Semantic Web Technology and Ontology designing for e-Learning Environments

Shaileshkumar K. Patel[#], Dr. Harshad B. Bhadka[*]

[#]Assistant Professor, Department of MCA, Atmiya Institute of Technology & Science, Rajkot, India.
Ph.D. Scholar, School of Computer Science, RK University, Rajkot, India.

[*]Professor and Director – MCA, C. U. Shah University,
Surendranagar, India.

Abstract— **A million of websites and billions of documents are presents on the current web. These documents are arranged in unstructured manner on the web. So retrieving the correct information from the web is becoming very difficult. This is because the web documents are connected using the hyperlink only without any relationship among them. Semantic web technology (SWT) solve this problem. SWT links the documents on the web in the meaningful way by the means of relationship among web documents. So retrieving the relevant document is becoming possible. In the first section of this paper describes the problems of WEB 2.0 and the usefulness of SWT. Second section introduces the key techniques used for building semantic web application. Third section is about the limitation of current e-learning environments. Forth section in this paper is shows how the limitation of current e-learning can overcome using the SWT. And in the last section presents the development of ontology for proposed e-learning environments.**

Keywords— **Semantic Web, Ontology, RDF, SPARQL, Metadata.**

I. INTRODUCTION

Fig. 1 shows the unstructured data means the data which are not stored in any predefined data model and followed a very textual mode for storing data. According to Fig. 1, the web documents are in the form of unstructured manner and they are just interconnected with each other using hyperlinks without involving any sense among them. So the retrieving information from the WEB 2.0 is becoming complex. Therefore there is an essential requirement of human involvement into the retrieval and categorization of relevant information from Web 2.0. Semantic web technology enables a web talking to machines, where machines have enough processing power to identify the correct needs of user because SWT follows the structured way for keeping the information [1]. This structured data follows some data model to store information like RDF. In this RDF data are easily organized so retrieval of data from web become possible very easy and fast. Fig. 2 shows, web documents are interrelated with some relation to each other in structured way and will be use RDF to store them in triple format [2]. A triple is like the single facts like University hasDepartment Engineering.
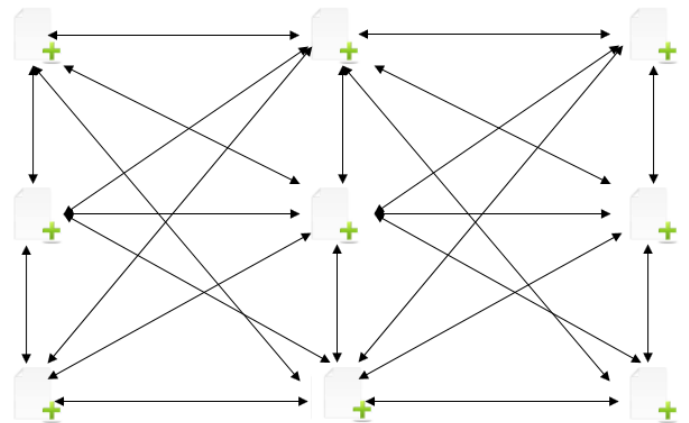

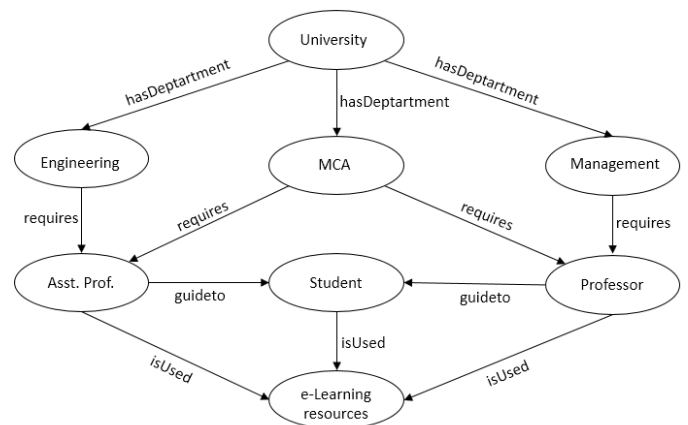Fig. 1 Web documents are interconnect with each other in unstructured manner in WEB 2.0

Fig. 2 Web documents are interconnect with each other in structured manner in SWT

II. THE SEMANTIC WEB

Semantic Web is not the separate web but it is the extension of the current web which make possible information to share and reuse. SWT provides such environment so that machines can talk with each other to fulfil the needs of the user by providing the right information. To accomplish this task, SWT uses the number of techniques like Ontology, RDFs, XML and SPARQL.
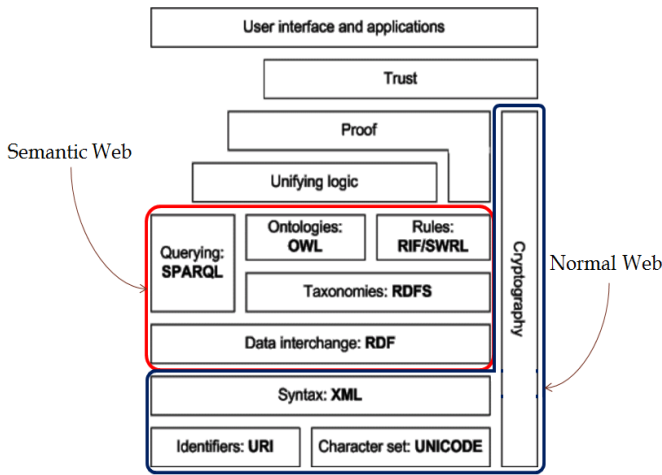
Fig. 3 Semantic Web Architecture [3]

A. RDF

RDF stands for Resource Description Framework and it is a graph data model similar like relation data model to organize data into the more meaningful way. The data things are organized with its attribute via links in the form of relation. For example, Indian rupee is the currency of India. There are two things named Indian rupee and another is India. These two things are interrelated with each other by the link "is the currency of".

RDF consists of a triple. That is subject, predicate and object [4]. It is used to describe the various attributes of thing like name, DOB, city.
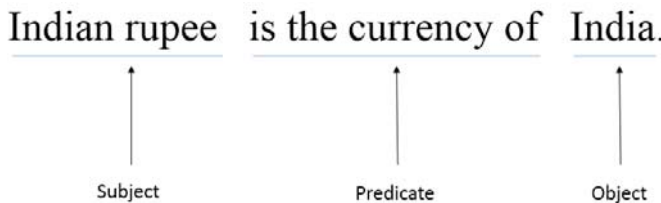

Fig. 4 RDF data model

B. Ontology

Ontology is an explicit specification of conceptualization [5]. Ontology is helpful to create semantic web application to share and reuse information [6]. There are number of tools available to create ontology. Here, we use Protégé tool to create ontology for creating proposed e-learning environments using SWT.

C. SPARQL

The Simple Protocol and RDF Query Language (SPARQL) is a SQL like RDF query language for databases, able to retrieve and manipulate for any data stored in Resource Description Framework format [7] [8].

D. Software Agents:

They are software programs that can discover and process information from the web and then exchange these information among them [9].

E. Meta data:

Metadata means the data about the data which is used to describe data. It is used to understand more about the web document data [8].

III. LIMITATION OF CURRENT E-LEARNING ENVIRONMENTS

E-Learning (electronic-learning) is just learning using technologies like computer system, internet, and network [1]. Current e-learning environments is developed in computer programming languages. It works according to how it programmed well in advance. Sometimes it fails to supply learning resources according to the learner's needs, and produce irrelevant results which are not match to learner's query and interest. So that learner has to involve and spend time to categorize the web results which he/she actual require to learn [10].

IV. PROPOSED E-LEARNING ENVIRONMENTS USING SEMANTIC WEB TECHNOLOGY

The proposed work will solve the problem of previous e-learning environment and will be prove a better e-learning environment which is based on semantic web technology.

The proposed work first identify the needs, interest, media to learn i.e. audio, video, pdf and other, background, profile, knowledge level, search history of the e-learner before delivering the e-learning resource results to e-learner. Based on the said factors the proposed model exactly identify the actual requirements of e-learner and produce only such relevant learning resources to e-learner. The important thing is in this approach is that discovering, identifying, categorizing and presenting the relevant results to e-learner is performed by the machines not the human. So the learner can spend more time in learning activities and feel better learning environments. This mechanism will work on the various techniques of Semantic wet technology like Ontology, RDF, SPARQL and XML.

V. ONTOLOGY DEVELOPMENT FOR PROPOSED WORK

The core part of SWT is developing an Ontology [11]. This paper and section covers and explains the development of ontology for proposed e-learning environments. The ontology discuss here is developed in the Protégé tool. It is freely available, open source, having a great set of plug-ins, GUI based and also popular.

Fig. 5 shows the ontology building for proposed e-learning environments, which has three major classes Learner, LearningObjects and University. Learner class contains three subjects like student, teaching staff and non-teaching staff. LearningObjects class having number of subjects like Quesiton bank, assisngment, material, Lab manual and many more. And finally the University class having the four subjects like department Engineering, ComputerScience, Management and Pharmacy. Fig. 6 represents the object property assigned to various subjects of different classes. Fig. 7 is facility of protégé that shows the visual representation of the different classes created under the proposed e-learning enviournments.
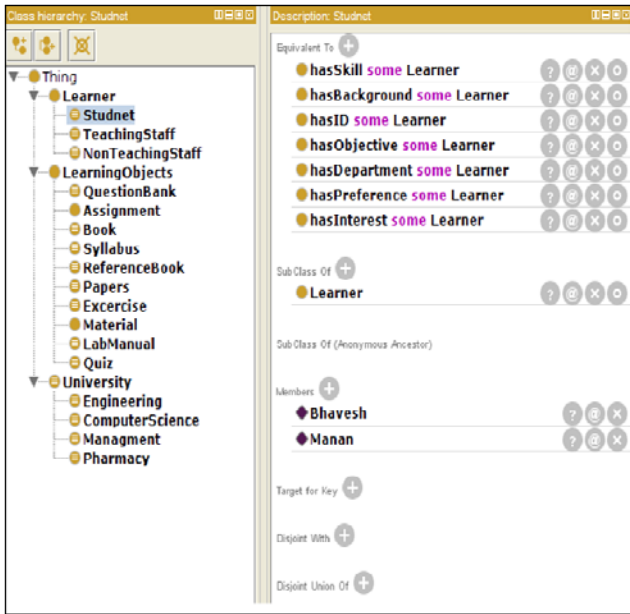
Fig. 5 Class hierarchy for proposed research work

Fig. 8 focus on Leaner class which shows the how the various subjects, data member and different properties are associated with it. Finally Fig. 9 the ontograf for the ComputerScience class with the data member, properties.
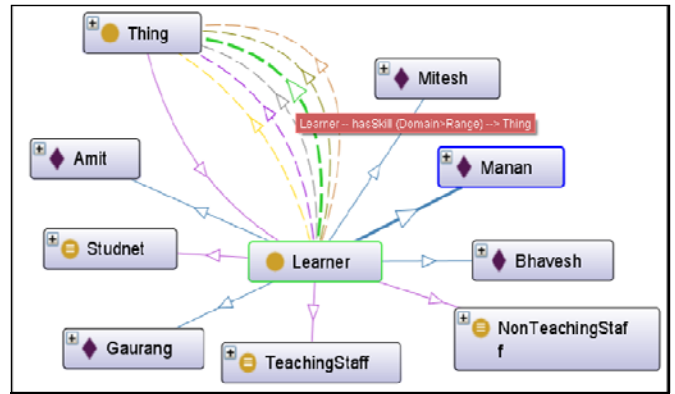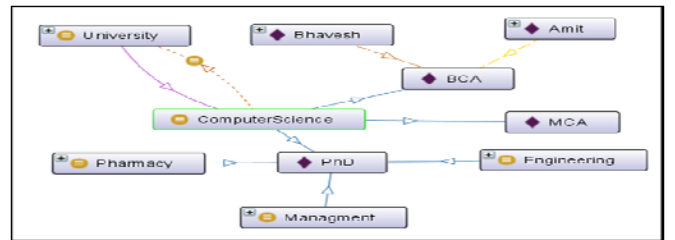

Fig. 6 Object Properties

Fig. 7 OntoGraf for the three classes

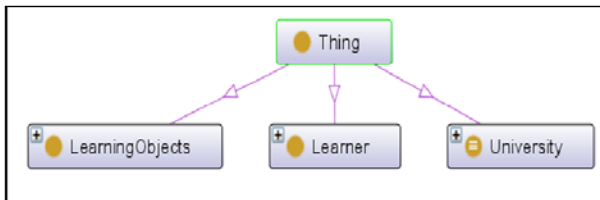Fig. 8 OntoGraf for the Learner class

Fig. 9 OntoGraf for the ComputerScience class

VI. CONCLUSIONS

The proposed research work solve the limitation of current e-learning environment by providing most relevant learning resources to e-learner quickly. A learner need not require to discover, identify and categorize the learning resources which are provided by the proposed e-learning environment. Because the previous e-learning approach work on the predefined algorithm and software program, they are not enough powerful to understand the learner needs and requirements dynamically. This problem will solve in the proposed work because this new approach is based on semantic web technology and the e-learning resources are interrelated with each other in the sense of some relation in structured manner.

REFERENCES

[1] S. K. Patel, H. B. Bhadka, "Automatic Discovery and Presentation of highly Personalized E-learning Resources: A Survey," *International Journal of Advanced Technology & Engineering Research (IJATER)*, vol. 3, pp. 25–29, Mar. 2013.

[2] N. Shadbolt, W. Hall, Tim Berners-Lee, "The Semantic Web Revisited," *IEEE Computer Society,* pp. 96–101. May-Jun. 2006.

[3] G. Abraham. (2013) The Semantic Web Architecture. [Online]. Available: http://semanticsage.blogspot.in/2013/03/the-semantic-web-architecture.html

[4] J. Hebeler, M. Fisher, R. Blace and A. Perez-Lopez, *Semantic Web Programming*, M. Dean and M. Smith, Wiley, United States, 2011.

[5] F. Colace, "Ontology for E-Learning: A Bayesian Approach," *IEEE TRANSACTIONS ON EDUCATION*, vol.53, pp. 223–233, May. 2010.

[6] Y. Hong-yan, X. Jian-liang, W. Mo-ji, X. Jing, "Development of Domain Ontology for E-learning Course," *IEEE,* pp. 501–506. 2009.

[7] (2013) The World Wide Web Consortium website. [Online]. Available: http://www.w3.org/

[8] L. Rui, D. Maode, "A Research on E - learning Resources Construction Based on Semantic Web", in *2012 International Conference on Solid State Devices and Materials Science*, Elsevier, p. 1715 – 1719

[9] T. Segaran, C. Evans, J. Taylor, *Programming the Semantic Web*, 1st ed., M. E. Treseler, O'Reilly, Jul. 2009.

[10] T. Lendyuk, S. Rippa, "Information Portal of E-Learning System in Semantic Web Environment", in Proc. The 6th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications, 2011, paper 978-1-4577-1425-2/11, p. 637-641.

[11] S. Ram Kannan, P. Saravanan, "Implementation of Ontology in Intelligent E-learning System Development based on Semantic Web," *International Journal of Research in Engineering & Advanced Technology*, vol. 1, pp. 1–6, Mar. 2013.