A Novel E-Learning Approach to add more Cognition to Semantic Web

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Abstr*act:* **E-learning approach using semantic web provides relevant and meaningful information to the learner but human mind designs his own cognitive structure of the information which is fuzzy and uncertain. When the knowledge structure of any domain is large and well connected then it is very easy to learn and acquire the semantically connected knowledge. An Elearning approach is designed where the semantic web is made more meaningful by adding human conceptual representation and reasoning mechanism to learn based upon the knowledge, profile and experience of a learner**.

Index Terms: **E-learning, semantic web, conceptual spaces, xml, html, ontology**

I.INTRODUCTION

E-learning is the process of learning anytime and anywhere with dynamically changing contents of any course using an electronic media in contrast to traditional method of learning using scheduled classroom session where the course contents are static in nature. E-learning gives the option of learning through abundant resources available on network in real time where the agenda is decided by the learner and not by the instructor.

Several advantages of e-learning are students do not have to travel all the way to classroom, they have flexibility to join discussions on bulletin boards and chats, they can learn any module as per their area of interest, and higher consistence. Students can carry thousands of e-books. Disadvantages of E-learning are, slow internet connection may break down learning process, student may feel isolated from instructor and classmates and their cognitive behavior based upon his past experience is least concerned.

World Wide Web (or web) is a large repository of information like educational contents, e-books, research papers, journals, multimedia contents and software. The information on Web is growing day by day, hence web is best resource for e-learning. Traditional web consist of unstructured information in the form of html pages whereby relevant meaning to the content is negligible and information is not machine understandable. To overcome the above problems traditional web is enhanced to new generation of web called semantic web.

Understanding how people learn is a fundamental aspect in delivering the semantic content to the E-learner. Cognitive semantics states that the real meaning of the term is cognitive structure in a human mind [3]. Human mind creates its own structure of learning contents based upon the past knowledge, experiences and judgments. Semantic web is an extension of current web where the information is given well defined meaning [1]. The semantic web layer cake is shown in the Figure 1.

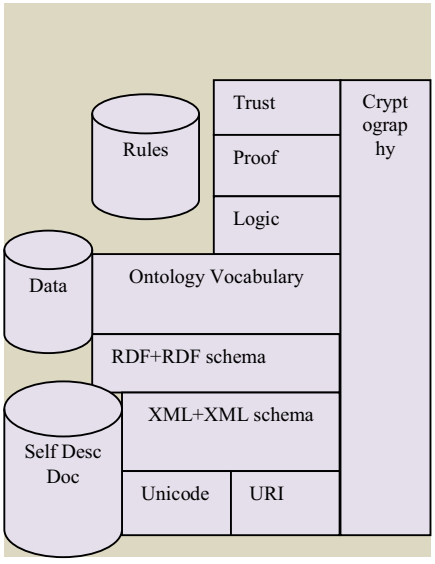

Fig. 1. Semantic web layers

Unicode manipulates text in any language whereas URI identifies semantic web resources .2nd layer is markup language (xml) enables creation of documents, 3rd layer consist of RDF and RDF schema which is used to describe the data and RDF schema is language describing the properties of

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data. Ontology is used to represent the knowledge. Logic layer is placed upon the ontology to extracts the information using logic. Trust is the final layer of semantic web. It describes the policies so that unwanted user cannot have access to the sources.
E-learning falls into four categories [2] i.e. knowledge database, Asynchronous training, Online support and synchronous training. Finding out relevant and meaningful information is very difficult since the information lacks the semantic description of the Learning contents, therefore the use of semantic web has been a great resource for E-learning environment. In this paper major emphasis is given to the cognitive side of the content for learning process as to how the learner thinks and retrieves the desired knowledge.

II. RELATED WORK

E-learning system using semantic web has been developed and implemented since 1990's. Vladimir Kolovski and John [4] developed E-learning system using software agents where the repository consist of Resource Description framework(RDF) files but the relevancy of content was not given importance. Ljiljana Stojanovie et al [5] proposed an approach of E-learning using semantic web technology where ontology was used as a backbone to provide structure to the learning material. Because of the use of ontology the learning content are more domain specific, But the user's area of interest is still not taken into consideration. Pertti [6] presented semantic learning using modeling approach where the interaction between the teacher and the student behavior is activated to consider explanatory learning behavior. Weihong et al [7] presented an e-learning framework using description of learning content in various contexts such as learning model, knowledge object representation and learners personality. Tarek M. Mahmoud [8] proposed an elearning framework for dynamic resource creation and extension. Data visualizing tool gives scope to the learner to choose it own data of interest. Yun Feng Gu [9] described an E-learning on semantic web where the recommended system is made more personalized. Fransesco Colace [10] used Bayesian approach for ontology in E-learning. Bayesian network is a knowledge representation model used in artificial intelligence to represent the knowledge which is uncertain in domain.

Next sections present a proposed Model for Elearning using cognitive approach.

III.PROPOSED WORK

Human conceptual representation and reasoning mechanism adds more meaning to the semantic web [11]. Human mind captures the graphical and textual information while learning the things based upon the experiences and stores them in the form of framework in his long term memory as shown in Figure-2.

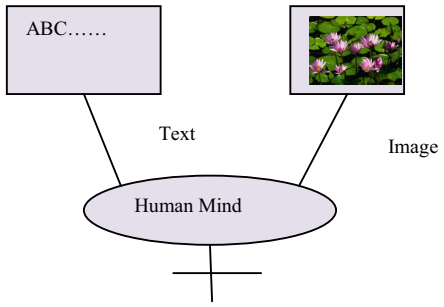

Fig. 2.Information Processing channel

Data and the knowledge in real world is fuzzy and uncertain in nature. Human mind designs its own structure of knowledge based upon its personal background and profile. Semantic web allows meaningful connections to create a structure so that machine can very well understand and tries to retrieve the information from the web of knowledge. Our proposed Model represents the E-learning system using semantic web where cognitive behavior of human mind and how learner understands, process and interprets the information with semantic similarity and concept combination. Cognitive science is the scientific study of human mind where information is processed between human mind and machine. Knowledge is represented in the form of conceptual spaces with geometric topological structure in which new XML based language called conceptual space markup language (CSML) is used to create ontology of concepts, property, advanced methods of combining the concepts .CSML describes the semantic structure of an learning material more clearly which may not be captured or described well by the ontology languages like OWL (web ontology language).

V. PROPOSED MODEL

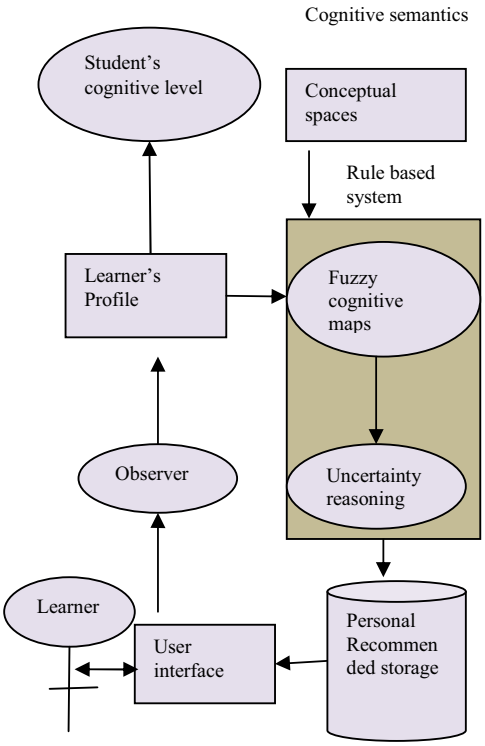

Fig. 3. E-learning Model using cognitive approach

The proposed model shown in Figure-3 consists of two parts cognitive semantic based system and rule based system.

1. Cognitive sematics: It represents the meaningful information in the form of conceptual spaces where conceptual space markup language (CSML) is used to represent the ontology.CSML represents the semantic at the conceptual level.

2. Rule based sysem: Rule based system has fuzzy cognitive maps to reason uncertain information in the way human perceives it.

3. Fuzzy cognitive maps: Fuzzy cognitive maps are a graphical representation of the knowledge where the nodes represents the concepts and relations between the nodes is used to compare the strength of impact. It is a general combination of fuzzy logic with the cognitive maps. Cognitive maps visualize recalling and learning the things using human mind.FCM analysis human perception and produce conceptual model well suited to represent unstructured knowledge [12].

4. Uncertainty Reasoning: Imprecise and fuzzy knowledge in real world leads to uncertainty. Human cognitive behavior tries to learn the uncertain information where a probability measure, Bayesian approach represents measures for uncertainty reasoning. In our approach we compute probabilistic assessment for general knowledge of learner, knowledge related to specific topic and cognitive level to understand the subject area to draw the hypothesis. Suppose there are two events which causes learner to learn i.e. knowledge about the subject area and general knowledge of the learner and if knowledge of the subject has direct effect upon the general knowledge of the user then the situation can be well modeled by using Bayesian model with all the variables having two possible values l and h as shown in Fig-4.suppose the general knowledge of student has direct effect on knowledge he already acquired then assessment is based upon the joint probability distribution. The nature of dependency of a child node on the parent is to be computed by conditional probability table (CPT).As shown in Figure 4 let us assume the two parent nodes as K and G and child node as C,let each node have 2 states s={l=low, h=high}.The node C is dependent upon two parent nodes K and G.Probablity of learning is based upon the parent states, knowledge about the subject area is influenced by the general knowledge of the user, hence the joint probability of the model is defined by equation(1) as

$$p(K,G,C)=p(k|G,C)p(G|C)p(C)\text{----------(1)}$$

The probability of situation that the learning is better influenced by the knowledge about the subject area is calculated by equation (2)

$$p(G=h|C=h)=p(C=h,G=h)/p(C=h)\text{--------(2)}$$

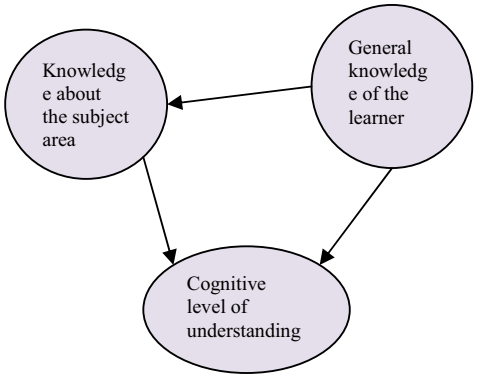

Fig. 4. Simple Bayesian Model

5. Personalized recommended storage: This model is used to recommend the knowledge based upon the area of interest and level of a learner. Personal recommended storage request and recommends the data which learner is interested to acquire.
6. Student cognitive level: consist of how student emphasis the learning, recalling the ideas and designing the mental structure. Based upon the cognitive level of the learner, the learner profile is very important factor of E-learning i.e. history of the learner, characterstics and the level of understanding the things. Each and every learner has its own level of cognition to retrieve the meaningful information from semantic web.
7. User Interface: User interface acts as an interface between the request send by the learner and the material recommended by the personalized storage. It acts a mediator between the learning system and the learner.
The complete flow of the Elearning approach is shown in Figure 5.

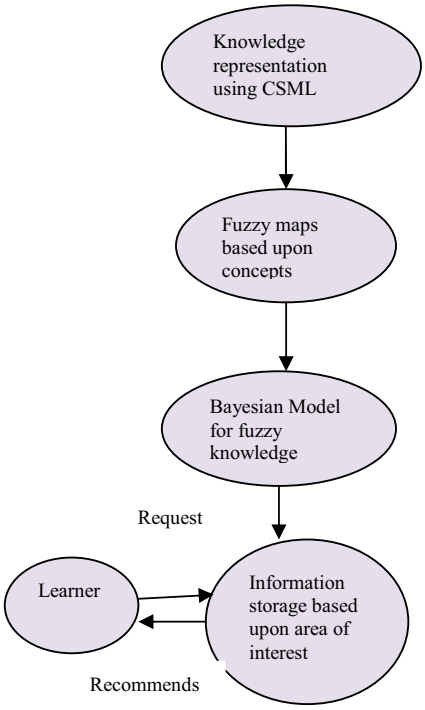

Fig. 5. Flow Diagram

The Learner request for the subject he is interested in learning. Learning contents are stored in the personal recommended storage area based upon the user's experience, qualification and the domain he intended to aquire.Knowledge in a real sense are uncertain and fuzzy. Bayesian network model represents the fuzzy knowledge wherein the concepts are represented by using CSML and personal recommended storage later on recommends the knowledge to the user according to his request and hence is able to learn the desired contents. This E-learning Model takes the semantic web to the new generation where the learner is able to learn according to his metal level of understanding the things rather than instructor forcefully recommending the learning material.Conceptual spaces represents the knowledge of thought by using geometrical structure.

V.CONCLUSION

In this paper a novel approach to E-learning is used that considers human cognitive approach to give more meaning to the semantic web. Human mind tries to percepts imprecise, fuzzy, incomplete and uncertain information which is not very well represented by traditional web ontology languages.The paper presents a new xml based language called CSML for knowledge representation and learning in the way human mind tries to learn the things thereby increasing the semantic similarity and concepts combination.

VI. FUTURE SCOPE

The Future scope of the paper is the enhancement of semantic web to make it more cognitive such that it will be an emergent of social network of human and cognitive agents interacting in hybrid environment. Semantic web can be made more semantic using cognitive approach. E-learning system using Semantic web can further be enhanced using cloud providing low cost solution to academic institutions as a service on internet.

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