

Implementing E-Learning Ontology to Scale For Provenance

Amit Kumar Bajpai, Rajiv Pandey, S P Tripathi

Abstract: This paper explores the aspects of providing education through E-learning model evaluating its relevance to distance education and for ICT systems. A subset of E-learning is a Web based learning that makes the learning -easier, impressive, structured and properly managed. The paper defines an university ontology describing how e-learning provides resources which are available online and designated cloud that can be delivered anywhere any time among the users. In the proposed model data is stored in designated cloud and users are able to share efficiently the same as it provides services to learner. Provenance or trust with respect to the academic resource is a major concern in these types of models, users accessing data must be trustable which help learners, researchers, developers, and users in future work also. This paper proposes an e-learning model which is well organized and structured, such that the machine responds with the accurate, trustable, desired information and results. The paper defines an ontology for semantic structuring, semantic rendering and applies provenance on suggested ontology to achieve authentic results. It is also desired to establish trust of the source contents of the Semantic Web, with the result that a user receiving data will need to verify whether the received data from source is in fact trustable or not. The defined ontology is suitable for consumption of both man and machine in the context of the e-learning and Semantic data rendering Web Keywords
ICT (Information and Communication Technology), Ontology, Semantic web, CMS (Content Management System), LMS (Learning Management System)

I. INTRODUCTION

E-learning is a modified version of Distance Education used to achieve better training and education through ICT (Information and Communication Technology). ICT is defined as a “diverse set of technological tools and resources used to communicate, to create, disseminate, store, and manage information.” E-learning uses an information network- the Internet, an intranet (LAN) or extranet (WAN). These networks are wholly or partly used for interaction, course delivery, evaluation and/ or facilitation. E-learning is also preferred as online learning, which is delivered with the help of electronic devices. Electronic devices are necessary in teaching and education. In present scenario available system are not fulfilling the need of users and are insufficient. For the actual need of learners, educational development and as per demand it is not sufficient to impart education among the entire segment of the society in time and place. Now with the help of I.T. technology a gap may be reduced between learners and quality oriented resources. However, in conventional e-learning model, a system with specific network, a required

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band width and maintenance related issues at the users’ side or institution located in interior which results a lot of problem. In the mean time these issues can be overcome using Cloud computing which helps learners in terms of its dynamic approach and usage of resources accurately. it can be successfully implemented if resources are limited. [1]. All future e-learning models are bound to be cloud based for its advantage of availability, scalability and cost [2], [12]. In order to enrich resources eg., study material, extensive use of audio/ video a system must be capable to reaches learners by making use of multiple delivery systems. Such a delivery mechanism must provide the learners with the flexibility to accommodate the changes from user’s side regarding change of location etc. Technologies are to be applied to make efficient way for supporting learners to be able to achieve the desired results here it is needed to develop such system which provides a new dimension of learning and openness of education [3].

A. E-learning Platform

Multimedia and Internet technologies are used to facilitate access to resources and services which improves the quality of learning. Virtual learning environment is created through which training courses can be delivered. It also provides monitoring and administrating facilities.

B. Relevance of E-learning

The under mentioned points state like relevance of e-learning:

- 1) Online Learning Accommodates Everyone’s Needs
- 2) Lectures can be taken any number of times
- 3) Offers Access to update content
- 4) Quick delivery of lesson
- 5) Scalability
- 6) Consistency
- 7) Reduced Cost
- 8) Effectiveness
- 9) Less impact on environment

C. Issues & Disadvantages in today’s Context

There are various issues & challenges in e-learning in today’s context.

- 1) Technological research challenges for fulfilling the user’s requirement, e-learning resources are developed.
- 2) Developing of new forms of Interactive Learning and community.
- 3) For supporting learning, New forms of multi nodal interface.
- 4) To understand and support learning communities, new techniques are used.

- 5) For supporting mobile communities of learners, systems are developed.
- 6) Personalization techniques are used for user personal needs and current activity.
- 7) For promoting and supporting interaction, new techniques are used.
- 8) New learning communities are discovered.
- 9) Time to time assessment services are supported.
- 10) Developing new knowledge facilities for e-learning
- 11) How to develop uncertain and incomplete knowledge to Develop learning methodology and reasoning theories.
- 12) Large-scale learning facilities developments.
- 13) To enhance & support dynamic learning process.
- 14) Sharing of information across various learning facilities.
- 15) Pedagogical and organisational research issues for e-learning:
 - Interdisciplinary
 - Access and inclusion
 - Change
 - Convergence and interoperability
 - Interactive and social interaction

II. ISSUES WITH THE PRESENT SEARCH ENGINES

The issues with the current engines can be summarized as follows:

The Search engines generate results which contain volumes of pages but all or most are not truly relevant/meet user needs. The user has to therefore further carry out self evaluation/search to determine context/domain relevancy. Therefore, the user has to perform a “Search within search” in other words the search engine is only pointing to the URL and locating only the URL’s thus more of location finder. The above “search within search” may be done by user or employ a software agent to do it on its behalf. Search engines are more of text matchers whereby they may check for spellings or generate pages based on the literals supplied.

Apart from the above issues the major Draw backs of the Search engines [20], are:

- 1) High Recall, Low precision: Large volumes of pages are returned but very few are really significant or relevant to the intended search.
- 2) Low or no recall: Sometimes the relevant pages are not returned.
- 3) Results are highly sensitive to the vocabulary: Synonyms may produce different result sets, but the rule should be that the search with same meaning key words should produce similar results.

Results should be single web pages but if the information required to users are spread over many web pages the users get many different pages and has to extract information from these web pages as per their need. The search engine does not do this for us. The Semantic Web (SW) may be represented as it is advancement of the current web; for representing information in a specific manner, it is specifically designed, which machine can understand easily. In this context the ‘object’ or “resource” derived from web must be a unique as Uniform Resource Identifier (URI). Ontologies are used to

establish the relationships between objects. Trust or provenance plays important role in the semantic web. Trust defines the merit by which a user considers authenticity of the documents. A user has to take decision regarding selection of the documents based on considering all the parameters of trust, whether given information is reliable or not. The documents available in the web and the services provided, further users put a new set of problems every time and need to obtain the solution exactly trustworthy. And it is for machine or web services require a more automated way to deliver the same. [9, 10].

III. GENERATION AND VISUALIZATION OF ONTOLOGY WITH PROTÉGÉ

It can be understood with the help of a basic concept in an academy where-

- 1) Teachers teach modules
- 2) Students study modules

Now classes, data properties, object properties and individuals are identified.

A. Classes Abstract groups, sets or collections of objects are said to be classes in Ontology. Here parent classes and child classes are defined-

- 1) Parent classes
- 2) Person
- 3) Module
- 4) Child classes
- 5) Students
- 6) Teacher
- 7) CS Module
- 8) Math Module

B. Object Properties Object property defines how classes can relate to each other on the basis of their instances. This paper explores two object properties-

- 1) Studies
- 2) Teaches

C. Data Properties Data properties are similar to object properties, but their domains are typed literals. These are-

- 1) First_name
- 2) Last_name
- 3) Index_number
- 4) Staff_number

D. Individuals Individuals or instances are the basic, components of an ontology. The instances of courses in an academy are given below-

- 1) CS11
- 2) CS12
- 3) CS13
- 4) CS14
- 5) MA1
- 6) MA2

The instances of teachers in an academy are-

- 1) Teacher_1
- 2) Teacher_2

The instances of students in an academy are-

- 1) Student_1

2) Student_2

Now creating the identified classes, data properties, object properties in the ontology.

- 1) Creating Classes
- 2) After clicking on the classes tab and open the class hierarchy.
- 3) All classes identified should be sub classes of “Thing” class by default.

When clicking on “Add subclass” icon and in the pop-up menu, explore the name of the class.

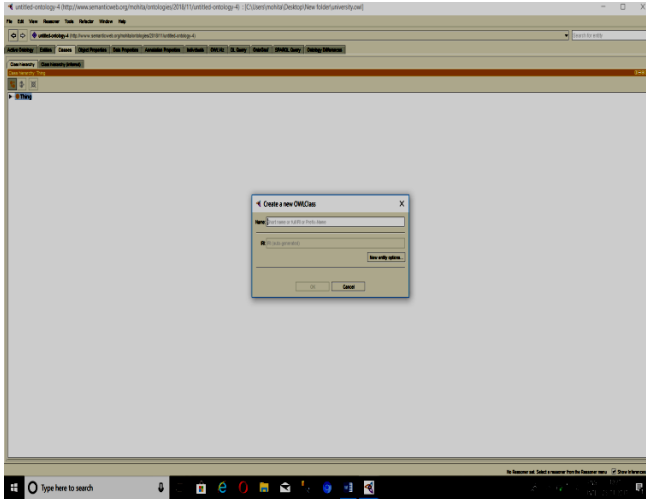


Figure 1: pop-up menu, explore the name of the class.

Fig. 1 illustrate with the help of an example in which class “Lecturer” is a subclass of “Person” class and “Person” class is a subclass of “Thing” class. When class taxonomy is created, the hierarchy should be as defined.

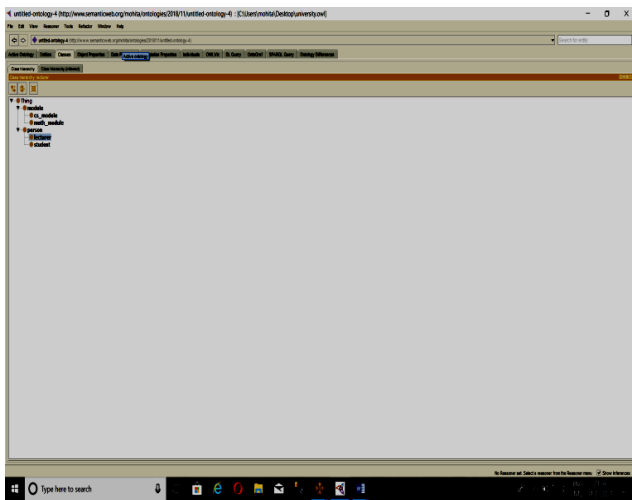


Figure 2: Hierarchy of Class

Fig.2 explores how to create the identified object properties, By selecting the Object Properties tab and click on “Add sub property” icon. Here by default all properties will be sub properties of the “top Object Property”.

In this

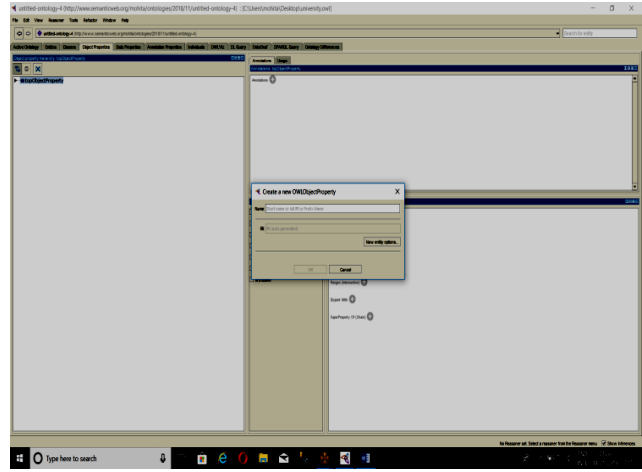


Figure 3: Sub property of object properties.

Fig.3, how to add domain and range to these object properties. Domain is a predefined property which gives syntactically a property to a class description. Range is also in built property which gives a property to either a data range or a class description. Now for object property “studies” we can add “Student” as the domain and “Module” as the range.

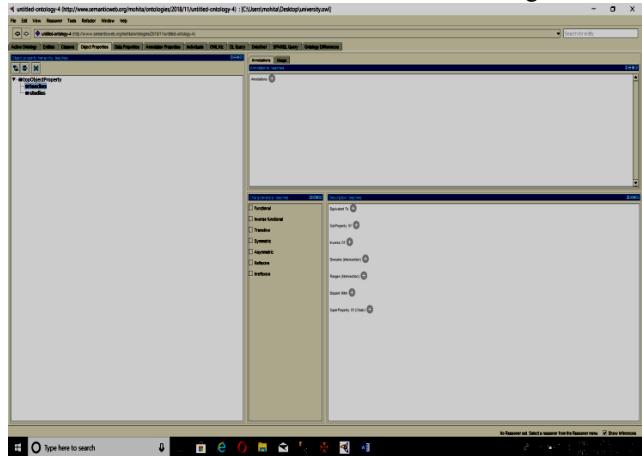


Figure 4: Property to a class description

Fig.4 illustrate to add domain or range, simply click on the ‘+’ button near the required item and select the items which want to add.

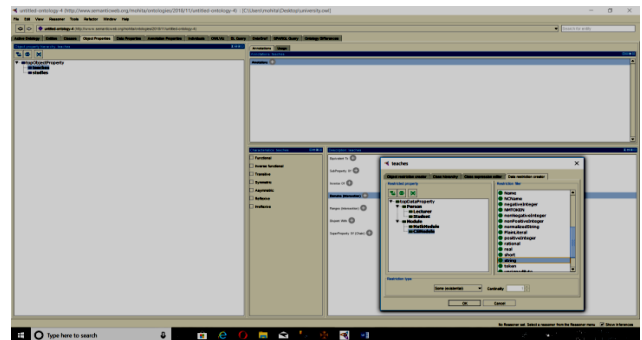


Figure 5: Property to a class description

Fig. 5 illustrate “Teacher” as the domain and “Module” as the range for the object property “teaches” are considered.

E. Creating Data Properties

For creating the identified data properties, click on the ‘Data Property’ icon. All properties displays as sub properties of the ‘top Data Property’ by default.

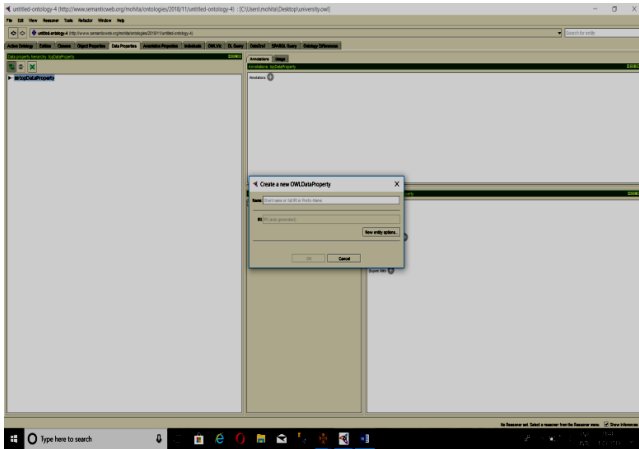


Figure 6: Sub property of the top Data property

Fig.7 illustrate that after addition of all the properties identified, the following overview is obtained-

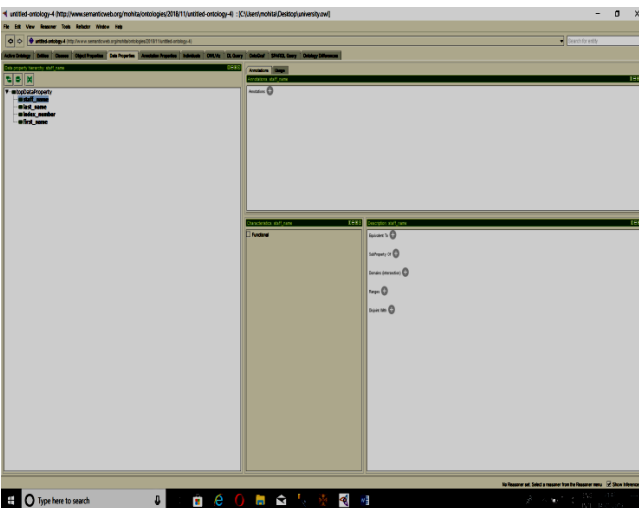


Figure 7: Over view of properties.

In the same way, object properties are added, domain and range for each data property are also defined as well. However, in the range selection, rather having a class description, need to add a data types. For example “first_name” data property has the range of “xsd:string”. To add this data types on the ‘+’ button near “Range” and select “Built in data types” and select the relevant data type from the given list.

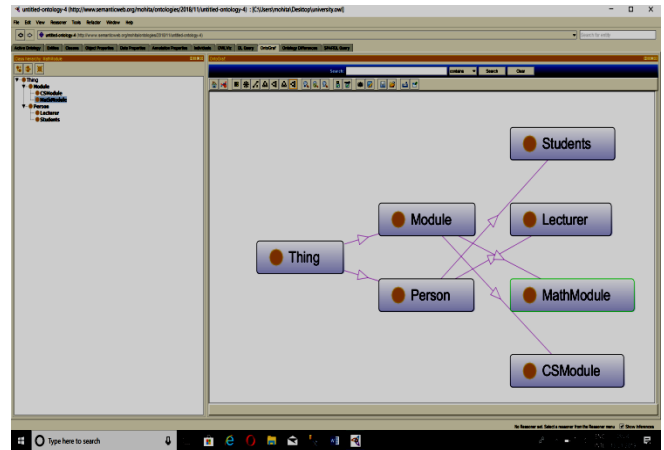


Figure 8: Data properties with object properties.

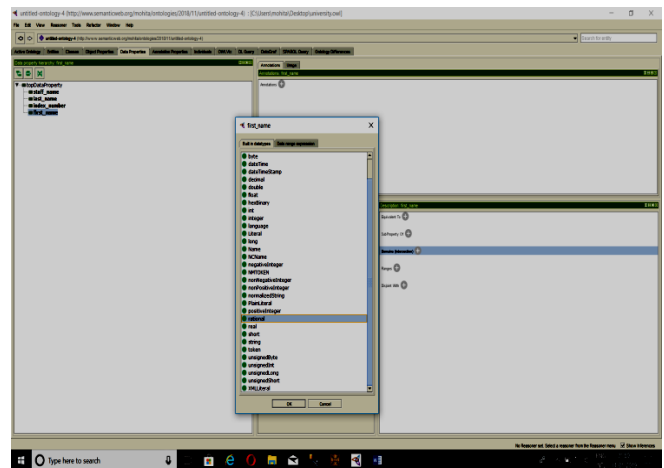


Figure 9: Data & object properties exploration.

Now add the following ranges to the other identified data properties as well.

- first_name → xsd: string
- last_name → xsd: string
- index_no → xsd: int
- staff_no → xsd: int

F. Adding Individuals

Fig.10 explores on adding “individuals”. Click on the “individuals” tab and click on the “Add individual” icon.

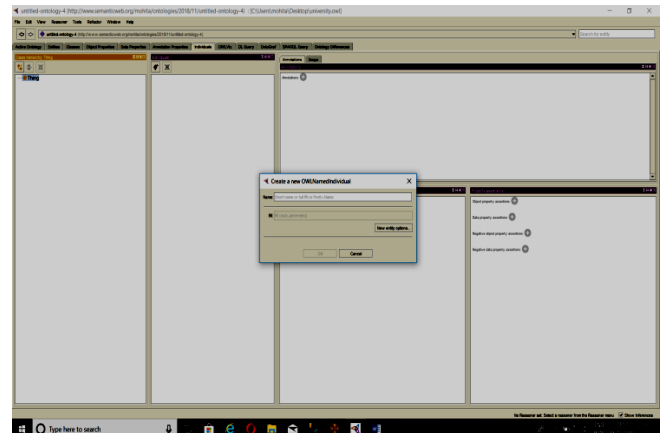


Figure 10: Exploration of Modules.

First, "Module" individual is created. Follow the below steps to set the individual property.
Create the "Module" individual "CS11".
Add the Type for the "CS12".

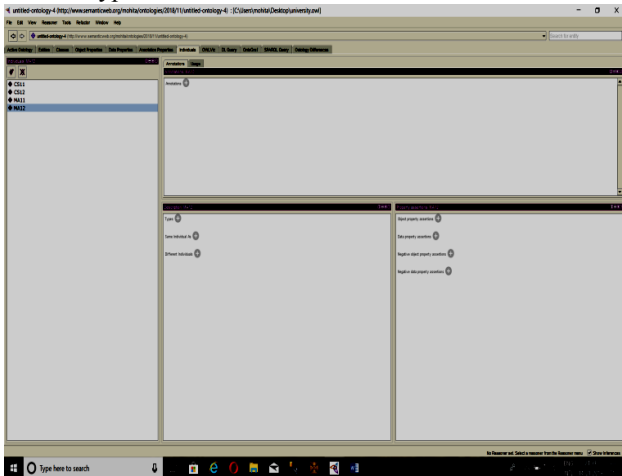


Figure 11: Creations of Modules.

All the modules can be done with same manner. The graphical representation of university ontology is as follows-

IV. SEMANTIC WEB AND ONTOLOGY

Semantic web is the semantic communication between human and machine agents in an intelligent web environment. It focuses on machine compatible content for apprehending it, so that the exact query has to be perceived by machine which is required by the user. When machine is compatible with the content, the user will get the exact answer for every query asked rather than a group of hyperlinks [14], [15]. Ontology means "a *specification of a conceptualization of a specific domain*" [4]. The purpose of designing Ontology is to enable knowledge sharing and reuse. Here Ontology based e-learning system; the first step of the development procedure carries to capture and documentation as user's point of view. The steps are:

- 1) Scope of ontology as well as identification of the objective
- 2) Re-use existing vocabulary.
- 3) The important terms in the ontology are given as:
 - Classes with their hierarchy.
 - Properties of the classes.
 - Properties' features
 - Defining instances.

V. SUMMARY

Now e-Learning can be concluded as follows-

- 1) Follow good hierarchy among Faculty, Students and provide accurate as well as trustable information of the Programme and courses.
- 2) Track your learners in respect to they are fulfilling their periodic assignment, Tests and examination within stipulated time as per schedule.
- 3) Usage of different types of media like Audio/Video lectures, e-mail, availability of instructional material and proper establishment of studio for learners' interaction.

A structured e-learning in which provides instructional material in time and proper divided chapters in defined sessions, continuance self-assignment evaluation and conduct of examination online. On the other hand e-learning material is available on the sphere of cloud but lost due to lack or weak network. The ontology aspects have been conceptualized, however the next aspect needs be embedded, thus, the ontology will be scaled to enable trust.

VI. CONCLUSION

This paper explores to fulfillment of education for users through web technology on their door step for all the segment of the society in anywhere and in any time. But the bottle neck is in case failure of network, updating modification and uploading of material in time to update learners periodically. Further different new tools may also be introduced as technology moving fast. Various issues and relevance for E-learning are also discussed in this paper. In that way the relevant task can be performed in relevant time.

VII. SIGNIFICANT STATEMENT

E-learning in its various forms is gaining significant through its feature like 24*7 availability, breaking geographical boundaries, comfort of learning with respect to mood, availability of time and customize / tailor made contents. However a bottle neck exists with respect to semantic search, semantic translation, semantic presentation and the most important aspect of trustability. This bottle neck can be overcome through semantic representation of the underline educational contents, semantic inferences there by rendering meaningful and trustable curriculum to the learner. This paper describes and signifies the relevance of semantic representation through ontology using protégé as tool.

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