Smart Interface Design and Web 2.0 application in the Intelligent e-Learning Systems

Dimitar G. Nedev[1]

Abstract: - **This article focuses on smart user interfaces in web-based e-Learning systems at the advent of the Web 2.0 technologies. It describes the basic interface design guidelines and how the increase the productivity of the learner along with the techniques for smart adaptation of an interface. The article also elaborates on the topic of Web 2.0 technologies, their everyday use and implementation in the e-Learning systems of second generation. The last topic is the use of these techniques and technologies in the Moodle Course Management System.**

Keywords: **e-learning; intelligent system; smart interface design.**

I. INTRODUCTION

In the modern world e-Learning is defined as "learning facilitated and supported through the use of information and communications technology" [1]. Some of the benefits provided by this type of remote education are: reduced overall cost and learning time, consistent delivery of content and Expert knowledge [2]. These advantages of the e-learning have made it very competitive and the number of people relying on it is growing very fast. According to Sloan Consortium (Sloan-C) educational surveys "nearly 3.2 million students were taking at least one online course during the fall 2005 term, a substantial increase over the 2.3 million reported the previous year" [3], which clearly shows the great increase in e-learning popularity. The web-based electronic education systems are the particularly versatile and easy to adapt, and proved the best possible student-teacher interaction of all e-learning systems. The web-based electronic education provides particular benefits for the learners such as: fast/frequent update, 24/7 access, easy student tracking, personalized learning [4]. The personalized learning is of particular importance since it helps to provide the best possible environment for the learner/user. This facilitates faster and easier learning process. An adaptive Graphical User Interface (GUI) the can contribute to the ease of work of the user by arranging the elements. This help the interface to adjust to the individual user's needs and allow the user to make full use of the e-learning system [5]. This all makes the design and implementation of the GUI an important part of the electronic learning system. Nowadays there are many techniques for the creation an adaptive GUI – the developer can follow the guidelines for user interface design and facilitate the Web 2.0 technologies. There are also many smart adaptations that help the GUI to adapt to the individual user, thus offering optimal learning conditions [6].

[1]Dimitar G.Nedev, Computer Science student at Jacobs University – Bremen, Germany; Address: Bulgaria, 8600 Yambol, Dimitar Blagoev Str. 11-A-42, vnedeva@tk.uni-sz.bg

II. INTERFACE DEVELOPMENT GUIDELINES

There are some simple rules the designer has to follow when developing a user interface (UI). First of all the user that is actually going to use it must be considered, for example who the user is – is he a professional or a novice.

The general limitations of the human must also be taken into consideration – of importance here is the so called information processing model, which explains how the user actually perceives a page when he/she is browsing through it. According to it the visual stimuli on the screen are perceived by the receptors, than processed and sent to the short-term memory. The information remains there only for a short period of time (about 30 seconds). When overburdened the user stops to perceive the new stimuli or forgets what was already observed before, therefore the information of the screen must be chunked for easier navigation. The menus must not have too many items on them and the most common should be on top. There must also be several methods for accessing the same content, thus once the learner has left the system it is easier to start from where he left last time. Such ways are: a single well organized main menu, keyword search, bookmark/history system, index/site map. A combination of them could provide enough possibilities for the user to continue his work without spending much time retracing his steps. All parts of the interface (menu entries, navigations, and buttons) should be clearly labeled and must not mislead the user. They must be consistent with the layout of the interface throughout the whole web site and must have meaningful names that explain their function. Another approach is to use visual metaphors that suggest with common sense logic what a certain interface element does [7].

Another important fact that comes from the information processing model is that in order to remember a learning material it must pass from the short-term memory to the long-term memory. For that to happen the material must be structured clearly, chunked in appropriate peaces and there must not be too many stimuli to distract the learner [2].

Also of importance is to put the user in control. First it must be clearly stated where exactly on the site the user is currently and there must always be some form of navigation – a way for the user to go back or to entirely leave this part of the site. All the actions performed of the user must be reversible – done by some sort of back/undo or another way to reverse what has been done. Also there needs to be a way to tell the learner when certain action is being preformed by that server and he/she has to wait [4]. The user must always know what is going on – even if an error has occurred. For every error in a user depend at process there must be a clear message stating what went wrong and explanation how to fix it. There must be also instruction how to use the site that is easily accessible and

understandable. They must give information to the user how to get through any situation he/she gets into. In form of pop-ups or using scripts the instructions that guide through the menus, explain the function of buttons or other elements of the interface must be provided [8].

Following the rules for a graphical user interface will help the easier navigation of the web-based electronic education system and will also support the learners' ability to perceive and remember the actual information provided by the e-learning system.

III. INTELLIGENT USER INTERFACE

The intelligent user interface (IUI) is built on several paradigms based on the way of interaction between the user and the system and they are: user-based, model based and agent based interaction. In the case of user-based interaction is based on the ability of the interface to adapt to the level understanding and the needs of the individual user. There are two approaches: adaptive and adaptable. The adaptive IU constantly adapts to the user following the experience of user interaction, usually using dedicated software tools. An adaptable IU provides the user the means to adjust it according to one's needs [6].

The model-based interaction relies on a range of interaction models and knowledge repositories. It strengths are shorter time to create, due to the use of reusable methods, design support and automation. It allows the use of techniques such as later design refinement and incremental approach [6].

The agent-based interaction relies of the use software agents that distribute the task between the different aspects of the interaction. The agents have a "model of belief in the state of the environment" and "have the capability to look for "patterns of behavior from user(s) and agent(s)" [6] and learn from them. The agents are divided into several categories. The first one - the interface agent - gains experience from the action of the user and works as and intelligent assistant. The second one – the tutor agent - is involved in the problem solving tasks and "provides an envelope progressively removes it" [6] while the learner is acquiring the knowledge. The last one is the information agent; its role is to provide connection to the information source. In order to function all agent require model for interaction for the learner, the tutor, the domain and the interface.

The IU can also react to the user's action based on different paradigms – based on the how often the data is used (adaptive ordering); based on the information from the model (adaptive prompting); based on agent interaction (guidance). Through these paradigms the IUI adapts to the individual user's needs and preferences.

IV. THE WEB 2.0 AND eLEARNING 2.0

The seven principles of Web 2.0 are [11]:

1. The Web As Platform. The web is the only true link that unites us all together whoever we are and wherever we are in the world. Hence, to harness collective intelligence and to create the intelligent web - we need to include as many people as we can. The only way we can do this is to treat the web as a platform and use open standards.

2. Harnessing Collective Intelligence. Now becomes the 'main' principle or the first principle

3. Data is the Next Intel Inside. By definition, to harness collective intelligence - we must have the capacity to process massive amounts of data.

4. End of the Software Release Cycle. This pertains to 'Software as a service'. Software as a 'product' can never keep up to date with all the changing information. Of course in the web 2.0 sense, we are dealing with code as well as data - so the service concept keeps the data relevant (and the harnessed decision accurate) by accessing as many sources as possible

5. Lightweight Programming Models. The heavy weight programming models catered for the few. In contrast, using lightweight programming models we can reach many more people (hence sources of information – to enable data collection and a more intelligent web).

6. Software Above the Level of a Single Device. More devices to capture information and better flow of information between these devices leads to a higher degree of collective intelligence

7. Rich User Experiences. A rich user experience is necessary to enable better web applications leading to more web usage and better information flow on the web - leading ofcourse to a more 'Intelligent' web.

The next generation web technologies combined under the name Web 2.0 are coming into existence. Based on them is the new phase of the electronic education called eLearning 2.0. One of the basic concepts of the new eLearning finds its foundations in the ever more popular aspects of the based on collaborative effort. These trends are the blogs, Wikis, discussion forums and so on. There the contributors are actually the user – in the case of eLearning system - the learners. Today there are a growing number of online educational forum that provide support for the learners, giving them opportunities to freely (and anomalously) ask question and get answers. The educational blogging is an also important part of the collaborative nature of the eLearning 2.0. They provide means of the learners to share their knowledge with the others.

The wiki system is another Web 2.0 technology that can be utilized for educational purpose. The Wikipedia project, founded by Jimmy Wales and Larry Sanger, has become one of the largest online encyclopedias and now part of it is translated into many languages. Besides being ever growing, due to the increasing contribution of the users, the Wikimedia Foundation has started a wiki-based project called Wikiversity that is devoted to free online education hub with wide range of support materials [9].

Even more popular is the trend of using web feed formats (also known as syndication) usually using simple XML documents. The most popular such syndications are RSS and Atom. This allows all subscribers of a certain feed to receive regular updates of content published on blogs, the latest news headlines or even podcats. There is also a possibility of connecting a number of blog using RSS [10].

Fig. 1. The seven principles of web 2.0 as outlined by
Tim O' Reilly [11]

The Web 2.0 is usually relying on technologies such as: PHP, Cascading Style Sheets (CSS), XML, validated HTML, AJAX and so on. The weblogs, syndication and wiki systems have also become important part of the Web 2.0.

An import step for the Web 2.0 is the partial or complete use of Open Source Software (OSS) and its increase use today contributes for this - the expansion of the Linux market, the wide availability of free SQL databases and the ever growing number of Open Source products in use today. The next generation of the web is also heavily relying on the use of SQL databases for storing solution on the web and the Linux-Apache-MySQL-PHP (LAPM) software bundle or one of its iteration is in the base of the many contemporary server solutions. This particular software pack is Open Source and further encourages the use of OSS.

The new technologies and standards that are becoming ever more widely used would significantly contribute to the development of the intelligent e-learning systems.

V. PRACTICAL IMPLEMENTATION – MOODLE

The Moodle e-learning platform that has significant number of registered sites (28610 as of 29.08.2007 [12]) and the popularity of the system is swiftly increasing. Moodle provides free support, besides having a large community that. Moodle is a Course Management System (CMS) that has open source and is based on the Web 2.0 technologies, making it a good example for an e-Learning 2.0 system. The Moodle CMS is designed to run on several operating systems including: Windows, Linux, MacOS X, FreeBSD. It could run from any server as long as there is a working PHP and a SQL database. Moodle can work with both MySQL and PostgreSQL which are free database systems.

Part of the CMS is also numerous modules that such as: RSS/Atom syndication, blogs, wikis, quizzes, chats, forums and many other [13]. There are also many in-house and third-party developed modules, plugins and themes. This could be contributed to the free and open source nature of the system that allows for vast contribution, since all users are allowed and encouraged to modify and distribute Moodle under the GNU General Public License [10]. The extensibility of the system makes it even more versatile.

Another important feature is that Moodle is supports several languages. This is of great importance for a e-learning systems since this help to provide the best possible learning environment. The convenient and ease-of-use environment is also aided by the user interface. The Moodle GUI is designed according to the guidelines. The interface is intuitive, smart, and easy to use and navigates you through the whole CMS.

Fig. 2. The main page of Moodle in Bulgarian running at Technical College – Yambol [14]

The system provides all that is needed for a e-Learning 2.0 system in a single package with minimum requirements. Moodle is an intelligent course management system, based of the latest generation of web technologies. The smart interface and the open source code makes adjustable and even extensible to everyone's needs.

VI. CONCLUSION

The latest generation of Web technologies are now becoming more widespread on the Internet. Syndication, wikis and blog, along with PHP, CSS – all now part of the daily life of most Web users. Their development is further pushed forward but the popularization of the Open Source Software, as it is free allows for easier customization. Now the developers tend are turning towards the techniques for interface adaptation to facilitates faster and smoother navigation of the user through their web sites. The e-Learning systems of second generation are build on top of these technologies – now proved, improved and easy to use. Smart interfaces and even intelligent Course Management Systems are now necessity for a system to succeed. As the goal of the e-Learning systems is to teach and the best possible way to do that is in environment best suited to the individual needs of the learner, the implementation of a smart user interface is and crucial part of any electronics learning system. And now the third implementation of the Web is being drawn, describing the Internet as a global database managed by artificial intelligence. This all underlines the importance of intelligent electronic education systems and their smart user interfaces.

REFERENCES

[1]   University of Bath – ttp://www.bath.ac.uk/internal/web/cms-wp/glossary.html, 14.07.2007- 1

[2]   Designing e-Learning User Interfaces Part 1: Assisting User Memory by Kevin Kruse http://www.e-learningguru.com/articles/art4_2.htm -7

[3]   The Benefits and Drawbacks of e-Learning by Kevin Kruse , http://www.e-learningguru.com/ articles/art1_3.htm 14.07.2007 -2

[4]   http://www.sloan-c.org/publications/ survey/survey06.asp, Making the Grade: Online Education in the United States, 2006, Solan Consortium -3

[5]   Using the Web for Learning: Advantages and Disadvantages by Kevin Kruse, http://www.e-learningguru.com/articles/art1_9.htm -4

[6]   AUI-ICEB-2004(Dec2004)EN060-paper.pdf -5

[7]   Designing e-Learning User Interfaces Part 3: Logical and Consistent Screen Design by Kevin Kruse http://www.e-learningguru.com/articles/art4_4.htm -8

[8]   Designing e-Learning User Interfaces Part 4: Provide User Guidance Kevin Kruse; http://www.e-learningguru.com/articles/art4_5.htm -10

[9]   http://en.wikipedia.org/wiki/Wikiversity - 13

[10]   E-learning 2.0, By Stephen Downes, National Research Council of Canada -12

[11]   http://en.wikipedia.org/wiki/Image:Web_2.0_Map.svg -15

[12]   http://moodle.org/stats/ -11

[13]   http://docs.moodle.org/ -16

[14]   http://tk.uni-sz.bg/e-learning/ - Technical College - Yambol E-Learning Page -17

[15]   Nedeva V., Y.Hristova, V.Stoikova, Virtual Learning Environment in Computer Subjects in the Automation, Information and Controlling Equipment, Engineering, technology and education – 2007, 5-6 July 2007, Yambol, Bulgaria -6

[16]   Designing e-Learning User Interfaces Part 2: Put the User In Control by Kevin Kruse, http://www.e-learningguru.com/articles/art4_3.htm -9

[17]   What Is Web 2.0, Design Patterns and Business Models for the Next Generation of Software by Tim O'Reilly 09/30/2005; http://www.oreillynet.com/lpt/a/6228 -14

[18]   http://docs.moodle.org/en/License -18