Ontology Based Learners Style Compliant E-Learning System

Oluyinka Iyabo Omotosho

Department of Cyber Security Science, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

Abstract*: In the last decade the evolution of technologies forced an extraordinary interest in new methods for delivering learning content to learners. The role of technology has often been over estimated causing a myopic consideration of the critical issues in e-learning. This paper provides a general over view of e-learning and its importance and discussed the role of ontology in the context of e-learning. Herein, an efficient e-learning system with an ontology approach that provides a flexible access to information and resources at a time, place and pace at users' convenience was developed.*

Keywords: E-learning, E-learning system, ontology, learning space, knowledge base, Learning styles.

1. Introduction

Integration of Web-based e-learning systems to the knowledge acquisition process has been on the increase, as a mediation tool between the user and his knowledge. This accounts for the continuous proliferation of eLearning based systems ina very significant way, which are more adaptable to the user's profile, favoring the knowledge acquisition process. A growing number of physically existing tertiary institutions such as the universities, as well as online existing colleges, offers set of academic degree and certificate programs via the Internet at a wide range of levels and in a wide range of disciplines. E-Learning is learning utilizing electronic technologies to access educational curriculum outside of a traditional classroom. In most cases, it refers to a course, program or degree delivered completely online. Though each institution uses a specific system, they are all similar in their ability to present course material including class syllabus, assignments, quizzes, provide video and audioplus a whiteboard screen where the lesson is presented just like it would be on a classroom's video screenor blackboard [1].

Regardless of E-learning's aim at responding to the specific convenience needs of users, courses are instructor led and follow the same semester schedule as traditional courses and users must keep up with the scheduled course and duration. Unfortunately, most current e-learning platforms are yet include important features, such as students' learning styles and ability, capable of providing user adaptively in a satisfactory manner. Up till now, all users are exposed same learning objects and activities, which do not offer any reusability possibility due to the lack of granularity or access possibilities to different devices in an efficient way. Ontology, a promising research domain to overcome the most common problems for intelligent educational applications, allows specifying formally and explicitly the concepts that appear in a concrete domain, including their properties and relationships. This work however focuses on adapting eLearning platforms in compliant with learners style and ability with the use of ontology. The main objective being knowledge sharing which consist developing reusable software, reusable components and learning objects.

2. Related Work

E-learning comprises all forms of electronically supported learning and teaching. The information and communication systems, whether networked or not, serve as specific media to implement the learning process [6]. Also, eLearning is essentially the computer and network-enabled transfer of skills and knowledge. E-learning applications and processes include Web-based learning, computer-based learning, virtual classroom opportunities and digital collaboration [7]. Content is delivered via the Internet. Intranet/extranet, audio, video tape, satellite TV, and CD-ROM. It can be self-paced or instructor-led and includes media in the form of text, image, animation, streaming video and audio [7]. Today many technologies can be, and are, used in e-learning, from blogs to collaborative software, ePortfolios, and virtual classrooms. Most eLearning situations use combinations of these techniques [4]. Abbreviations like CBT (Computer-Based Training), IBT (Internet-Based Training) or WBT (Web-Based Training) have been used as synonyms to e-learning.

Today one can still find these terms being used, along with variations of e-learning such as eLearning. E-learning is first and foremost about learning. Without a focus on the learner, the learners' needs, and the aptitude of the learner, e-learning cannot take place. However, the enabler for allthis online learning is technology. An online learner cannot learn if he or she is encountering technical difficulties. F**ive** technology characteristics that is needed when selecting an e-learning solution includes programming languages, authoring packaging, learning management systems, content management system, learning Content Management Systems [6]. Ontology provides a common vocabulary, and an explication of what has been often left implicit. Ontology engineering has contributed several interesting aspects to modeling [8]. Guarino and Giareta [7] summarized several common definitions of ontology into a main consideration that ontology is a specialization of a conceptualization.

3. Architectural Framework

Our work consists mainly of ontology as discussed in sub-section A. The interface design details are then discussed in section **B**.

Other components include a user interface for uploading and accessing learning material and the OWL API/RDF that gives a high-level implementation of ontology concepts for integration into a web accessible format.

A. Ontology eLearning
The first step taken in the development of any ontology based application is the development of the ontology itself, a foundation on which every other development block is laid [9]. The ontology developed is meant to appropriate

modeling and classification of various concepts and reaching a consensus in the eLearning domain.

The ontology development is carried out using Protégé 4.1, an ontology editing tool in conjunction with the Protégé-OWL editor, which is an extension of Protégé that supports the Web Ontology Language (OWL). The ontology, developed is meant to appropriate modeling and classification of various concepts und reaching a consensus in the eLearning domain. Its logical consequences, i. e. facts not literally present in the ontology, but entailed by the semantics.

For proper modeling of the learning materials, the ontology developed in this work is used to integrate the main e-learning components, which include course material, course content, course, document format, learning style, learning ability, user, role and right as shown in Figure 1.
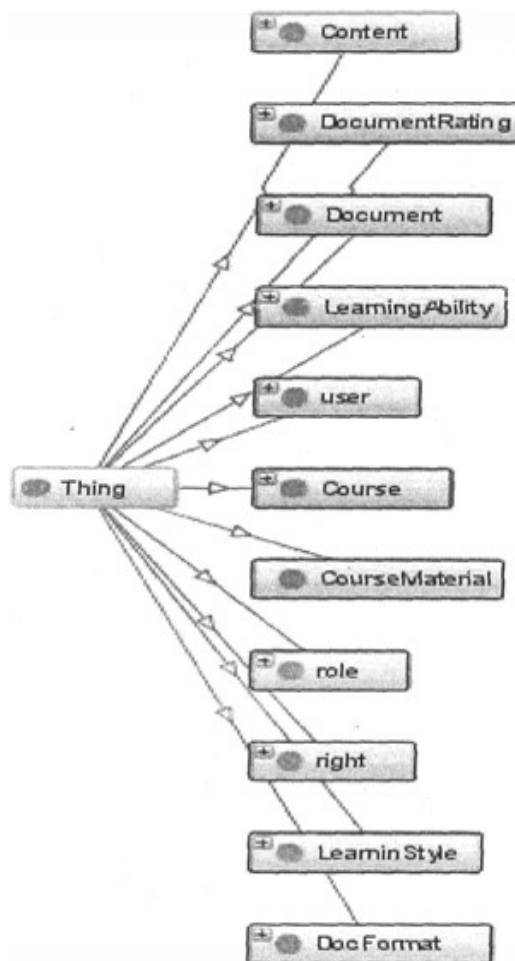

Figure 1: Ontology graph diagram showing eLearning top-level concepts/classes

All eLearning concept and entities are captured in a hierarchy as well as the relationship between such entities. Figure 21 gives a snapshot of the entire ontology. The diagram shows that various concepts or classes in the eLearning domain are greatly related in a top down approach. This enables the creation of successful and proper consensus. In the course building phase, the ontologies support lecturers in the activities of analysis and semantic annotation of learning materials and the definition of a

course content so as to fit into the knowledge base. In the course content phase ontologies support students in following a course from the eLearning platform. Students may follow the given learning path, or may dynamically modify it. The domain ontology plays a vital role in modeling structure of ontology in relation with the courses. Figure 2 shows the Ontology graph diagram showing relationships between eLearning entities
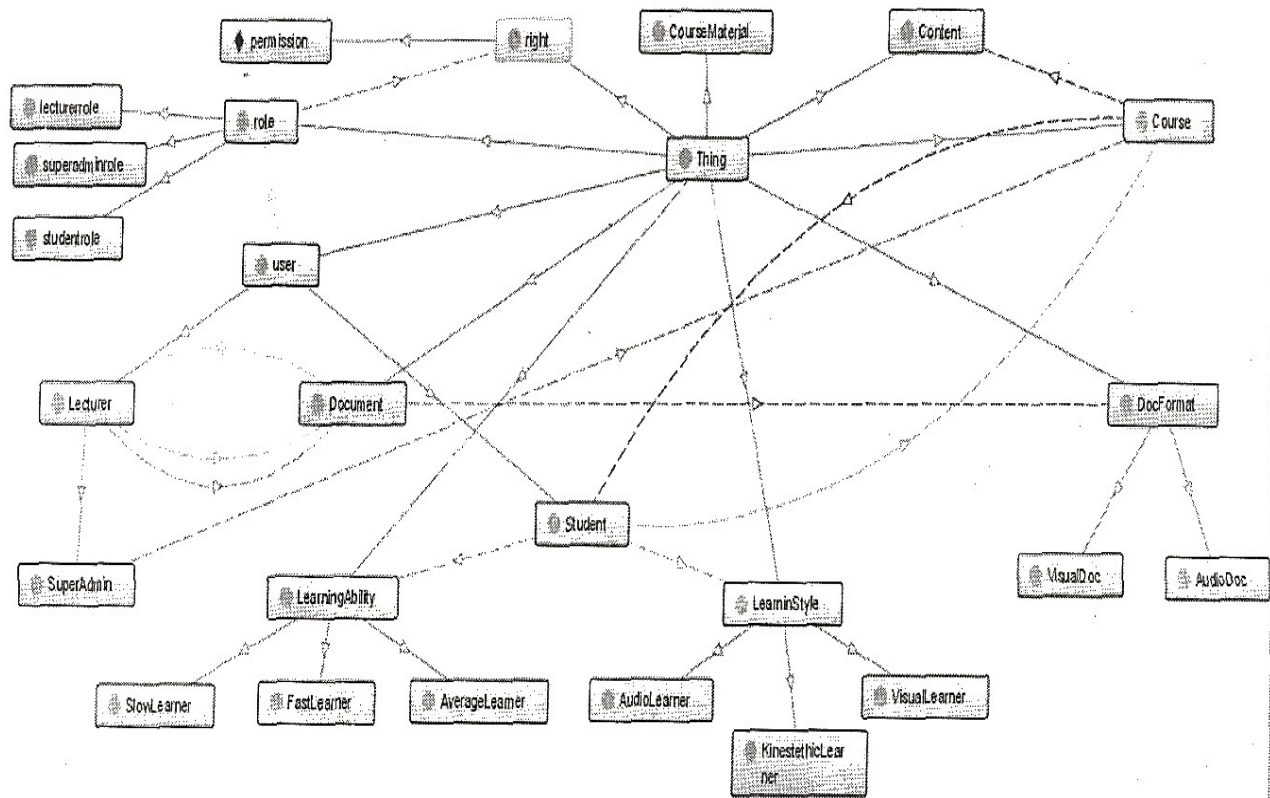
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Figure 2: Ontology graph diagram showing relationships between eLearning entities

Ontology Classifications or Specializations

With the eLearning ontology model that was developed, three major classifications were made; Document Classification, User classification and the Students' classification. This classification helps us to be able to effectively search for all the documents that match students criteria. Everybody that can interact with the ontology based system is seen as a user. The interaction of various users with the developed system is based on the area the user belongs to in the user classification.

Document Classification

As documents are being uploaded by lecturers, their ratings are specified. This enables the framework to carry out proper search of the documents when a student needs it. A matching is done using an appropriate matching technique. The document rating relationship is depicted in Figure 3.

Figure 3: Document Classification

Student Classification

Students are classified based on two criteria: Their learning ability and their learning style. Their learning ability is related to their level of understanding while their learning style is associated with convenience of studying. The relationship is interpreted as shown in Figure 4. The broken line between the student concept and the discussed generalization depicts a sense of possession; i. e. a student has Learning Ability also Learning Style. The Figure also emphasizes three types of students based on their learning ability: Slow learner, Fast learner and average learners. Also based on the learning styles, we have Audio Learner, Visual Learner and Kinesthetic Learner.
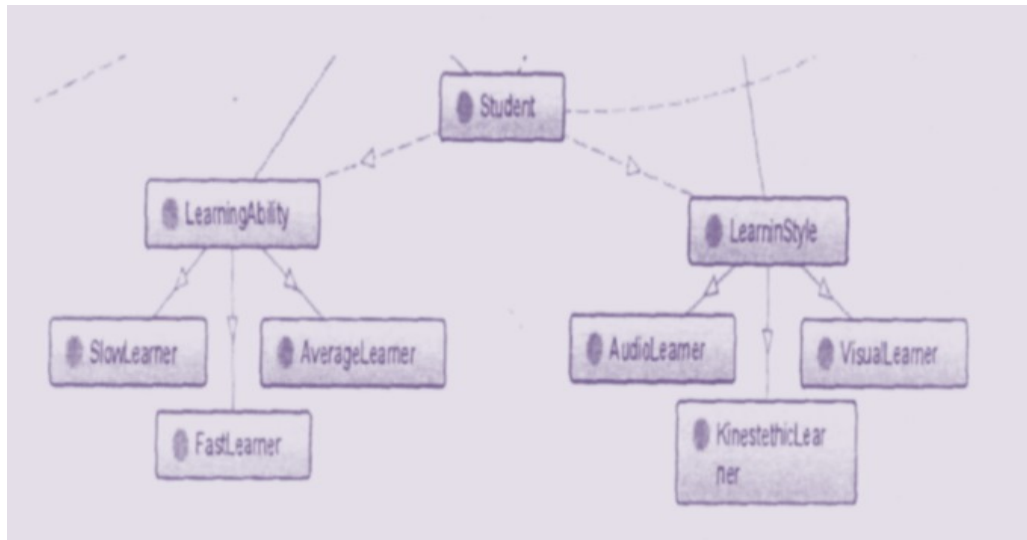
Figure 4: Student Classification

User Classification

The users of the eLearning system developed are also classified based on their roles and interaction with the system. This is determined by the permission that is attached to each of the created roles. From the user classification shown Figure 5, we have two main users: The Lecturer and Student, the super admin is just a role that has been created from that of a lecture, i. e. a super admin is a lecturer that has a higher permission. Super-Admin is created from the further classification of the lecturer concept.

The classes and object properties are also arranged into subsumption relationship with the classes instantiated. This definition encodes essential background knowledge into the ontology that enables consistent and correct inferences to be made at the point of eLearning access.
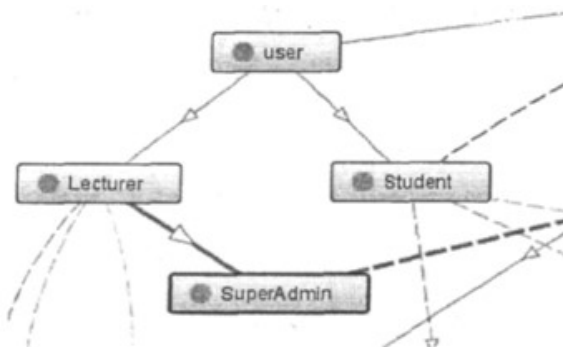

Figure 5: User classification

Interface design

The developed ontology requires an interface, being a web based in this work, to access the knowledge represented in it. Hence a web based application was developed. The application was developed as a web based application using ASP. net and C#. The developed eLearning ontology is imported into the ASP. net web service using a custom framework that can interpreted the OWL/RDF framework that was developed as discussed in section 3.1. Figure 6 shows the integration of protégée with ASP. Net.

With the design, a lecturer can upload course materials and categorize them based on their level of difficulties. This is very important and helpful in being able to match the students search and learning abilities. It is the role of the super admin to create courses and also attach lecturers to courses. It is the lecturer that has been attached to a particular course that can upload materials for the course and also manage the course. Students Login into their eLearning portal. Using the developed ontology, students are matched with the various materials that match their style. The classes identified in the ranges from the students who searches for materials to lecturers that uploads the document. Users are classified based on interactions with the system and their roles.
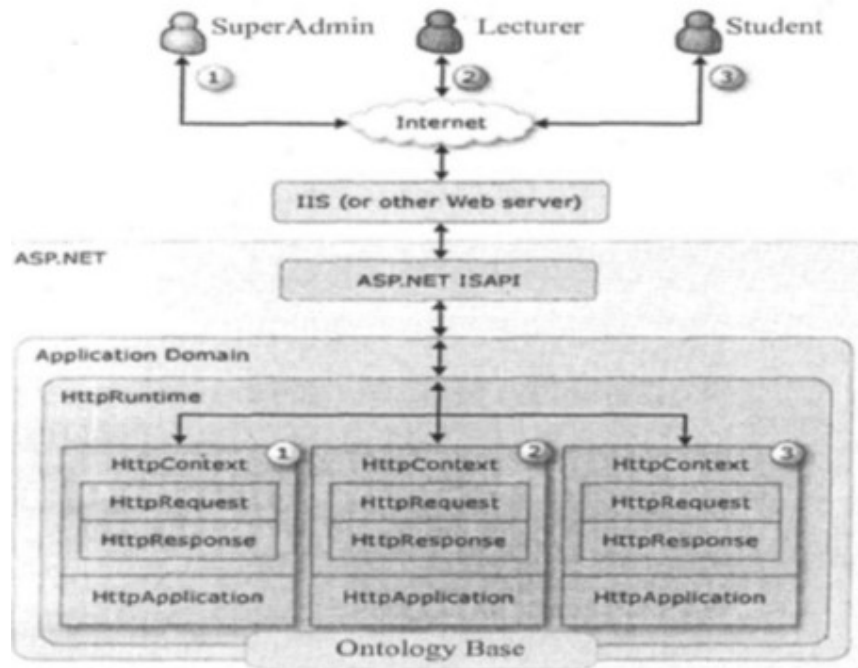
Figure 6: Integration of Protégé with Asp. Net.

4. Conclusion

Faced with the challenge of generalizing learners and learning objects in e-learning, the concept of ontology is employed to define and re-engineer the system to eliminate static learning materials and provide a personalized learning space based upon the learners style and ability. It is therefore good to say that ADAPTIVE ONTOLOGY BASED E-LEARNING APPLICATION has effect dynamism into e-learning.

References

[1] Patrick S., Jerman M. and Brian D. (1967). Computer assisted Instruction: New York: Academic Press, 371 pp.

[2] Kapp, K. M. (2003). Five Technological Considerations When Choosing and E-Learning. Solution, Elearn Magazine. http: //www.elearnmag. org.2003.

[3] William D. Graziadei, (1993), Strategy for Technology-Based Course Development and Management.

[4] Jasper R. and Uschold M. (1999), Four Main Use Cases of Ontology.

[5] Nielsen, J., and Molich, R. (1990). Heuristic evaluation of user interfaces, Proc. ACM CHT90 Conf. (Seattle, WA, 1-5 April), 249-256.

[6] Billings and Moursund (1988), The E-Learning Revolution.

[7] Guarino and Giareta (1995), E-Learning based on the semantic web.

[8] Mizoguchi, R. Task ontology for reuse of problem solving knowledge, Proceeding KB&KS95, Enshede, The Netherland, 1995.

[9] Sampson Abel (2003), Ontology and the Semantic Web for E-learning.

[10] Paul Owiizo (2004), A Document Ontology and Agent Based RDF Metadata Retrieval, maya.cs.depaul. edu/../dinos. pdf

[11] Owl 2 Web Ontology Language Structural Specification, www.w3.org/tr/owl2-syntax/

[12] The Jena Ontology API. jena. sourceforge.net/ontology/

[13] Zareen Syed, Tim Finin and Anupam Joshi. Wikipedia as an Ontology for Describing Documents. Zarsyedl[at]umbc,edu, www.slideshare.net/zareen/wikipedia