Development of asynchronous e-learning systems with the use of Java technology

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Abstract: - E learning is one of the revolutions that where born through the growth of the new technologies and the Internet and change everyone's way of view about education and the deliver of knowledge. It is used more and more in education as it can deliver knowledge through internet to every corner of the planet. For development e-learning systems are used various technologies and Java technology could be one of them offering unique features to these systems. Java has emerged as a powerful programming language for developing platform-independent, interactive software that can be used on the World Wide Web through a Java-enabled Web browser. This paper introduces the Java programming language, the possibilities available by using Java in asynchronous e-learning systems and an example of a self paced system that was created with Java.

Key-Words: - e learning, asynchronous, java, jsp, facilitated, self paced, applet

1 Introduction

Distant learning is an educational method that exists since the beginning of the 21st century. Then the knowledge was delivered though the traditional mail. As the technologies grew distant learning begun to take a new form, and today distant learning is provided in many ways and methods. Of course one of them is e-learning [1,2,3,5,6]. Through the mass growth of the internet and the Information and Communications Technologies [7], and as a big part of our lives has passed into the internet age, and business [9, 11], government [25, 26], commerce [10], communication [8] take place nowadays and electronically, through the internet, and are known with an "e" at front, e-learning was the next step of education towards the digital age.

E–learning is categorized into two wide sections, the synchronous and asynchronous e learning.

Synchronous e-learning involves geographically dispersed students that are connected to the internet and logged on in a virtual classroom at the same time and communicate directly with each other and the teacher or instructor. In most platforms, students and teachers can use a whiteboard to see work in progress and share knowledge. Interaction may also occur via audio- or videoconferencing, Internet telephony, or two-way live broadcasts.

Asynchronous e-learning is more common because it creates a just-in-time, on-demand student learning experience [12, 13]. Unlike synchronous training, students do not need to schedule their time around the predetermined plan of the instructor that means there is complete flexibility with asynchronous training.

For the development of e learning systems are used variant technologies, authoring tools, and all systems are based in fundamental learning standards [14, 15]. Recently more software and e learning developers begin to understand the possibilities and the advantages that Java could offer to the development of an e learning system in what concerns either the development of educational content or either of the development of a complete educational environment

2 Java overview

Java is both a programming environment and a programming language developed and maintained by JavaSoft [16], the Sun Microsystems company responsible for Java It's use is very popular as for as the development of applications that run on a web browser as for the development of applications that can run in stand alone mod. The Java programming language is written in the same way that every other language is written. Its main difference from the other languages is that it is an object-oriented [24].

One feature that makes Java distinct among other programming language is the possibility for creating special programs called applets, programs for internet use that can be run under Java enabled browsers such as Internet Explorer [17] or Netscape Communicator [18]. The applications that can be developed with Java are separated in two sub categories. The console

applications that can do not support the use of graphics and the windowed java applications and which make use of all the features of a user graphic interface. Thus one can create dynamic web pages or learning environments that contain audio or video, vector graphics instead of bitmap, real time movement and real time applications. Another feature of Java is multithreading, that is the possibility for executing many processes at the same time.

Multithreading is important for example, for usage of images and, simultaneously data input from the user.

The evolved libraries of Java, such as Swing and AWT [22], can make possible in a window environment, the simultaneously presentation and usage of labels, buttons, text fields, and images for the development of the graphical user interface. Moreover, the constituents of the Java libraries are considered as lightweight, meaning that they are all written in the same language [21].

3. Asynchronous e- learning

Asynchronous e- learning is more flexible than synchronous because the student can choose the time he wishes to access a lesson. It comes in two forms, facilitated and self-paced.

3.1 Facilitated asynchronous e learning

Facilitated asynchronous e learning involves an instructor and group of students, but the interaction is not in real time. The instructor will post assignments on a Web page, which includes for example, online reading or research conducted on various Web sites, on line course material and quizzes. Students communicate with each other through discussions, and submit their homework to the teacher via e-mail. An advantage of this type of training is that can receive personalized attention and guidance from the teacher.

3.2 Self paced asynchronous e learning

Self paced asynchronous e learning consists of standalone instructional material that can be accessed and completed via the Web, without additional interaction among students. Materials could include guided tutorials, discovery learning simulations, and assessment exercises. Examples are self-paced courses taken via the Internet or CD-ROM, online discussion groups, and email. There can also be on line support and communication with a time delay, with the teacher.

4 The use of JSP for facilitated asynchronous e learning

Java Server Pages (JSP) is a technology for developing web pages that include dynamic content [20]. Unlike a plain HTML page, which contains static content that always remains the same, a JSP page can change its content based on any number of variable items, including the identity of the user, the user's browser type, information provided by the user, and selections made by the user.

JSP provides many benefits, such as, separated content and display logic, support of the software reuse through the use of components, platform independency, better tool support, portable to multiple servers and operating systems, extensibility, and it's better for the development of dynamic parts a powerful model for developing web applications that separates presentation from processing.

However, a JSP page also contains special JSP elements that allow the server to insert dynamic content in the page. JSP elements can be used for a variety of purposes, such as retrieving information from a database or registering user preferences.

When a user asks for a JSP page, the server executes the JSP elements, merges the results with the static parts of the page, and sends the dynamically composed page back to the browser [19].

5. The use of Java for Self paced asynchronous e learning

Java can be used for development of self paced systems either on the web or in a cd rom, and give the systems unique possibilities and features

5.1 WWW

Java can be intergraded in most types of internet pages such as HTML, PHP and ASP. For example an HTML page can host java applets or applications. The browser (Netscape Navigator 2.0 or higher or Internet Explorer 3.0 or higher) requests the necessary Java code from the Web server on which the code resides (Fig. 1).
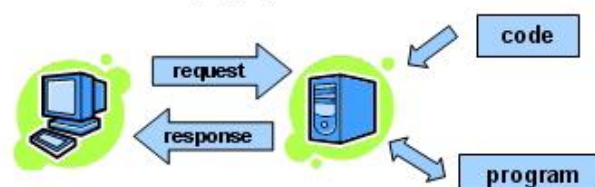

Fig.1 Client – Web Server

The Java code, passed around the WWW in compiled form as a "class", encapsulates data and the

functions necessary to manipulate that data [24]. There are no specific limitations on what the Java language can be used to do. One can create multiform and interactive content such as tutorials, exercises with self assessment, and quizzes. For security reasons, however, there are restrictions on how Java elements have access to the computer on which it is run (in this way the user is protected from misguided or dangerously unskilled programmers).

5.2 CD-ROM
Java can be used for the development of applets and applications and also self paced environments that can run in stand alone mode. The self learning material can contain text, audio, pictures and also can be interactive for a more sufficient and complete education in the form of applets and applications that can be integrated in a self learning platform made with Java and consist an e-learning software for cd rom use

6 Advantages
In this section are presented the advantages of Java for in order to realise the reasons that Java could be used for the development of a self –learning system.

6.1 Tailored for the Internet
The Java language is unique in its in-built handling of the network protocols required to send and receive data across networks such as the Internet. Programs can easily be written to allow world-wide access to and interaction with various information resources.

6.2 Platform Independency
The major strength of Java is that most software developers are no longer forced to choose between computer platforms, or expend great resources porting code from one platform to another. People according to their needs and preferences use operating systems such as MS Windows, MacOS, and the many flavours of UNIX. Choosing one platform means excluding others and thereby limiting the usefulness of the resource to students and contributing faculty. Finally platform independence greatly increases the usefulness of developed resources to the world-wide Internet community.

6.3. Creation of interactive content
Java is making Web pages dynamic. The user provides his/her input with the familiar computing tools of keyboard and mouse and receives feedback through live video and sound.

6.4 Interaction between teacher-student
Java allows a Web environment in which numerical analysis can be performed on computationally intensive engineering problems. This capability gives educators the freedom to present students with open-ended questions, where the user can be involved in the problem definition, exploration, and solution. In the past, interaction has only been possible through a fixed set of options presented in fill-out forms.

6.5 Java Applications Run Locally
Java runs the Java applets locally, rather than requiring a constant and slow continual transfer of data from a remotely-located Web server. An applet is although it is downloaded, data can be passed between the applet and a remote data server as the applet is run.

6.6 Security
Security is a significant matter whenever one receives files from an unknown or untrusted site. There is the danger that a file coming from such a site can cause harm to the computer. For a example it may contain a virus or be a Trojan horse. The Java language and program environment have prevented this by restricting rules to applets and applications. For example an applet can't write to a user's hard disk without his permission.

7. Case Study
In order to demonstrate how Java can be used for the development of a self learning system, in this section is presented a self learning system for Greek Paleography which its content and platform was made with Java [28]. Among others a keyboard has been developed which contains the constituents of Greek Paleography and consists the main educational tool for the particular self learning lesson (Fig. 2). The user is called to manuscript the words presented to him with the use of the paleographic keyboard buttons by the application, and the application returns the result of the words imputed by the user and the correct answer if the answer is wrong.
Another type of lessons that was created with Java, is a lesson where the user transcripts the given words by the application using the Greek polytonic system

(Fig. 3). Self-assessment is also provided in these courses, as the application presents to the user the correct writing of the word transcripted, by the user, by character. The use of Greek polytonic system was not easy to implement, as the Greek keyboard on Windows was recently available. Taking advantage of the Java libraries that contain classes and interfaces for the support of text constituents, and through the ability given by the nature of Java, for selecting the desired font, the use of the Greek polytonic system, by the user for data input and from the content of the database, became possible for the first time.

As a whole, the platform that was created with the use of Java, provides multiple ways of accessing educational and knowledge content, multiple levels of lessons and exercises, multiple lessons and exercises features, multiple lessons and exercises forms, multiform and friendly user interfaces, multimedia and graphics usage in order to enhance educational procedures and value, and finally self assessment methods available for the students.

8 Conclusions

The Java programming methodology is new and there remain some inadequacies and bugs. However, Java supports a new paradigm in computer programming by allowing programmers to create platform independent and Web browser executable software. The future of development effort on the Web utilizing Java appears to be very promising. Since its introduction in the summer of 1995, major software development companies such as Microsoft, IBM, and Oracle have licensed the technology to integrate the Java programming methodology into their WWW based software products.

References:
[1] Djamshid Tavangarian, Markus E. Leypold, Kristin Nölting, Marc Röser, Denny Voigt, "Is e-Learning the Solution for Individual Learning?" Djamshid Tavangarian, Markus E. Leypold, Kristin Nölting, Marc Röser, Denny Voigt, University of Rostock, Germany, Electronic journal of e-learning, Vol.2,Issue 2, December 2004.vo
[2] Dr. Marc J. Rosenberg, "E-learning"
[3] Lewis, M. "Interactive multimedia pedagogy: How interactivity supports learning", 2003, (http://www.thelearningcurve.com/lessons/resources/media/TLC_interactive%20pedagogy.pdf)
[4] National Learning Network, 'Paving the way to excellence in e-earning",
(http://www.nln.ac.uk/materials/tutors/Paving_the_way.asp?menuitem=paving).
[5] A.S.Drigas, L.G.Koukianakis, An Open Distance Learning e-system to support SMEs e-enterprising, 5th WSEAS Int.Conf. on ARTIFICIAL INTELLIGENCE, KNOWLEDGE ENGINEERING, DATA BASES (AIKED 2006), Madrid, Spain, February 15-17, 2006
[6] A.S.Drigas, D.Kouremenos, S. Kouremenos and J. Vrettaros
An e-Learning System for the Deaf people, ITHET 6th Annual International Conference, July 7 - 9, 2005, Juan Dolio, Dominican Republic, TC2-17
[7] United Nations Educational, "Scientific and Cultural Organization, Institute for Information Technologies in Education, "Information and communications Technologies is Distance Education", 2002.
[8] Laurie K. Benson, "The Power of eCommunication".
[9] A. Spellmann and R.L. Girmarc, "eBusiness Performance: Risk Mitigation in Zero Time", in Proceedings of the Computer Measurement Group's 2000 International Conference (CMG 2000), Dec 2000.
[10] Opportunities for E-commerce in Networking, David G. Messerschmitt, Jean-Pierre Hubaux, IEEE Communications Magazine, Sept. 1999
[11] ICT and E-Business Strategies for Development High-level Regional Conference for Transition Economies, Geneva, 20-21 October 2003
[12] Moore, M.G, Three types of interaction, The American Journal of Distance Education, 1989
[13] Moore, M. G., & Kearsley, G., Distance education: a systems view, 1996
[14] Jennifer Hofmann, The Synchronous Trainer's Survival Guide: Facilitating Successful Live and Online Courses, Meetings, and Events
[15] George M. Piskurich, Getting the Most from Online Learning, 2003
[16]JavaSoft, a Sun Microsystems Company, http://www.JavaSoft.com/HotJava/.
[17] Netscape Navigator, http://home.netscape.com/
[18] Microsoft's Internet Explorer 3.0, http://www.microsoft.com/ie/
[19] Hans Bergsten, JSP - Java Server Pages 2nd Edition – 2002
[20] Duane K. Fields, Mark A. Kolb
Web Development with JavaServer Pages, 2000
[21] George Liakeas, Introduction to Java, 2003
[22] Ken Arnold, James Gosling, The Java Programming Language, 2nd Edition, 1998
[23] Donald Ball, Pratik Patel, Alan Hudson, Michael Thomas Java Programming for the Internet:

A Guide to Creating Dynamic, Interactive Internet Applications, 1996

[24] Mary Campione, Kathy Walrath, The Java Tutorial: Object-Oriented Programming for the Internet, 2nd Edition, 1998

[25] Benjamin "Quincy" Cabell V, Joseph J. Rencis Javed Alam, Hartley T, Grandin, Jr, Using Java to Develop Interactive Learning Material for the World-Wide Web, The International Journal of Engineering Education, 1997

[26] Apostolos Andreoulakis, Greek Deputy Minister of Interior Public Administration and Decentralization,"e-Government:Focusing on the citizen",WCIT 2004 - XIV World Congress on Information Technology in Athens, 19-21 May 2004, Session Theme: ''The State - of- the Art''.

[27] Paul Waller, Peter Livesey,Karin Edin, "e-Government in the service of democracy", ICA International Council for Information Technology in Government Administration, ICA Information No. 74: General Issue, June 2001.

[28] A.S. Drigas, A. Tagoulis, P. Kyragianni, P. Nikolopoulos, D. Kalomirakis, D.Kouremenos, Ch. Emmanouilidis, J. Vrettaros, A self learning e-system for Greek palaeography, WSEAS TRANSACTIONS on INFORMATION SCIENCE and APPLICATIONS, Issue 8, Volume 2, pp. 1096-1099, 2005
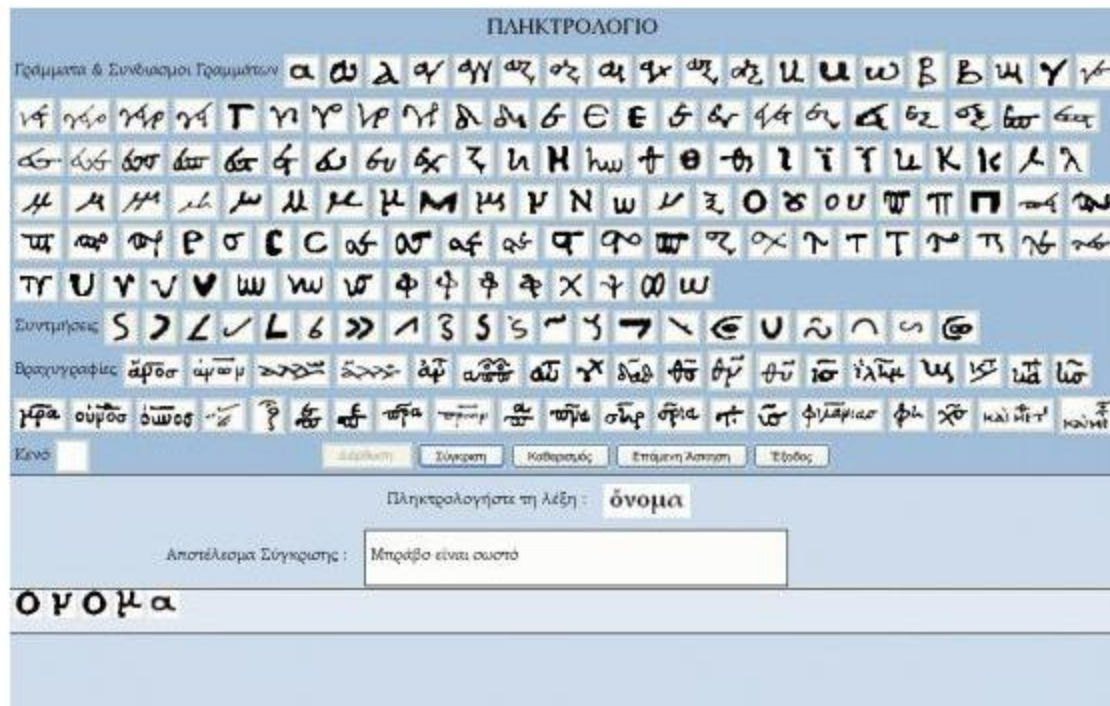
Figures:

Fig. 2 Sample of the Greek palaeographic keyboard

Fig. 3 Sample of the Greek palaeographic transcript lesson