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Proposed Model Of E-Learning Management System Using Semantic Web

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ABSTRACT

Today’s World Wide Web (WWW) well-known as Web 2.0 consist of social networking sites, blogs, wikis, and hosted services, video sharing sites, web applications, and so on. It also embraces E-learning Management system. It is a process in which we use the electronic medium to access the demarcated set of applications. Research works in the arena of E-Learning are characterized by a broad spectrum of applications, ranged from virtual classrooms to remote courses or distance learning. Because of a lot of limitations using web 2.0 for creating E-learning management system, now-a-days we use Web 3.0 which is known as Semantic web that recovers the limitations of Web 2.0. In this paper, we have proposed a model of “E-learning Management system using Semantic web technologies”, where course syllabus, teaching methods, learning activities and learning styles are included and it will be more appropriate in different learning institutions. We hope that it will provide a excessive feedback from both teachers and students.

Key words: E-Learning Management System, Semantic web, RDF, Ontology.

Introduction

Electronic base training is known as E-learning. A learner learns the instructional matters through the electronic technology. E-learning has a comprehensive range of learning strategies and technologies; from CD-ROMS, videoconferencing, TV lectures, and virtual educational work, corporate universities and many more but our main focus is on virtual education, based on Semantic web (Stephen E. Merrill et al., 2001). Research works in the field of E-Learning are signified by a broad range of applications, ranged from virtual classrooms to remote courses or distance learning. Web-based courses offer apparent advantages for learners by making access to educational resource very fast, just-in-time and consequence, at any time or place (Fayed Ghale et al., 2006). Semantic Web is a group of methods and technologies to allow machines to understand the meaning - or "semantics" - of information on the World Wide Web. It was “invented” by Tim Berners-Lee (amongst others), a physicist working at CERN in 1980s (Berners-Lee T. 2000). One of the hottest topics in recent years in the Artificial Intelligence (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 the Web performing complex actions for their users (Heflin, J., 2001). 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 (Gómez-Pérez, A et al., 2002). Ultimately, Semantic Web is about how to implement reliable, large-scale interoperability 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 (McIlraith et al., 2001). This is possible due to the advancement of present day high speed processor server computer (Azim.R.et.al2011, Faruque, M.R.I.2011-Islam.M.T et.al-2010). Because web is now available in mobile communications. Web 3.0 is highly related to mobile communication. Mobile communication performance depend of its different antenna performance (Mobashsher, A.T, et.al, 2010, Islam, M.T 2009- Shakib, M.N,2010).

Unfortunately, the Web was built for human consumption, not for machine consumption, although everything on the Web is machine-readable, it is not machine-understandable (Lassila,et al 1998). 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.

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Tim Berners-Lee (inventor of the WWW, URIs, HTTP, and HTML) himself that pushes the idea of the Semantic Web forward. The father of the Web first envisioned a Semantic Web that provides automated information access based on machine processable semantics of data and heuristics that use these metadata (Berners-Lee et al., 1999, Berners-Lee et al., 2001). The explicit representation of the semantics of data, accompanied with domain theories (ontologies), will enable a Web that provides a qualitatively new level of service, such as: intelligent search engines, information brokers, and information filters (Decker et al., 2000). Researchers from the World Wide Web Consortium (W3C) already developed new technologies for web friendly data description. Moreover, AI researchers have already developed some useful applications and tools for the Semantic Web (Scott Cost et al., 2002). 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. In this paper, we adopt a conceptual proposed model of E-learning Management system using Semantic web technologies such as Resource Description Framework (RDF), RDF Schema (RDFS), Web Ontology Language (OWL), Uniform Resource Identifier (URI), XML, and SPARQL.

Every Web-based application distinguished three basic levels that is: the Web character of the program, the pedagogical background, and the personalized management of the learning material (F. P. Rokou et al., 2004). They defined a Web-based program as an information system that contains a Web server, a network, 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.

They have presented a model for educational activities and educational materials (Juan Quemada et. al.). 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. Their 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. 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 modelling of how the systems manage interoperating educational data relevant to the educational process (H. Adelsberger et al., 2003). The IMS and SCORM models describe well the educational activities and system implementation, but not the educational contents knowledge in educational activities.

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 e-learning systems because it specifies the conceptualization of a specific domain in terms of concepts, attributes, and relationships. The hierarchical (ontological) 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.

Moreover, the number of ontology-cantered researches has increased dramatically because popular ontological languages are based on Web technology standards, such as XML and RDF(S), so as to share and reuse it in any Web-based knowledge system. Thus, we have devised a model that provides the contents structure using an ontology for a adaptive and intelligent e-learning system.

Followings objectives are set to achieve our aims.

- To identify the main reasons that brought up the semantic web development,
- To identify the problems for individual and a learner to adopt the semantic web
- To propose an ontology based Learning Management System(LMS) model

Why choose semantic web for our proposed E-LMS:

A new web generation, the Semantic web have a promising technique for improving the semantics Interoperability for e-learning components. Most of the Semantic web domain ontology is to receive a formal conceptualization of a single domain. The new-generation web, the Semantic web has the best capabilities for composition and reuse of materials and contexts of e-learning. The Semantic web provides an opportunity to
improve the metadata connected with e-learning materials and also expansion of the existing opportunities for e-learning stipulations (Hafiz waqasmalik et al, 2009).

Again it becomes possible to use concepts of the Semantic Web integration process in the adaptive composing of learning materials. Different specialized pedagogical knowledge becomes accessible for all interested systems over the Semantic Web. Note also that current LMSs like Blackboard CourseInfo or WebCT cannot be easily made intelligent educational systems not only because they lack ontological support (V. Devedžić et al, 2003). They also lack intelligent learner modelling, reasoning and adaptively, although they do provide presentation and management of learning material and scenarios, as well as database management and administration of learners.

Proposed Model:

In this paper we have proposed a Ontology based E Learning Management System where basic tools administration, Instructor, Learner are interrelated through Learning Resource (RDF) and Ontology-based Contextual Knowledge (OWL). Where each tool contains several elements that are given in the fig-1. This model is designed with six subsections, that are marked(1,2,3..6) in our Proposed ontology based E-LMS model in fig-2.

![Fig. 1: Elements of Proposed ontology based E Learning](image-url)
The subsections are:
I. Registration and Conformation
II. Course document distribution
III. Annotation
IV. Assessment
V. Useful Links and Tutorials
VI. Help & Discussion

The tasks of these subsections are given below:

I. Registration and Conformation:

To illustrate the overall procedure, we will go through an e-learning scenario. A student first search 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 a notification service. Otherwise, the user may find a suitable course among the offerings and then makes a final decision about registering for the course. Processing the registration can be seen as a complex service involving registering with the system, creating a confirmation notification, creating a student account (authentication/authorization), and providing learning materials. Here the fig. 3 shows a model that represents how to register with our proposed LMS.
Firstly a registration request is sent to the Instructor and instructor forward the request to the confirmation tools to check the validity of the learner. Then accept or reject message according to the result of confirmation tools is sent to the notification tools. If confirmation tool accept the learner request then student management tools under the Administrator parts doing the following things:

i) Create a student profile that is the learner gets his/her learning resources after log in.

ii) Save the Records to the database for further use.

II. Course Document Distribution:

LMSs are high-distributed systems over the Web. One course presents an integrated structure of many learning resources that can be hosted on different Web locations. The same resources can be combined with others in different courses. Also, more student groups can learn many courses at the same time. When Instructor finds new student under his specific course, he sends queries to the learning resources to search for learning content that is appropriate for the learner entity component. The ontological knowledge is added to the learning resources as a resource for contextual learning, and it may be searched by means of queries.

Here in fig-4 shows a course document model where publish document sequencing the query related course document by using a knowledge base of learning resources.
III. Annotation:

In our proposed LMS model, annotations might include the context in which the document is placed, links toward other similar objects, the relationship to other documents (some learning contents might be prerequisites for access to others), rating (which will be updated with other users’ ratings), etc. Importantly, however, the Learner will also be able to add his own, further annotations to personalize and enrich the learning material and Instructor may also include some annotation on that particular contents. Moreover, these annotations are not necessarily collected in one document – they may be dispersed throughout the Web. Here in the figure-5 when further annotations added with the learning content it also automatically converted this additional information to the RDF statements and add this new statement to the existing RDF statements repository for further use.

RDF specifications provide XML syntax for writing down and exchanging RDF statements (called RDF/XML), the repository is implemented as a set of RDF/XML files. However, the RDF/XML syntax is quite complex and developing an RDF parser is not a trivial task. Motivated by the need for an RDF parser and automatic conversion is done by using the Jena API, rap API, etc.

![Fig. 5: Annotation model](image)

IV. Assessment:

Main purpose of Assessment tools is to evaluate the performance of learners. Instructor provides exercises, quizzes or exam question towards learner for evaluation. Learner submits answer script to the assessment tools. Student may also submit papers on various topics to the control submit paper tools. Here in the figure -6 after evaluating the script and paper the assessment tools sends result the Monitor Student performance tools. Then finally the result is stored on the database and one copy is sent to the announcement tools for learner. In LMS, every moment the teacher can monitor his students’ results.

![Fig. 6: Assessment model](image)

V. Useful Links and Tutorials:
As our system is web based thus instructor may update information like useful links (displays a list of useful URL links that have been identified by the course instructors), interactive tutorial (about any course topics). All this job is performed by the manage Link & and other document tool. He can modify the learning contents during the student’s learning. Here in the figure-7 shows one of the most important tools of our model is update information. As most of the contents will initially be provided by the instructor in the form of links to small learning objects. All of these links will be annotated with RDF statements that will provide a description about the document/URL linked.

Fig. 7: Useful links and tutorials model

In case new links or documents the update information tools does the followings: When new link are added by the instructor then all related course document will be updated according to the link document. Especially when learners read some contents and instructor add or update link or information related to that contents then the lesson will update automatically without the request of learner. This update information is not a part of Learner or Instructor; it is an autonomous tool that performs its operation when any kind of update occurs in LMS.

VI. Help & Discussion:

This tools mainly deals with learners help by means of search, navigate or discussion. Here in figure-8 semantic search is used for finding contents with learner interest about any topics. Course navigator is used mainly for navigate through the all courses with its contents and related information. Both semantic search and Course navigator retrieve result to the learner by applying query on learning resource (RDF) and Ontology Based knowledge (OWL).

Fig. 8: Help & discussion model
In the given figure through collaboration tools the learners can also collaborate with other learners and teachers. This communication is mainly Synchronous or Asynchronous. When two or more learners or instructors are logged on, they can directly communicate with each other is Synchronous communication. But communication like e-mail to instructor is Asynchronous communication. There is also a predefined given time when Instructors are in online for synchronous communication with their respective Learners.

Conclusions:

The main contribution of this paper is our new model for E-learning Management system using Semantic web, using the Semantic Web technology. In our paper there are two primary advantages; 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. We hope that this proposed model will be very beneficial than other proposed model that we got from other research papers. 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. This proposed model will help to create E-learning management system using semantic web in any learning institutions.

References

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