

# A Literature Review of E-Learning Model Based on Semantic Web Technology

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**Abstract**-Research works in the field of E-Learning are represented by a broad spectrum of applications, ranged from virtual classrooms to remote courses or distance learning. Web-based courses offer obvious advantages for learners by making access to educational resource very fast, just-in-time and relevance, at any time or place. In this paper, based on our previous work, we present the Semantic Web-Based model for our e-learning system. In addition we present an approach for developing a Semantic Web-based e-learning system, which focus on the RDF data model and OWL ontology language.

**Index Terms**- E-learning, Semantic Web, RDF, Ontology, OWL.

## 1 INTRODUCTION

E-learning is not just concerned with providing easy access to learning resources, anytime, anywhere, via a repository of learning resources, but is also concerned with supporting such features as the personal definition of learning goals, and the synchronous and asynchronous communication, and collaboration, between learners and between learners and instructors. One of the hottest topics in recent years in the AI community, as well as in the Internet community, is the Semantic Web. It is about making the Web more understandable by machines. It is also about building an appropriate infrastructure for intelligent agents to run around machine-readable, it is not machine-understandable [4]. We need the Semantic Web to express information in a precise, machine interpretable form, ready for software agents to process, share, and reuse it, as well as to understand what the terms describing the data mean. That would enable web-based applications to interoperate both on the syntactic and semantic level. The premise underlying the concept of a learning object is that it can be reused. Current research and development efforts focus on establishing standard ways to annotate learning objects using metadata schemas so that they can be retrieved easily. There is, however, a pressing need for research and development work to investigate how learning objects can be reused in a pedagogically appropriate way. This work-in-progress paper describes a project that aims to address this gap by developing a framework to assist teachers and instructional designers incorporate learning objects into generic learning designs they adapt to suit their educational contexts. We will introduce the implementation of Semantic Web concept on the e-Learning environment offered by our web-based e-learning system [5]. The facilities that the application will provide include allowing e-learning content to

the Web performing complex actions for their users [1]. Furthermore, Semantic Web is about explicitly declaring the knowledge embedded in many web-based applications, integrating information in an intelligent way, providing semantic-based access to the Internet, and extracting information from texts [2]. Ultimately, Semantic Web is about how to implement reliable, large-scale interoperation of Web services, to make such services computer interpretable, i.e., to create a Web of machine-understandable and interoperable services that intelligent agents can discover, execute, and compose automatically [3]. Unfortunately, the Web was built for human consumption, not for machine consumption, although everything on the Web be created, annotated, shared and discussed, together with supplying resources such as lecture notes, course description, documents, announcements, student papers, useful URL links, exercises and quizzes for evaluation of the student knowledge. In its broadest sense, a learning object is "any entity, digital or non-digital, that may be used for learning, education or training". This definition is useful in that it encompasses both content and activity-based resources. However, it says little about the characteristics of learning objects that make them reusable. The paper is organized as follows: in Section (2) we present some related works. In section (2.1) we give brief overview about the Semantic Web and discuss number of important issues. In section (2.2) we introduce the Semantic Web model for our web-based e-learning system, in section (3) we present the implementation of web based e-learning system. In section (4) we present the system evaluation and the paper is finally concluded in section (5).

## 2 LITERATURE SURVEY

Several researchers studied the issue of Web based application. F. P. Rokouet al. [6] distinguished three basic levels in every web-based application: the Web character of the program, the pedagogical background, and the personalized management of the learning material. They defined a web-based program as an information system that contains a Web server, a network, a communication protocol like HTTP, and a browser in which data supplied by users act on the system's status and cause changes. The pedagogical background means the educational model that is used in combination with pedagogical goals set by the instructor. The personalized management of the learning materials means the set of rules and mechanisms that are used to select learning materials based on the student's characteristics, the educational objectives, the teaching model, and the available media. Many works have combined and integrated these three factors in e-learning systems, leading to several standardization projects. Some projects have focused on determining the standard architecture and format for learning environments, such as IEEE Learning Technology Systems Architecture (LTSC), Instructional Management Systems (IMS), and Sharable Content Object Reference Model (SCORM). IMS and SCORM define and deliver XML-based interoperable specifications for exchanging and sequencing learning contents, i.e., learning objects, among many heterogeneous e-learning systems. They mainly focus on the standardization of learning and teaching methods as well as on the modeling of how the systems manage interoperating educational data relevant to the educational process [7]. Juan Quesada and Bernd Simon have also presented model for educational activities and educational materials [8]. Their model for educational activities denotes educational events that identify the instructor(s) involved and take place in a virtual meeting according to a specific schedule. F. P. Rokouet al. [9] described the introduction of stereotypes to the pedagogical design of educational systems and appropriate modifications of the existing package diagrams of UML (Unified Modeling Language). The IMS and SCORM models describe well the educational activities and system implementation, but not the educational contents knowledge in educational activities. JuanQuemada's and F. P. Rokou's models add more pedagogical background by emphasizing educational contents and sequences using the taxonomy of learning resources and stereotypes of teaching models. But the educational contents and their sequencing in these models are dependent on the system and lack standardization and reusability. Thus, we believe that if an educational contents frame of learning resources can be introduced into an e-learning system, including ontology-based properties and hierarchical semantic associations, then this e-learning system will have the capabilities of providing adaptable and intelligent learning to learners. The hierarchical contents structure is able to show the entire educational contents, the available sequence of learning, and the structure of the educational concepts, such as the related super- or sub-concepts in the learning contents. Furthermore, some of

semantic relationships among the educational contents, such as 'equivalent', 'inverse', 'similar', 'aggregate' and 'classified', can provide important and useful information for the intelligent e-learning system. For this purpose, ontology is introduced in our model. It can play a crucial role in enabling the representation, processing, sharing and reuse of knowledge among applications in modern web-based-learning systems because it specifies the conceptualization of a specific domain in terms of concepts, attributes, and relationships.

## 2.1 Semantic Web Overview

There is a number of important issues related to the Semantic Web. Roughly speaking, they belong to four categories: Semantic Web languages, ontologism, semantic markup of Web pages, and Semantic Web services. **Semantic Web Language:** In order to represent information on the Semantic Web and simultaneously make that information both syntactically and semantically interoperable across applications, it is necessary to use specific languages. It is important for Semantic Web developers to agree on the data's syntax and semantics before hard-coding them into their applications, since changes to syntax and semantics necessitate expensive application modifications [10]. RDF is a framework to represent data about data (metadata), and a model for representing data about "things on the Web" (resources). It comprises a set of triples (O, A, V) that may be used to describe any possible relationship existing between the data -Object, Attribute and Value [11]. **Ontologies:** Ontologies applied to the Web are creating the Semantic Web [12]. Ontology's provide the necessary armature around which knowledge bases should be built [13], and set grounds for developing reusable Web-contents, Web-services, and applications [14]. Ontologies facilitate knowledge sharing and reuse, i.e. a common understanding of various contents that reaches across people and applications. Technically, an ontology is a text-based piece of reference-knowledge, put somewhere on the Web for agents to consult it when necessary, and represented using the syntax of an ontology representation language. There are several such languages around for representing ontologies, see [15] for an overview and comparison of them. It is important to understand that most of them are built on top of XML and RDF. By 2004, the most popular higher-level ontology representation languages were OIL (Ontology Inference Layer) and DAML+OIL [16, 17]. Ontology developed in any such language is usually converted into an RDF/XML-like form and can be partially parsed even by common RDF/XML parsers [18]. Of course, language-specific parsers are necessary for full-scale parsing. There is a methodology for converting an ontology developed in a higher-level language into RDF or RDFS [19]. **Semantic Markup:** Ontologies merely serve to standardize and provide interpretations for Web content, but are not enough to build the Semantic Web. To make Web content machine-understandable, Web pages and documents themselves must contain semantic markup, i.e. annotations which use the terminology that one or more

ontologies define and contain pointers to the network of ontologies. Semantic markup persists with the document or the page published on the Web, and is saved as part of the file representing the document/page. Services also must be properly marked-up, to make them computer-interpretable, use-apparent, and agent ready. They must contain pointers to the corresponding service ontologies. **Semantic Web Services:** Intelligent, high-level services like information brokers, search agents, information filters, intelligent information integration, and knowledge management, are what the users want from the Semantic Web. They are possible only if a number of ontologies populate the Web, enabling semantic interoperation between the agents and the applications on the Semantic Web, i.e. semantic mappings between terms within the data, which requires content analysis.

### 2.2 E-Learning Model Based On Semantic Web

In the following subsections, based on the Semantic Web technology and e-learning standards we describe our existing e-learning model, illustrated in Figure 2.3. **The Web-based Services:** Our existing model in Figure 2.3, provides the student with two kinds of contents, Learning content and Assessment content. Each content has different types of services such as: **Learning services:** provide registration, online course, interactive tutorial, course documents (is a repository for files that the instructor have made available to the student as a part of your course), announcements (displays information to the students that the instructors of the course want him to know), links (displays a list of useful URL links that have been identified by the course instructors), student papers (students can post/upload requests files to the instructor), and Semantic search (helps the student to search for resources). **Assessment services:** provide exercises and quizzes for evaluation of the student knowledge. On other hand, our e-learning system allows instructors to create his course websites through a browser, and monitoring the student's performance. they have many services and tools such as: publish documents in any format (Word, PDF, Video, ...) to the students, manage list of useful links, compose exercises/quizzes, make announcements, and have students submit papers. To illustrate the services architecture, we will go through an e-learning scenario. Student first searches for an online course: the broker handles the request and returns a set of choices satisfying the query. If no course is found, the user can register with notification service. Otherwise, the user may find suitable course among the offerings and then makes final decision about registering for the course.

The agents interact and communicate between each other by means of PHP, MySQL database and using the Apache Web Server.

### 3.1 Administration Section

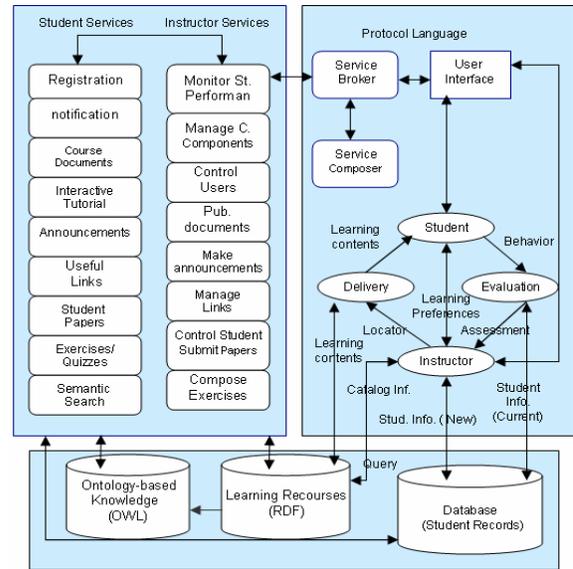


Figure 1. Proposed model for web-based e-learning system

### 3 Implementation

The main agents used in our system are: Student and Instructor, both of them are implemented as PHP classes

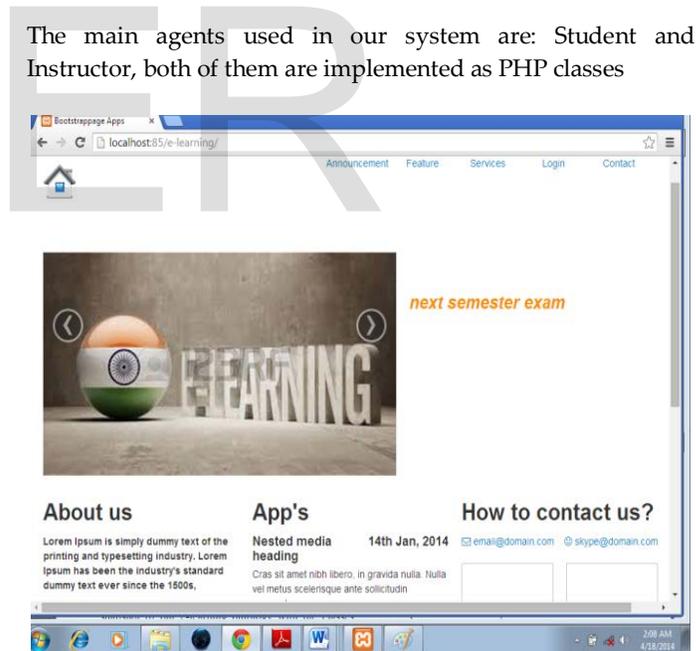


Figure 2 Snapshot of the proposed system.

This section can be accessed by providing administrator password. In this section the administrator can authorize persons to view data entry and reports. The administrator can edit the master table information, add new materials. Only administrator can update learning information and users account. Only administrator can navigate through the entire system.

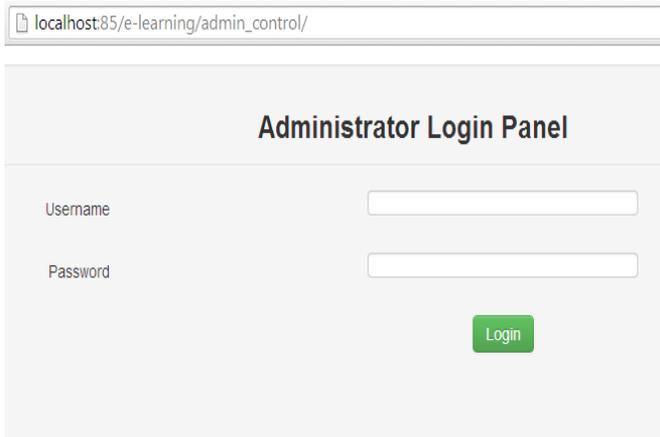


Figure 3 Administrator Login Panel

### 3.2 User Section

This section can be accessed by providing users password. Registered users can update their account and check learning process. If we want to login then we enter the user name and password and if there is a new student then student will fill the login form for registration.

After enter the user name and password student corner menu is opened as shown in figure 4.

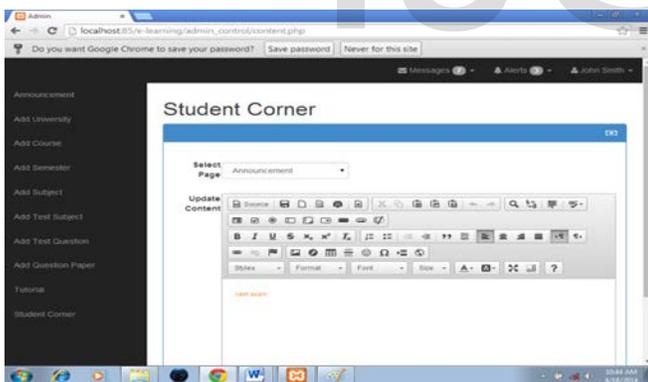


Figure 4 Snapshot of Student Corner

In student corner menu we can give any announcement. The following announcement will show on e-learning site.

In student corner menu In student corner menu if we click add question paper menu then we can choose University, Course, Semester, Subject and we can also add it and download it in any papers as shown in figure 5.

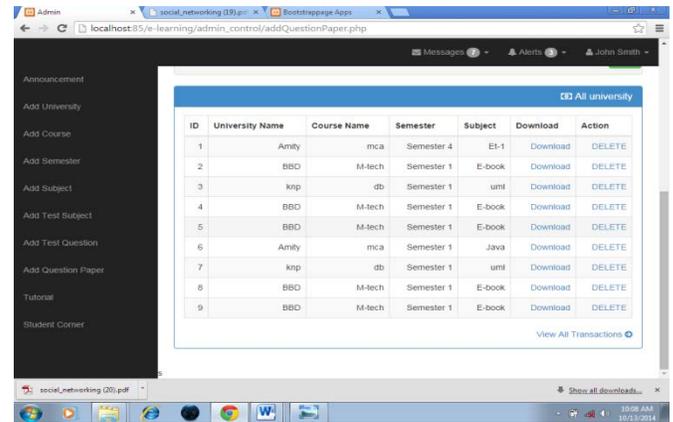


Figure 5 Snapshot of downloading question paper.

## 4 System Evaluation

To obtain some feedback about our Web based e-learning system, we demonstrate the effectiveness of our model using different type of courses .In this section we selected the Exercises/Quizzes service provided by the system and present the feedbacks of the students, as shown in Figure (6).

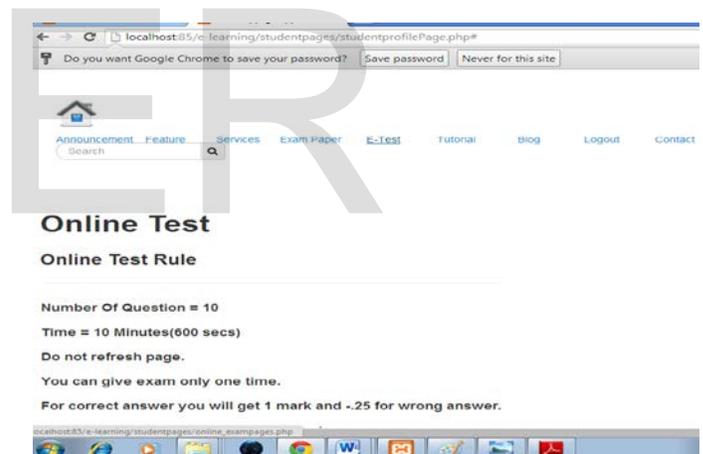


Figure 6 Snapshot of the quizzes

## 5 CONCLUSION

The main contribution of this paper is our new model for e-learning system, using the Semantic Web technology. Our model including various services and tools in the context of a semantic portal, such as: course registration, uploading course documents and student assignments, interactive tutorial, announcements, useful links, assessment, and simple semantic search.

A list of the technologies used in the implementation of our web-based e-learning system includes PHP Platform, Apache Web Server, MySQL database.

We believe that there are two primary advantages of our Semantic web-based model. One is that the proposed model, which contains a hierarchical contents structure and semantic relationships between concepts, can provide related useful information for searching and sequencing learning resources in web-based e-learning systems. The other is that it can help a developer or an instructor to develop a learning sequence plan by helping the instructor understand the why and how of the learning process.

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