AC 2011-1003: FREE ACCESS TO TECHNOLOGY FOR INTERNATIONAL ONLINE ENGINEERING EDUCATION

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Free Access to Technology for Online Engineering Education

Abstract — Open source technology plays a vital role in a cost-effective and robustly accessible online engineering education. This role becomes even more vital in some developing countries where there are much engineering education demand and where the supply of accessible technology may be cost prohibitive and not as accessible. This paper encapsulates some of the freely accessible state-of-the-art open source technology and their applications in online engineering education and addresses some key features of the current technology. Open source technology is not very useful without the appropriate tools. Thus, discussions also include some open source tools to facilitate the access and the cost-effectiveness.

Index Terms — distance learning; pedagogy; engineering education; open source technology; freeware; learning management system

INTRODUCTION

Distance learning (or DL) is a vital educational tool in developing countries where education is not easily accessible. In some countries in Africa, for example, distance learning can significantly increase access to organized education and degree programs that is otherwise cost prohibitive. Prior to the availability of computer and software technology used routinely in education today, "distance learning" referred to as an individualized mode of learning only available through correspondence. Today, "distance learning" and interchangeably used "distance education," "E-learning," "I-Learning" and "online education," are commonly referred to as educational methodologies and delivery systems that provide the learners the opportunity to remotely access courses via advanced technologies. Such methods are widespread across the world and here in the United States, i.e., at Daytona State College and at Texas A&M University. Present technology and the accessibility of the internet have made distance learning much more viable, and it has evolved from traditional ways to robust, more efficient, and more convenient for both the students and the instructors. Online teaching and learning is progressively regarded as a means of increasing flexibility and robustness of delivery to provide for greater student access to, and control over, their learning whether they are studying on-campus or in distance mode, or offshore[1, 2, 3].

Online engineering education delivery is a powerful and robust method in engineering and technology education. Some of it's indispensible advantages and feasibility have been well established in the literature, more recently in Mehrabian, et. al., 2007[3] and Mehrabian, et. al., 2008[7]. As online education delivery methods and technology advance with time, the efficiency and robustness of the delivery methods and available technology and management systems increase. This is also partly due to the users' demand for a more complex, yet user-friendly tools to be able to handle more sophisticated functions and operations. Cost is an important issue in this process, particularly in areas of the world where the supply of the technology may be cost prohibitive and not as accessible as some other parts of the world. Not all countries have access to the same financial and other types of resources. The cost of

a system in one country could translate into a more costly system in another country due to several reasons, including inflation, currency equivalencies, economic stability, etc. As such, the needs for accessible software and hardware should be addressed and discussed to level the playing field and make engineering education "universal" and transparent. This is also advocated by the American Society for Engineering Education (ASEE) and other engineering professional societies in their meetings and workshops.

Presented here in this paper are a few open source and "freeware" software to introduce the distance learning stakeholders and educational providers, and the interested end users to the world of "free" and accessible Open Source Technology (OST). In this article, we adopt the definition of "Open Source" as, "of or relating to or being computer software for which the source code is freely available." (from http://wordnetweb.princeton.edu/perl/webwn?s=open-source). All presented software here can be downloaded free of charge over the internet or requested from the developers free of charge. In some case, there maybe a nominal fees associated with the setup and logistics. The costs of the servers and workstations are not included in these fees, and they should be considered appropriately. Only a short list is provided here where it is not an all inclusive list. We only provide some key features of the current technology for Course Management System (CMS). The discussions provided here apply to higher education, although it is not limited to college education only. All systems require user training, some of which is available online in the forms of groups and interactive and non-interactive discussions. In this article, the focus is on the systems for engineering and technology education with the understanding that the presented technology and CMS can be applied to other fields, depending on the field, course type, and content. By no means the provided information and discussions here are exhaustive. A more extensive information and comprehensive discussions can be supplied from the references and literally, millions of websites out there on the cyberspace.

LMS OPEN SOURCE TECHNOLOGY

A Learning Management System (or LMS) is a term used to describe any software that supports the education or training of individuals or groups. Seeing as the term, LMS, is very generic. It makes sense to expect there to be many varied implementations of LMS software. Those using OST are presented here in no particular order. All of them are applicable to engineering education and can be used as such. The degree of sophistication is also a variable that should be considered. This list is not compiled and discussed for comparative purposes and it should not be used as such. The discussions provide opportunities to present alternatives and flexibility in the number and the types available to the engineering education community.

1. Moodle: Moodle is an Open Source Course Management System (CMS), also known as a Learning Management System (LMS) or a Virtual Learning Environment (VLE). It is a free web application that educators can use to create effective online dynamic web learning sites for students. To work, it needs to be installed on a web server somewhere, either on one of institutional computers or one at a web hosting company. One main advantage of Moodle is that it is free to download and registration is voluntary (http://moodle.org/). Moodle also provides opportunities for course conversion from traditional learning environments to online learning environments[8]. Several examples of Moodle successful applications can be found in the literature[8]. Many stakeholders in developing countries in Latin America and Africa,

for example, used Moodle. A visit to the provided website above would enlist other users from international arena of engineering education. The registration is free.

2. LogiCampus: LogiCampus is a distance learning (DL) and CMS that is freely available to colleges, universities and schools, globally. It was built in conjunction with Tarrant County College Center for Distance Learning of Fort Worth, Texas, United States. LogiCampus allows a college, university, or school district to run existing courses or online courses via the web as well as provide the foundation for an institution to create additional integrated applications. LogiCampus provides a single sign-on for students, faculty, and staff of an institution and provides more than just a course management and DL system. LogiCampus provides the standard tools for faculty to create their online courses, process assignments, make tests and stay in contact with students. Students can see their assignments, lessons and other information for all of their courses. Staff benefit by other applications such as the built-in help desk, textbook requisitions, exam scheduling and faculty course changes.

LogiCampus is built on top of the open source application server LogiCreate. This learning system provides a foundation on which an institution can build additional integrated applications. Since the system is using LogiCreate, many applications may be added to meet stakeholders' needs while still providing a single sign-on environment (http://logicampus.sourceforge.net/). This would reduce redundancy and add flexibility to the system, while maintaining the ease of access to multiple applications.

3. Dokeos: Dokeos is the Open Source alternative for Enterprise Learning Management, Administration and Education around the world. An DL and CMS web application, Dokeos development is an international, collaborative effort. It focuses on user friendliness, simplicity, and consistency. Dokeos has many tools and is light and flexible. The 2.0 release (planned January 2011) will make us more standard-compliant (W3C xhtml and css, SCORM import and export) and more modular (plugins, code libraries). The system has translations for many languages in various stages of completeness. The 2.0 release works with mindmaps, a touchscreen interface and a new authoring tool. Mindmapping reshapes the role of images in DL, i.e., concepts, words, become space and structure. The mindmap-based menus, broadcast visual training contents at once, despite ones lack of graphical skills. It allows note-taking and sharing them with classmates, commenting on their sketches, and brainstorming together. In 2.0 release, the software interface has been redesigned to simplify users experience with less clicks and less hassle. Drag and drop activities may fit in your touchscreen devices. There includes 30 multimedia templates, 30 quiz mockups and 30 mascots, provide authors with a professional studio environment. The new Scenario tool frees the pedagogical imagination and empowers creative instructional designs. (http://www.dokeos.com/)

4. ILIAS: This is a robust platform for Web-based training. It was originally developed at the University of Cologne, in Germany, using PHP (Hypertext Preprocessor, a recursive acronym, originally personal home page) and MySQL. It has been available since 2000 as open software under the General Public License or GPL. The system's core is an authoring tool for creating courses. Other main components include personal desktops, a mail system, newsgroups, a group system, and system administration. Many current learning management systems today are integrated into a larger environment of institutional administrative systems. To enable information exchange with these sometimes much larger systems, ILIAS offers a SOAP (or Simple Object Access Protocol) interface, that allows to control almost everything in ILIAS with an external application. ILIAS is a powerful

Open Source Learning Management System (OSLMS) for developing and realizing web-based DL. The software was developed to reduce the costs of using new media in education and further training and to ensure the maximum level of customer influence in the implementation of the software. ILIAS is published under the General Public Licence and free of charge. ILIAS allows efficient creation of courses and course materials. It offers standardized tools and templates for learning process including integrated navigation and administration. Groups in ILIAS allow collaborative learning and working on the platform without additional tools. Learning groups, working groups or groups for certain fields of interest could be created. Groups can use all ILIAS tools like wiki, forums or file sharing. Users can create groups that are open for everyone or have access restrictions. The system offers multiple ways to deliver learning content. All types of document files can be uploaded, with SCORM 2004, SCORM 1.2 and AICC are supported. It also includes an internal authoring environment to create XML-based learning modules, that can include images, flash, applets and other web media files. It is possible to create glossaries and reuse term definitions within other learning modules. ILIAS supports standard ways of communication as chats, forums and mails. The personal desktop includes an awareness function that shows users currently online. ILIAS also sends information via RSS to the user and displays external RSS feeds in the system. Beside RSS support, ILIAS offers the ability to manage podcasts. To create a podcast is as easy as uploading a audio file to the web. (http://www.ilias.de/)

5. Trellis: Trellis is a free LMS software designed to manage, track, and deliver educational and training courses in engineering and technology-based training. Its native extensible and well-organized architecture allows it to accommodate many varying learning environments with minimal development effort. Trellis is currently employed by many national and international organizations. At the heart of Trellis lies an extremely simple and flexible framework allowing it to adapt to almost any situation with relative ease. Its flexible tracking system tracks both online and classroom training as well as other types of training, with its content delivery system not requiring any third-party platform. Trellis document management system delivers stand-alone documents or files to target learners, and its portable XML course format fully supports Trellis courses' advanced features. Application of Trellis facilitates curriculum development with specific course objectives and delivery, enabling associate courses or programs synchronously and asynchronously, with specific locations, instructors, or schedules. The software can manage, track, and deliver certificates of completion to the end users after course completion. A recent (2009) addition of TrellisTalk plug-ins integrates full web-conferencing with other LMS functions to provide a fully integrated virtual meeting function for Trellis users.

Trellis is licensed under the GNU General Public License (version 3 or later) in order to protect its freedom and the freedom of its users. Anyone and everyone is allowed to view, use, and modify the source code as permitted by the license. (http://trellislms.org/wiki and http://home.learning.net/trellis/)

SUMMARY AND CONCLUSION

Online engineering education and technology providers and stakeholders are aware that open source technology plays a vital role in a cost-effective and robustly accessible online engineering education throughout the international globe. This role becomes even more vital in some developing countries where there are much engineering and technology education demand and where the supply of accessible technology may be cost prohibitive and not as accessible. This paper presents some robust yet flexible LMS software that are freely accessible and downloadable, presenting the state-of-the-art OST and its

applications in distance learning in engineering and technology. The accessible link for each listed software is provided at the end for the ease of reference and for more information on the support and training. We, the engineering education community understand there is no "one size fit all" learning philosophy in engineering education and distance learning. Thus, each software can be used for the appropriate application and content, deemed fit by the stakeholders, i.e., faculty members and trainers. In some cases, combined multiple resources may yield a more effective and robust educational experiences.

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