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Implementation of Ontology in Intelligent E-learning System Development Based on Semantic Web

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Abstract- It is visualized that Ontologies and Semantic Web technologies will influence the next generation of E-learning environment. Ontology provides flexible educational platform architecture for E-learning environment. The success of the Semantic Web depends on the procreation of ontologies. In general, Ontology based Learning supports the construction of ontologies by an ontology engineer. It takes over the ability to act in a genuinely intelligent manner by assessing the academics initially and providing personalized suggestions to the academics indicating their strengths and weaknesses. This ontology learning framework proceeds through ontology importing, extracting, pruning, refinement, and evaluating giving the ontology engineer a wealth of coordinated tools for ontology modelling This tool has been developed with the view of providing software based training to potential engineers and educating them. We construct a ontology model for separate learning domains and provide an effective method for enhancing learning effect of students through construction of course ontology which includes trainer and academic ontologies. This paper focuses on the development of ontology-based E- learning support system which allows academics to build dynamic learning paths. We also present an approach for developing a Semantic Web-based intelligent E-learning support system, which focus on the Web Ontology Language RDF and OWL. Additionally an automated and an intelligent e-learning service system have been developed.

Keywords – E-learning, Semantic Web, RDF, OWL, Ontology.

I. INTRODUCTION

E-LEARNING, refers to online learning or electronic learning, allows users to access learning contents and materials anytime, anywhere. Our aim is to use Semantic Web for the provision of distributed information with well- defined meaning, understandable for different parties based on Ontology combines the of context, content and structure of the learning materials, providing flexible access to these learning materials. Development of Ontology- based E-Learning support system by using a Semantic Web allows learners to build dynamic learning paths and how the Semantic Web resource description formats can be utilized for automatic generation of hypertext structures from distributed metadata.

This project focuses on the development of ontology-based E-learning support system which allows learners to build dynamic learning paths. We also present an approach for developing a Semantic Web-based E-learning system, which focus on Web Ontology language RDF and OWL. Additionally an automated learning service system has been developed. Our e-learning support system project aims at creating, integrating and interfacing of multiple ontologies on different layers, such that all are grouped together under a single ontology called domain ontology. This tool has been developed with the view of providing industry-oriented training to potential engineers and educating them. It gives flexible educational platform architecture for E-learning system.

The proposed work includes:

- Structured E-Learning Websites – with relationship.
- Effective Search engines with exact result. (along with dynamic keyword prediction)
- Includes Semantic Web that makes searching user-friendly (Directly tied to the specificities of the web environment).
- To build Dynamic Learning Paths through understanding curriculum.
- Tests for the levels or courses completed and Score cards mailed to the test takers.
- Best material for people preparing for the placements since it takes them across a tour to the necessary courses.
- Making use of OWL("Semantic Web Vision") increases the machine interpretability.
- YouTube videos with online or offline streaming and External Website Contents.

E-Learning content are directly tied to the specificities of the web environment as shown in the architecture diagram. All the Semantic Web technologies are used in this paper.

II. SYSTEM ARCHITECTURE

The architecture of the developed e-learning system consists of four important parts namely :

- Learning environment
- Semantic web
- Repository
- Administrator

LEARNING ENVIRONMENT:-

The learning environment consists of all the events that prevail in the system for students. The registration work consists of the process were the students who wish to take up their learning have to first register themselves with all the required details and information. This will gain them an entry to view the system that contains the course details. The course details consist of all the necessary details that the student wishes to take. It will contain the list the courses and the courses available. From the list, the desired course is selected. Also the different modes of learning will also be mentioned which makes them to select their necessary course. The internal tutorial is the place where the students can find the availability of notes from various faculty members and from reputed colleges and also people who have knowledge about the various courses. The external links is where there is the availability of various types of resources namely the PDFs, videos related to all the courses present both online and offline.

SEMANTIC WEB:-

Semantic web is the main part of the system where the search process takes place. It contains parts such as learning XML, learning paths, learning servers and metadata. Metadata consists of various data about the data that is present. The search process by the semantic web includes making search with the feature of more machine interpretability.

REPOSITORY:-

Repository is the database of the entire system. It is the place where the RDF files, OWL files are present. It contains the entire details of data present. It is the heart of this ontology system where there is complete presence of the entire data. Any information required will be fetched only from this repository. It also includes the student database which contains all the required details of the students who enter into this system. Any student's complete details will be present in this student repository.

ADMINISTRATOR:-

The administrator is the sole person who controls the entire functioning of the system. The administrator appoints people to take the sub functions namely evaluator, instructor, advisor where they perform roles like evaluating the performance of the students based on the tests they take, instructor instructing the students with the functionality of the system.

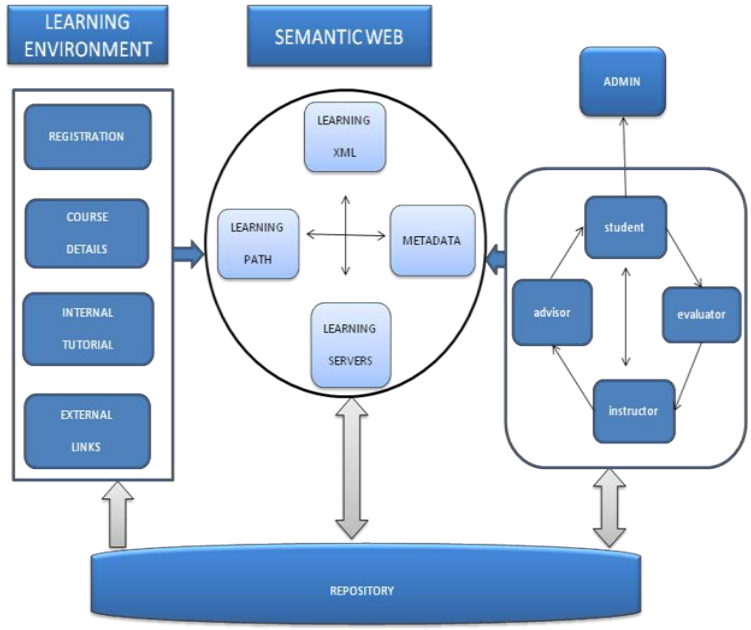

Fig. 1. The System Architecture of our ontology-based learning support system.

III. STRUCTURE of ONTOLOGY MODEL

The hierarchical structure of course ontology is depicted in Fig 3. Course ontology is constructed from one or more of academic-based ontologies, trainer-based ontology, several sub-domain based ontologies and learning materials. Trainer-based ontology contains learning concepts and knowledge structure based on several domain ontologies. Also, trainer-based ontology is schema ontology to be referred by academic-based ontologies. Academic-based ontology contains concepts and knowledge structure created by students. When a trainer presents learning courses, students investigate the courses and extract meaningful concepts and knowledge structure to create a new academic- based ontology or extend existing academic-based ontology during their learning process.

Session ontology is described as following 3-tuples, *<C, I, P>*. The symbol C, I and P represent class, instance and property. We explain the structure of trainer-based ontology and academic-based ontology based on above 3-tuples in following some paragraphs.

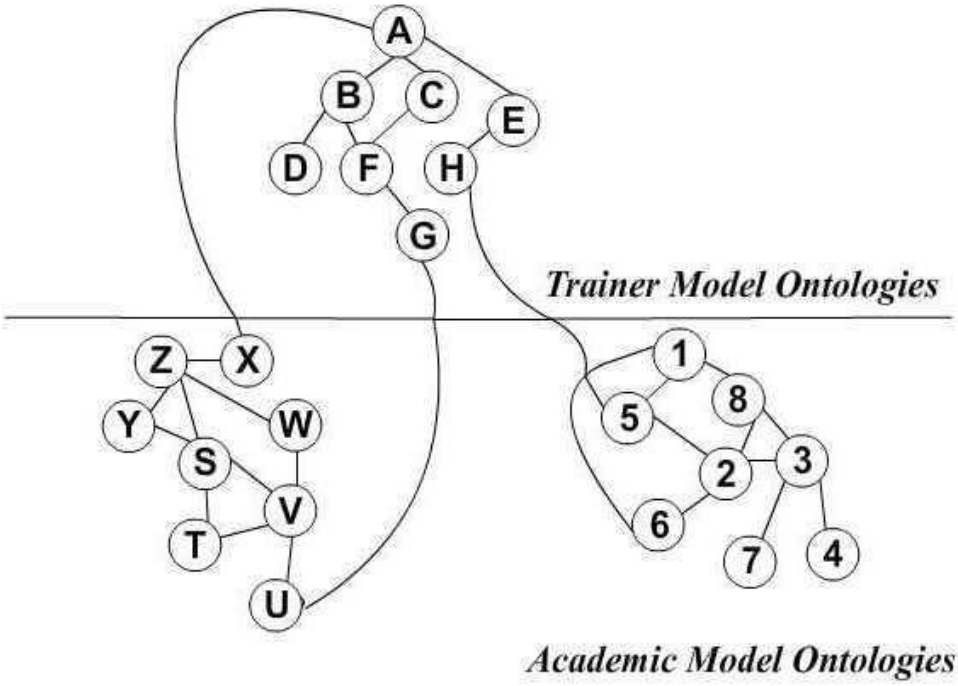

Fig. 2. The Building of Domain Ontology Development Model

OWL makes it possible to describe concepts but it also provides new facilities. It has a richer set of operators - e.g. intersection, union and negation. It is based on a different development model which makes it possible for contents to be defined as well as described. Academic and Trainer concepts that are complex can be built up in definitions out of simpler concepts. Furthermore, the development model allows the use of a synonym checker which can check whether or not all of the statements and definitions in the ontology are mutually consistent and can also recognize which contents fit under which definitions. The synonym checker can therefore help to identify the exact definition and meaning of each term. This is particularly useful when dealing with cases where classes have complex relationship.

IV. DESIGN FLOW DIAGRAM

Any user who needs to search for a topic can input for a keyword for the domain through the web based interface of the tool. The User Interface uses an ontology search engine to retrieve ontology files from the repository which contains the keyword that is mentioned. The ontology search engine performs a string search on class names, sub- class names and property names using the specified keyword in the ontology files containing various data of various languages. The relevant ontologies are kept in the repository. The user interface present has another important function to do namely finding the synonyms for the given keyword. The main reason behind is that the keyword may not exactly match the terms that are present in ontologies.

The synonyms found is given to the User (designer).The class extractor then processes the relevant ontologies that are in the repository and extracts the class names. With these class names returned the process of searching can be returned again until the refined required class is obtained. Since the above search leads to many new keywords on refining the User (designer) should maintain a data set that includes the knowledge about the domain in a wider sense. The User (designer) chooses the most relevant concepts that become the classes in the class diagram.

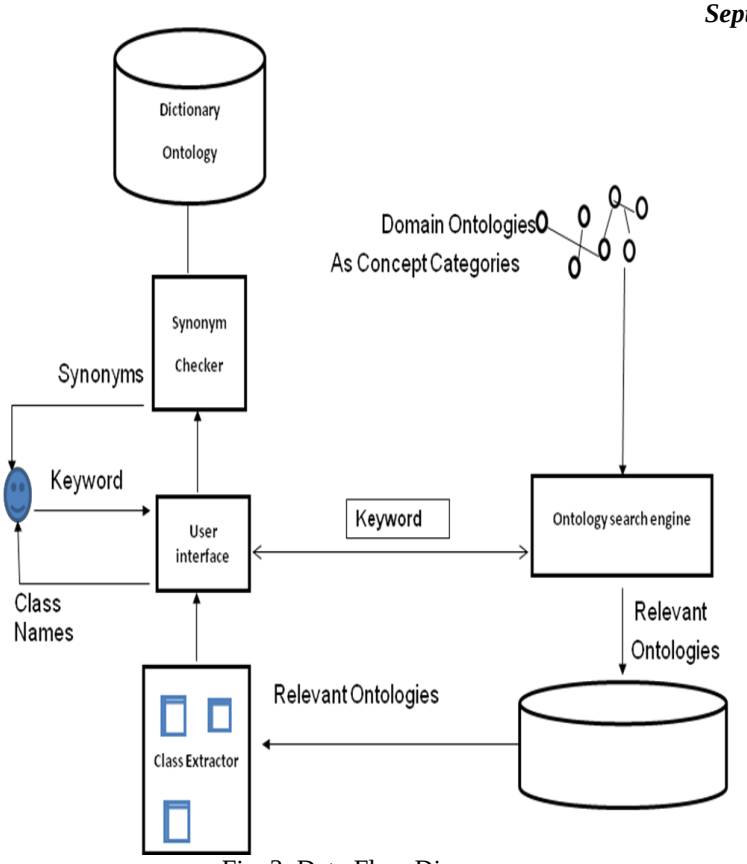

Fig. 3. Data Flow Diagram

V. LEARNING OUTCOMES

The graph depicted in Fig 4 shows the values of learning outcomes before and after applying learning ontologies to class. We compute the values of learning outcomes of students through evaluating of quiz, exams, homework, and so on. We define learning outcomes as follows:

- LO1 – Understand fundamental concepts of learning subjects.
- LO2 – Understand semantic relationship between concepts of learning subjects.
- LO3 – Problem understanding and solving ability.
- LO4 – Knowledge structure identifying ability.
- LO5 – Knowledge representing and sharing ability.
- LO6 – Critical thinking ability.

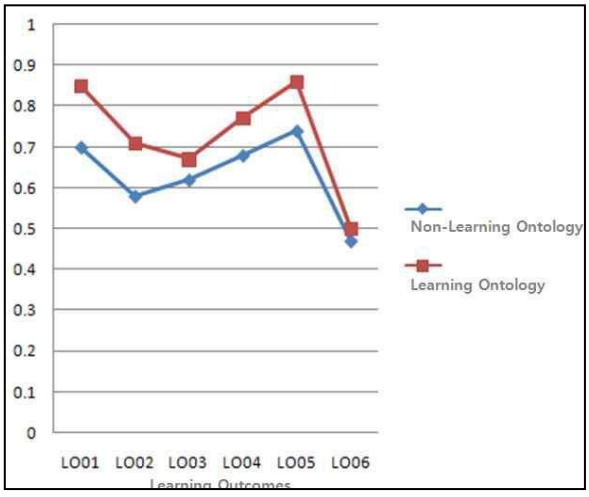

Fig. 4. Learning outcomes before and after applying subject ontology to class.

V. CONCLUSION

The proposed system contains all the features that were discussed in the earlier chapters. This includes a friendly user interface that makes the system very accessible to everyone irrespective of their computer knowledge. This system provides the learners to take course in the important subjects namely data structures and artificial intelligence. A person taking the course as a beginner is assured of turning a pro after the successful completion. The varied features includes the syllabus of all the engineering courses, happening events namely conferences, symposiums. The true assessment of the learner's knowledge in the subject allows visualizations and the dynamic learning path provide a better facility and a great experience through this virtual campus via their digital literacy.

Learning or gaining knowledge is one of the key aspects for a student. So the basis for the creation or any innovation we do comes only when we learn the concepts in depth. This site allows students to learn the concepts easily in which each concept is well organized based on their classifications. It is very common that people understand a concept or the basis from which it has been derived when given in the form of a flow chart. That is what we have implemented – ONTOLOGY in E-LEARNING. This website is implemented for engineering students to learn their course.

We applied the ontology concepts for the Data Structures domain to evaluate the effectiveness of Intelligent E-Learning support system. We found that this system increases the learning outcomes of students those who have undertaken this course of study.

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