological aspect. The country is also lagging behind in informatics literacy and in the sphere of mass usage of information-communication technologies and in education.

Further there are other problems mentioned which are global or characteristic for our country pinpoint the need for a wider number of steady scientific researches, as this one and similar to them. Knowledge becomes the biggest value of a society and also a key resource, whose exploitation brings economic and cultural prosperity. Because of that the aim of this society shall be to create a social environment whose system of values are established on knowledge and innovations.

For need of further researches pinpoints and more social requests. The creation of modern universities with recent learning medias is a good precondition for creating experts. The students of this country would be more motivated and stimulated for further learning if the country invested more in the development of educational techniques. On the other side, the great popularity of web based systems would force telecommunication companies to heddle high bandwidth internet connections on the territory of the whole country. This type of connection will enable the production of upper services of e-learning in the way of use different multimedia contents.

For accomplishing this aims there is a need to route attention on the need of distribution informatics literacy as a supposition for successful development.

The present time poses a demand for new serious scientific researches which will help us achieve the requirements of our time. The development of web service which is described in this paper is one small step to that tendency.

At the Polytechnical Engineering College a similar problem as described above had occurred. With the subject ‘Internet Technologies’ the need arose to supply the students with a quality service, accessible at all times for questions, testing and preparation for the exam.

3 Description of existing system
The staff of this college have been using a specific type of e-learning web services for more than 5 years. In our case we are using the originally product that has been developed and implemented by our own team. After 5 years of application there is a need for improving this system.

3.1 Functionality of existing system
The goal of the system is to enable students to learn, practice and test their knowledge of Internet technologies outside the classes, at home by using the Internet. The possibilities include reading the topics, analyzing the examples and program codes, practice their obtained skills using the online editor and testing themselves.

![Fig.1](image)

3.1.1 Test as an instrument of knowledge checking
Tests are one of the most frequently used instruments for knowledge checking. In distance learning the test is the dominant, and often the only instrument of knowledge assessment.
Rules for writing tasks in the tests are as follows:
• grammatically correct, clear, well-known and precise words,
• to avoid ambiguous questions, suggestiveness and traps,
• to avoid the formulation of the textbooks and stereotypical phrases, short sentences, questions,
• adjust the level of difficulty to that group,
• to avoid answers that overlap,
• the correct responsible not should be always the same.

One of the main features of our system is testing. The system provides two kinds of test. The first is the so-called entry test (Fig.1), and the second the real test. The first test contains 6 questions and the user has 60 seconds to answer them. The questions are true / false tasks. After having finished the test, the system checks how many correct answers that user has achieved and based on that it determines the level of the candidate’s knowledge. If the user has achieved less than two correct answers he cannot continue to the real test. If the number of correct answers is between 2 and 4 user’s level is intermediate. The advanced level is granted for 5 or 6 correct answers. The user has the possibility to re-take the entry test [2].

Our system takes an adaptive approach to the creation of tests. The system generates random questions for every test. The real test is a multiple-choice test consisting of 20 questions. The questions have the same level of difficulty as student’s knowledge level. The user is given 45 seconds for every question. They choose between offered answers. The number of answers ranges from two or four. Each question has one or more correct answers.

After the last question is finished, the system generates a report of the test success. To pass the test successfully, it is necessary to give correct answer for 70% of questions. In case the user failed the test, system shows the list of lessons where the correct answers can be found (Fig.2).

The system follows and archives all tests that every user had. Every user can look at his archive which shows the date of testing, the number of correct and incorrect answers and the percentage of effectiveness.

3.2 Improvement of existing system
At the end of the semester, additional students interviewing was carried out.

To the question "Would you use e-learning services in further education?" the students said the following:
Yes 83%
No 17%

To the question "Would you use e-learning services in combination with the traditional way of learning?," students said the following:
Yes 72%
No 28%

To the question "Would you have used only traditional way of learning?," students said the following:
Yes 17%
No 83%

These answers give great contribution to the daily use of e-learning service in the teaching process.
• higher level of interactivity (4%)
• remove the pop-up window (5%)
• more practical examples (6%)
• search based on keywords (7%)
• changes in service design (9%)
• providing comments and rating (11%)
• inserting the key words for each lesson (14%)
• use of video materials (tutorials) within lessons (19%)
• allow an unlimited number of test (25%)

The results of the survey conducted after the use of the web service are shown in the diagram from the 9, the user can see the desire to increase the level of interactivity and the manner of distribution of information. The greatest number of proposals relate to the testing limit (25% of the total proposals), because the existing system users have a limit on the duration of 24 hours if they did not pass the test.

Following the trends in web service development and the results of students’ survey, it was decided to improve system with further functions: video tutorials, lecture marking, giving suggests, comments and critics, keywords related lectures with tag cloud and make learning more adaptive. For programming improvements it is necessary to bundle pop-up windows because they reduce usability of web site. Also the use of AJAX technique is suggested for getting faster interactivity, and to made possible to enter questions and answers in XML format. We are also thinking of the implementation of a desktop application in Python programming language that communicates with web application using XML-RPC web service.

In order to maximize the easiness of distribution of material in the way to be the platform independent we decided to enable the creation of questions in the XML format. System on the basis of the formats will make the inputs in database. Some of the queries would be compliant with the assistance of a Xquery.

All lectures are written in Serbian language, thus the decision was made to change name of existing service (E-xpert) to Web profa. In Serbian language profa is an acronym for the word profesor which means professor in English. A new logo is designed for this service (Fig.4) [3].

Most of the lectures will have video tutorials. They are very suitably for visual representing of some material.

All registered and logged users should have an option to rate each lecture, to give their own comments or suggestions. This way we could have more information for future development of system.

A tag cloud or word cloud (or weighted list in visual design) is a visual depiction of user-generated tags, or simply the word content of a site, used typically to describe the content of web sites. Tags are usually single words and are typically listed alphabetically, and the importance of a tag is shown with font size or color.

We will enter the changes in the testing and monitoring the level of knowledge of users. After finishing the test, the system will assign a new level of knowledge based on the results of all tests that the user had. In the case that the level of user has increased, in the next test that user will get questions that matches his new level. In the case that a user showed very low success on tests in the long term, the system would warn the user that his level of knowledge is very low.

3.2.1 Development process
The most important thing for getting helpful information is a survey. An anonymous survey was made for the students who used this distance learning system. Based on the collected and analyzed answers it was conclude that students have similar or same requests for the improvement of system.

The implementation of this service emphasizes two very important items, security and user-friendly interface. The system is secured. Every web form is secure from web robots. During the test process there is no possibility to refresh the time left for solving. For security of web forms we will use Captcha method.

This information system is developed by use of following techniques: XHTML, CSS, JavaScript, PHP, AJAX, MySQL, XML and Python. For object oriented modeling UML is used. For the needs of web server Apache is used.
3.2.2 Web services
The definition of web service - According to the W3C web service is a software system that is designed to enable interoperable interaction between computers in the network, such as, Internet. It has a strong interface in a format understandable to a computer (eg WDSL - Web Service Definition Language).

Web services use XML technology as a presentation layer data for all protocols and technologies. Web services are loosely coupled. User of web service does not directly depending on the web service. Web service interface can be changed, and that when this does not affect the ability of the client to communicate with service.

XML-RPC - is a protocol for remote procedure call (RPC) that uses XML to encode its calls and HTTP as a transfer mechanism. It is a simple protocol that defines the only useful types of data and commands the entire description can print on two pages of paper. This is the opposite in relation to most RPC systems, where the standard documentation, and extends to hundreds of pages and require considerable support for the software to be used. XML-RPC was created in 1998. by the Dave Winer-a (UserLand Software) and Microsoft. So the new functionality is shown, a standard evaluate in what is now called SOAP. Some users prefer the XML-RPC and SOAP-due to its simplicity, minimalism and ease of use, and JSON-RPC is similar to him. XML is widely used and understood, and can be interpreted by most programming languages. This makes it a good and solid choice for the use of the data type for the web service, which can be used by different users and platforms [6].

3.2.3 Desktop application
As we previously said, we will create a desktop application that would allow easier access to the information in the desktop environment. Web service will allow communication between Web and desktop applications.

For the server of web service we chose Zend_XmlRpc_Server component from a very powerful framework PHP: Zend Framework. Using these components, creating a server for Web service is reduced to only a few lines of code.

3.2.4 AJAX
AJAX (Asynchronous JavaScript and XML) is not a new programming language, but a technique for creating better, faster, and more interactive web applications.

With AJAX, your JavaScript can communicate directly with the server, using the JavaScript XMLHttpRequest object. With this object, your JavaScript can trade data with a web server, without reloading the page.

AJAX uses asynchronous data transfer (HTTP requests) between the browser and the web server, allowing web pages to request small bits of information from the server instead of whole pages.

The AJAX technique makes Internet applications smaller, faster and more user-friendly.

AJAX is based on the following web standards: JavaScript, XML, HTML and CSS [3].

3.2.5 PYTHON
Python is a dynamic object-oriented programming language that can be used for many kinds of software development. It offers strong support for integration with other languages and tools, comes with extensive standard libraries, and can be learned in a few days. Many Python programmers report substantial productivity gains and feel the language encourages the development of higher quality, more maintainable code.

Python runs on Windows, Linux/Unix, Mac OS X, OS/2, Amiga, Palm Handhelds, and Nokia mobile phones. Python has also been ported to the Java and .NET virtual machines.

Python is a remarkably powerful dynamic programming language that is used in a wide variety of application domains.

The language itself is a flexible powerhouse that can handle practically any problem domain [4].

3.2.6 XML
The last time the XML is increasingly treated as a data model that the system as a set of mutually related types of documents, a database as a collection of inter related documents that appear defined types.

Differences between XML and relational data model are as follows:

XML data model
- data are stored in one hierarchy structure
- nodes have elements and / or attributes
- elements can be nested
- elements have a defined order
- cheme is optional
Relation data model
- data are stored in multiple tables
- characteristics have a value
- value of characteristics are indivisible
- the order of tuples is not defined
- scheme is required

Systems for managing data according to the way we treat the XML data model, can be divided into two groups:
- XML-enabled - systems that map the XML data model in a classic model, the most frequent relation, and so it is stored in a database. At the entrance and exit of such systems are XML data. From the well-known systems that are MS SQL Server, Oracle;
- Native XML (XML source) - systems that use XML data model in its original form

A query language that intelligently uses the structure of XML can be used for a query of any kind of data, whether the data is saved as XML documents or in another data model transformed into XML. This standard describes the XQuery XML query language, and the XQuery with the XPath language that is used for addressing parts of XML documents, which is built into XQuery, is dealt with below.

4. Modularity of system
The new created system is a modular. Existing modules are module for learning lessons and testing module. Module for learning the lessons contain video tutorials as well as the code editor. Each of these modules can be accessed separately, as they are independent of one another. They can be excluded or included as needed.

5 Conclusion
This paper presents the development of web based modular information system for the needs of distance learning, describes the reasons why distance learning is so important. Also some information is given on the self made e-learning system and their possibilities.

The anonymous survey was made with students. Based on the collected and analyzed answers it was concluded that students have similar or the same requests for the improvement of the system. With the use of AJAX, XML and Python technologies the system will be improved with some new functions.

After finishing the new version of this system it is hoped that the number of internet service users in Serbia will increase. The second aim that is to be realized is to make other areas available for learning and testing via the internet.

References:
[5] Dave Crane, Eric Pascarello, Darren James, Ajax in action, Manning, 2005