Imparting Semantic Web Based E-Learning In Education System: A Survey

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Abstract

Most of the major industrial firms, Academic organizations who are associated with academics are carrying out extensive research work on a wide spectrum allocations in the field of learning. As a result of that education system is transformed from class room system to virtual classroom as well as web based learning and remote learning. Basically e-learning is upcoming branch of web based learning where accessing educational resources are fast, just-in-time and relevance according to time/place. Semantic web technology has huge potentiality to be applied in the various areas of e-learning. The reason behind this conclusion is the semantic web is flexible and here the learning objects are annotated. So for the sophisticated learning demand, e-learning and semantic can be easily combined effectively. This paper focuses on the potential uses of semantic web in e-learning and a survey of related literatures is presented here.

Index Terms—**Semantic web, e-learning, Traditional learning , Ontology,RDF.**

1. Introduction

Today's new technological enhanced learning is characterized by high growing number of heterogeneous educational service provider[1].If we consider any particular student with a particular educational need, a typical scenario involves the student visiting several on-line educational centers, collecting information about courses/study programs, costs, eligibility criteria, duration and finally register it. This is too slow and is not possible for any student to browse all online learning centers before making decision. So the conclusion is derived that learning process should be fast and just-in-time. But compared to traditional system in which the instructor plays the intermediate role between learners and the materials, in e-learning instructor no longer controls the delivery of materials and learners have a possibility to combine learning materials in the course on their own. Thus this e-learning replaces old fashioned time/place/content/pre determined learning with a just-in-time /at work-place/customized/on demand process of learning [2].In addition, it needs to be relevant to the(semantic) context of business[3] and must be a on-line service, initiated according to the user profiles. Normal on-line learning solutions do not meet the above mentioned criteria and some of the areas where they are lacking in functionalities are information overload, inaccurate information and content that is not machine-understandable[2].The semantic web is a mesh of information linked up in such a way as to be easily processable by machines on a global scale. It is a new generation of web(web 3.0) that makes possible to express information in a machine interpretable form, ready for software agents to access[4].So it appears as a promising technology for implementing e-learning in large scale[2].The advantage of using semantic web in e-learning technologies provide more scope to achieve the aim of collaborative knowledge sharing and it also helps teachers to share their teaching materials, experiences with other through web technologies[5].

2. E-Learning

The actual origin of e-learning is computer based training ,which actually acted as an agent to automate education, replace a paid instructor and develop a self paced learning[2].But unlike CBT, e-learning provides learning without barrier of time, distance and customized to the business need of individual. E-learning is defined as " The delivery of individualized ,comprehensive, dynamic learning

content in real time, aiding the development of communities of knowledge, linking learners and practitioners with experts"[6].Table 1 explains the characteristics and also the differences between e-learning and traditional training methodologies[7].

Any e-learning course should serve a different learning group (novice, intermediate, advanced, experienced) and be presented in different forms [3]. Here instructor should not control the delivery of materials, learners will get the materials according to own expertise and it is a completely self paced learning [8].

According to [1], different versions of e-learning are i) Knowledge database, ii) Online support ii) Asynchronous training and iv) Synchronous training.

3. Semantic Web

According to Tim Berners-Lee[9] , semantic web is a web where the focus is placed on meaning of words, rather than the word themselves .Information become knowledge by semantic web and because of this reason it is termed as network of knowledge. Earlier idea of information age had been " more the information, better it is". But as a result of that unrelated information create the barrier when we search the web[5].HTML is intrinsically poor in terms of semantic capabilities.

For example, you want to find out the location of Institute of Engineering & Management, with HTML we have to go to the home page of the institution and search until we find it.HTML displays information without identifying it any meaningful way. So address is presented as text not as "address"[5]. So the heterogeneity of web led to intelligent web portal which are not "dumb", are smarter and carry out intelligent reasoning in background. Semantic web is the transformation of information on web portal from "only display information" to "meaningful information" by tagging information with descriptors like "address". It allows users to find relationships between tagged information using inference rules called ontology that provide logic and structure to the information embedded in web pages. So, machines can do a lot of the information grunt work currently required of humans [5].

Semantic web is built in layered approach because it is often easier to achieve consensus on small steps, whereas it is much harder to get everyone on board if too much is attempted [2].
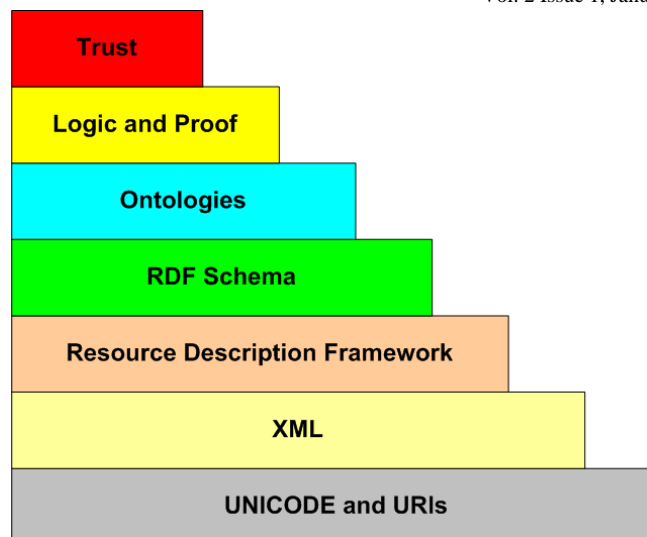

Figure 2: Layers of semantic web architecture [9]

Resources are the base of semantics and it is identified with unique resource locator(**URI**) or internationalized resource locator(IRI).The next layer is **XML** which allows users to add arbitrary structure to their documents by creating tags to make the page annotated. **Namespace** is a mechanism to create unique names of elements and tags which works with XML. On top of XML, is **RDF**(Resource description framework). RDF is the first layer of the Semantic Web properly. RDF is a simple metadata representation framework, using URIs to identify Web-based resources and a graph model for describing relationships between resources. **RDF Schema** is a simple modeling language for describing classes of resources and properties between them in the basic RDF model which provides a simple reasoning framework for inferring types of resources. Next, a richer language for providing more complex constraints on the types of resources and their properties is termed as **ontology**. **Logic and Proof** layer is an reasoning system provided on top of the ontology structure to make new inferences. The final layer of the stack addresses issues of trust that the Semantic Web portal can support.

4. Relationship between e-learning and semantic web

E-learning is assumed to be facilitated and supported through the use of information and communications technology, including technology used in classroom environments as well as blended learning where technology may be employed in the classroom and then supplemented by external electronic coursework. But most of the e-learning applications are highly monolithic and lacking flexibility because self describing materials and intelligent software agents which are the integral part of semantic web, were not considered into the designing. [10]. The Semantic Web offers learners the scope of having a wealth of related content delivered to their desktop without explicitly requesting it. Meaning and associated relationships between content in disparate systems will be continuously

evolving. Related content from learning objects to content stored within Virtual Worlds would provide a web of complex learning interactions both relevant and interesting to the learner. E-learning facilitators (teachers or advisors) can utilize this rich content to enhance the learning experience, allowing them to deliver engaging and relevant courses. However e-learning frame work should take the benefits of semantic services, interoperability and ontology. Semantic web could offer huge flexibility in fast, just-in-time learning by the use of collaborative/discussion, annotations tools [11].

The possible use of semantic web technology in e-leaning is displayed here in a summery form in Table 2[2].

5. Effects of semantic web on e-learning

The most successful online educators and their home institutions will want to take advantage of the capabilities of these new semantic web technologies to ensure that their course materials are the most desirable for the largest possible audience. This can be achieved by addressing of the following possibilities [5]:

☐ Personalized study materials – Based on prior knowledge and individual interests, study materials will be designed specifically to meet each individual's goals and needs. Past experience of a learner's success rate in understanding and applying information from various styles of presentation can influence the ways in which current information is presented.

☐ Formation of similar groups – Background knowledge, intellectual learning capacity and current understanding should be utilized to group students so that they can help each other learn in a best possible manner.

☐ Background knowledge of the learner – Teachers often struggle with understanding the prior knowledge of all of their students. This technology makes it possible to adjust study materials to accommodate for specific previous learning experiences.

☐ Smarter assessment method- Based on present and previous learning experiences – if students have shown previous proficiency in a particular area, assessments can account for that and change themselves to match a student's current level of knowledge.. These changes in course organization, resource management, design, and teaching are significant and, from our current technological perspective, may seem overwhelming.

Dimension	Traditional Learning	e-Learning
Delivery	Push: Instructor determines agenda	Pull: Student determines agenda
Responsiveness	Anticipatory: Assumes to know the problem	Reactionary: Responds to problem at hand
Access	Linear: Has defined progression of knowledge	Non-linear: Allows direct access to knowledge in whatever sequence makes sense to the situation at hand
Symmetry	Asymmetric: Training occurs as a separate activity	Symmetric: Learning occurs as an integrated activity
Modality	Discrete: Training takes place in dedicated chunks with defined starts and stops	Continuous: Learning runs in the parallel loops and never stops
Authority	Centralized: Content is selected from a library of materials developed by the educator	Distributed: Content comes from the interaction of the participants and the from web

TABLE 1: Differences between e-learning and traditional training methodologies

Requirements	eLearning	Semantic Web
Delivery	Pull – Student determines agenda	Knowledge items are linked to commonly agreed ontology (s).
Responsiveness	Reactionary – Responds to problem at hand	Software agents on the Semantic Web may use a commonly agreed service language, which enables co-ordination between agents and proactive delivery of materials
Access	Non-linear – Allows direct access to knowledge	User can describe the situation at hand (goal of learning, previous knowledge) and perform semantic querying.
Symmetry	Symmetric – Learning occurs as an integrated activity	The Semantic Web offers the potential to become an integration platform for all business processes
Modality	Continuous – Learning runs in parallel to business tasks and never stops	Active delivery of information (based on personalized agents)
Authority	Distributed – Content comes from the interaction of the participants and the educators	The Semantic Web will be as decentralized as possible.
Personalization	Personalized – Content is determined by the individual user's needs and aims to satisfy the needs of every user	A user (using its personalized agent) searches for learning Material customized for her/his needs. The ontology is the link between user needs and characteristics of the learning material.

Adaptively	Dynamic – Content changes constantly through user input, experiences, new practices, business rules and heuristics	Distributed nature of the Semantic Web enables continuous improvement of learning materials.

TABLE 2: Use of semantic web technology in e-learning

6. Conclusion

Time limitation, information overload, lack of accuracy and cost are considered to be the main obstacles facing the e-learning community. There is an urgent need for a mechanism to structure the huge amount of valuable e-learning resources and make it readily accessible and reusable in a customized manner. It is anticipated that semantic web will influence the next generation of e-learning applications by making contents machine understandable. In pedagogical perspective, semantic e-learning portal should allow students to determine their own learning criteria and they can construct their own course according to respective needs, preferences.

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