

A Web-based Tool for Building and Accessing Learning Objects and Online Courses^[1]

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Abstract

In this paper we present a web-based tool that facilitates instructors and trainers to easily develop learning objects and online courses so as to serve their distant learners' needs. Additionally, we present the way content created using that tool can be delivered to the learners during a learning process. We therefore present a sample content management and delivery system that exploits the potential of the above-mentioned web-based tool. The resultant e-learning content can be easily searched and retrieved, tracked in terms of the learners' interactions with it and reused within different learning objects and courses.

1. Introduction

In this day and age, the time and place limitations the traditional learning implies as well as the rapid growth of the Internet and the current web infrastructure, are in favor of the effective and efficient application of e-learning. In many cases, actually, web-based learning is used as a complement to the face-to-face education to meet the students' need for "any time-any place" learning. This growing need resulted to the incorporation of a variety of e-learning products in the market place, showing different characteristics and services according to their end-users requirements. However, content creation and delivery are considered the two key factors in any e-learning system [1].

The various learning resources are organized and catalogued by a (Learning) Content Management System ((L)CMS) and they can be combined to create larger instructional units. These can be delivered to the learners and, perhaps, monitored in terms of the learners' interactions. LCMSs, actually, are more than ever, expected to deploy and manage content that can be easily

searched and retrieved and reused for different educational purposes [2]. A first step towards content's accessibility and reusability is the learning resources description using metadata [2]. Another functionality that e-learning platforms are expected to expose, is the monitorship of the learners' interactions with the content. The last years organizations, initiatives and committees have made momentous standardization efforts and presented remarkable outcomes towards these needs. Though, SCORM specification [3] has precedence in comparison with the other ones, as it refers to the most significant of them while making one step further [4].

The application we present in this paper takes carefully into account the aforementioned requirements for the development and delivery of high quality learning objects and courses through the web. Special attention is paid on the utilization of open source technologies and web standards so that our application can form an easily accessible system.

2. Overview of the Web-based Tool

The tool, we present in this paper applies to individuals dispread in different geographical locations and interested in a particular field. Their shared purpose is to gain knowledge on the field, while taking part in the learning process at-any-time and any-place.

To extract the functional specifications of such a system we were based on the user requirements gathered for the purposes of the VirRAD project [5] concerning the learning content, its creation and access. These can be summarized as follows: a) the system should support the import of a wide variety of content formats; b) content elements should be easily combined and aggregated to enable the creation of a learning content repository; c) the courseware should be divided into small modules; d) the content should be reused within different learning objects

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and/or courses; e) online examinations should be available; f) the learner's interactions with the content should be tracked; g) the courseware should be provided on a "distance learning" basis and be platform-delivery independent; h) the system should provide the learners with mentors with whom they can communicate online, and i) the technology to be used should not demand any particular computer science or e-learning skills.

To meet the user requirements, the system has been divided into three main parts: a) the Public Web Site, which aims to invite potential users to the system, b) the Personal Desk component, which provides system members with tools so as to take on/withdraw a particular role and exchange private messages with each other, and c) the Instructional component that consists of the courseware and the learning management element.

3. System Architecture

According to the functional characteristics, the tool we present will be a network-based environment, which will be mainly comprised of the following: (a) multimedia courseware, b) a tool for the courseware creation and access and c) asynchronous features to support the communication among the users. The main modules of this architecture are the client, the web server with the scripting environment and the database.

The client is the end-user's personal computer, with an Internet connection and a web browser.

The web server is used for storing the learning resources as well as for storing and executing the scripts of the scripting environment. It interacts with the client's browser window using the HTTP protocol and with the database through the scripting interface.

The scripting environment constitutes the link through which the other system components can communicate with each other and contributes to the smooth and effective delivery of the appropriate content and values. It supports interaction with the database, system administration, user authentication, manipulation and extraction of the user's role(s) and access rights in the system. It, also, supports the Personal Desk and the Instructional Component.

The database management system constitutes the core of the whole system, where the majority of the available information is stored and organized. This includes information about the users and the available learning resources.

4. Implementation Issues

The system we have implemented is intended to be an easily accessible web-based system and, therefore, bandwidth and client-side system constraints should be

taken into account. The main prerequisites for the system architecture are: a) minimization of the client-side system requirements; b) cost minimization of the client-side system set-up; c) cost minimization of the server-side set-up. Taking these factors under consideration and after a research on the existing technological solutions towards these needs, we had made some choices.

First of all, the web server adopted in the system is the Apache web server due to the fact that it is free of charge, it runs on almost all operating systems; it supports many scripting languages and database management systems and it is reliable. Regarding the database we have exploited the MySQL server, which is supported by many scripting languages, it can be integrated with all major Web servers and runs in almost every platform. For the scripting environment we have mainly exploited the PHP scripting language that is open source, cross-platform and extensible, and the (client-side) JavaScript that is, also, open source and supported by all major Web Browsers.

As far as it concerns the content model adopted in our system, this involves components of three types: a) assets, which refer to multimedia files, b) the learning objects that can be either a collection of assets or an assessment and c) courses, which are aggregations of learning objects and/or other courses [2]. To meet the requirements for content accessibility and reusability, the system should follow a metadata specification. Our system supports the entire mandatory and some of the optional metadata elements defined in SCORM. Moreover, taking into account that the system should not demand any particular e-learning skills and in order to simplify the authoring process, the aggregation of the learning resources has been inspired, but is not identical, to that described in SCORM. Authors need only to select and order the learning objects/courses they wish to include, and fill-in in the appropriate metadata elements. Regarding the tracking of the learners' interactions, the system exploits the potential of the scripting environment. A SCORM conformant learning management system can also track users' actions. However, SCORM does not support all the interactions that should be tracked by our system.

To facilitate authors to easily create learning objects the system provides them with a "What-You-See-Is-What-You-Get" editor. This has been extended to enable the incorporation of images as well as other multimedia files, already uploaded into the Web server as assets. We will exploit the htmlArea editor, as it is open source and operates well using IE or Mozilla.

5. System functionality

The system we present in this paper is accessible to the wide audience through the Public Web Site (<http://ouranos.ceid.upatras.gr:8080/baloc/index.php>).

This site aims to invite potential users to the system and, therefore, it provides them with the appropriate means for making a registration. Furthermore, it acts as a gate for the already registered users.

Once a user enters the system, s/he can send private messages to other members from the Personal Desk component. A member can, also, apply for the undertaking/withdrawal of a role in the Instructional component (learner, author, mentor or Editorial board). The applicant may be notified accordingly through a private message.

Any system member can apply for the author's role. The main responsibilities of an author include the importation of assets into the system, the creation of learning objects, the building of a course, the enrichment of the learning resources with the appropriate metadata elements as well as the editing of the metadata elements and the structure of a course. Though, any change in the learning content is not readily available, unless approved by the Editorial board. Additionally, authors are able to access the courseware element but only in browse mode. In order his/her actions to be monitored (study mode) an author should take on the role of a learner.

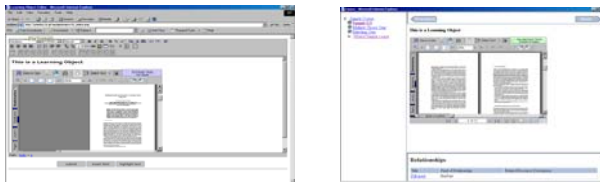


Figure 1: a) Learning object editor (authors) b) Courseware access (learners)

Learners are system members that have applied for the learner's role and filled in a form with information about their instructional and professional background. A learner can access the courseware, choose a mode of learning, search and retrieve content of his/her preference, access reports on his/her interactions within a course, which has been accessed in study mode, and get support by a mentor. When a learner accesses a course within the system, s/he is provided with a web page, which contains the course's table of content in one frame and the real content in another. Moreover, every time s/he clicks on a topic within the course, a list of all the learning resources this topic relates to appears in another (bottom) frame. Learners can also navigate through the course using the "Next", "Previous" navigation buttons. Additionally, a learner can contact a mentor requesting further explanations.

Mentors are subject experts having as main task to support the learners in the learning process. Users that have taken on this role can be mentors in more than one courses. A mentor can choose a maximum number of learners s/he will support by answering on questions or by advising them on the most suitable learning content after

accessing information about their instructional and professional background and their interactions.

The Editorial Board is a special group that decides upon: a) the assignment or not of the role of a learner/mentor/author to a system member, b) changes on the learning content, and c) the expelling or not of a member from the Instructional Component. The system administrator decides on the Editorial Board's role. Additionally, s/he is able to expel a member from the system and responsible for checking the data consistency and fixing potential bugs in the system.

6. Conclusions and Future Work

The Web-based tool we have implemented constitutes an attempt towards e-learning environment' requirements to deploy and manage accessible, reusable and traceable learning content. The system encourages users to actively take part in the learning process by undertaking one or more roles. Learners are allowed to select a mode of learning and thus choose whether their interactions with the content will be tracked. The Editorial Board assures the quality control of the learning content. Moreover, the system is based on open source technologies and it does not demand any particular computer science or e-learning skills.

Our next steps involve the exploitation of new communication ways among the system members, the expansion of the authoring tool functionality, the integration of a Learner Modeling system and the incorporation of a new function for the content authors so as to export a whole course in a SCORM compliant zip file.

10. References

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