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Learner Ontological Model for Intelligent Virtual Collaborative Learning Environment

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Abstract:
An enacting approach to intelligent virtual collaborative learning model is explored through the lens of critical ontology. This ontological model enables to reuse of the domain knowledge and to make the knowledge explicitly available to the agent working as an Expert System, which uses the operational knowledge in collaborative learning environment. This ontological model used by the agent to identify the preliminary competency level of the user. This environment offers personalized education to each learner in accordance with his/her learning preferences, and learning capabilities. Here the factors considered to identify the learning capability taken are demographic profile, age, family profile, basic educational qualification and basic competency scale. The conception of heuristics is then used by the agent to determine the effectiveness of the learner by referring the different parameters of the learner available in the ontological model.To help getting over this, the paper describes the experience on using an ontological model for collaborative learning to relate and integrate the history of the learner by maintaining the history of learner in collaborative learning environment that will be used by the Multi-Objective Grey Situation Decision Making Theory to infer the understanding level of user and produces the conditional content to the user.

Index Terms:*Collaborative Learning, e-learning, Expert System, Heuristics, Multi-Objective Grey Situation Decision Making Theory, and Ontology*

I. Introduction:

The collaborative learning is a technique one use to group of student together to impact learning more effective. As the group share ideas and knowledge in their respective domain, the other members also in the common domain add their view to make the solution more tangible. As we all know working together and learning together always increases the productivity of the result. The increasing use of Information Communication Technology(ICT) in education made the collaborative learning more popular and that made virtual learning environment more competitive. The effort here to make the user ontology that keeps track of the learner and learner preferences with all different activities performed by the learner in the system. The efforts here to manage the ontological model that helps the system to track and maintain the history of the learner and from which the agent infers the level of the learner for the conditional content presentation to him/her.

The ontologies which are nothing but the explicit formal specification for the domain, which helps to extract, infer the explicit knowledge stored. In the digital era the trend is, switch on the computer, connect to Internet, experience the resource pool and learn. As tend is diverted from F2F learning to e-learning, the content available is alsoincreasing and as a result the problem arises in searching specific information becomes tedious task. Here the virtual collaborative e-learning environment tries to provide a platform that initially takes learner details with different parameters and stores in the ontological model. The objective here to maintain the ontology is to identify the preliminary understanding level i.e. the competency scale of the user and based on that the content is filtered by the system and produced in front of the user. This leads to design a new agent that interacts with the system that enables it to cater learner profile and different parameters that helps in identifying the understanding level of the learner.

Ontology is an explicit specification of a conceptualization (Gruber, 1993). The term ontology has been widely used in recent years in the field of Artificial Intelligence, computer and information technology especially in

domains such as, Collaborative Information Systems (CIS), Intelligent Information Integration, Information Retrieval and Extraction, Knowledge Representation, and Database Management Systems (Guarino, 1998).

Ontology has been widely used for learner modelling because of many reasons. One is to support the formal representation of abstract concepts and properties and second they enable the extraction of new knowledge by inferring the information presented by ontology.

The ontology is commonly used when one need to share information. It includes machine-learning definitions of basic concepts in the domain and also defines the relations among them. Basic reasons to develop ontology are:

a. Share common understanding
b. Reuse of domain knowledge
c. Use of an explicit knowledge
d. Separate operational and non-operational knowledge
e. Process the domain knowledge

Here the model includes the entities, relations and functions needed to describe the leaner, learner preferences, demographic profile and the family background. These parameters help in identifying the preliminary understanding level of the user.

II. Description of learner ontology in collaborative learning environment:

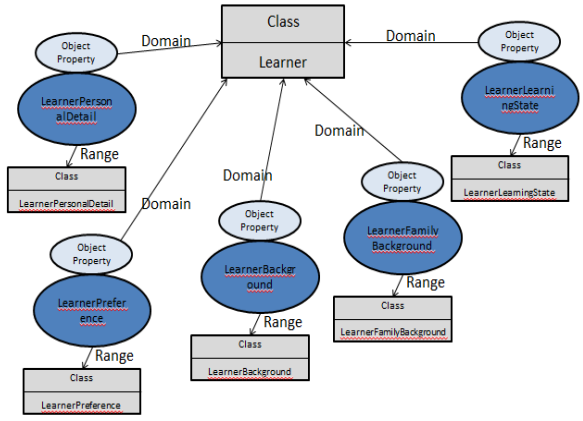
Ontology has become universal in any System one uses where the heuristics to be applied. As ontology represents the explicit entities with the relationship amongst entities; it helps in generating the knowledge from the existing one. They constitute the Semantic Web's backbone, facilitate e-commerce and e-learning, and serve all different application fields. As ontology development becomes increasingly widespread and collaborative, developers are creating ontological model using different tools and different languages.

In this section, we shall give a brief description of the basic components of the approach. The overall inference works in line with all other parameters like the preference, demographic profile, age, the competency level, and behaviour of the learner in the system. The classes' taxonomy is the following:

General learner information

- LearnerPersonalDetail - Name, Surname, Id, Age, PostalAddress, Email, Telephone;
- LearnerPreference –AccessTimespan, CommunityPreference, ObservationStyle, MultipleExpertise, PhysicalLimitation, LanguagePreference;
- LearnerBackground - LastEducation, Experience, AreaResident;
- LearnerFamilyBackground – FatherQualification, MotherQualification;
- LearnerLearningState - Interest, BasicCompetencyScale.

Learner ontology for collaborative learning environment:



Structure of Learner ontological classes:

1. LearnerPersonalDetail:
    a. Name
    b. Birthdate
    c. Email
    d. Mobile

   e. Address
2. LearnerBackground:
   a. LastEducationDetail
      i. Institute/College
      ii. ValidationFROM
      iii. ValidationTO
      iv. MajorSubject
      v. MinorSubject
   b. Experience
      i. Description
      ii. Duration
      iii. TypeOfWork
   c. AreaResident
3. LearnerLearningState:
   a. Interest Competency
      i. Type
      ii. Domain
   b. BasicCompetencyScale
      i. Scale
4. LearnerPreference:
   a. AccessTimespan
   b. CommunityPreference (GroupingPreference)
   c. PhysicalLimitation
   d. LanguagePreference
   e. MultipleExpertise
5. LearnerFamilyBackground:
   a. FatherQualification
   b. MotherQualification

In this approach, the model stores these parameters and on this basis, the agent applies the heuristics on it to find the preliminary knowledge level of the user by passing this details to the another agent which works on Multi-Objective Grey Situation Decision Making Theory that identifies the preliminary understanding level of the user.This ontology model is used to generate the knowledge base and also used by the agent working as an Expert System. The explicit representation of the knowledge makes the expert system work effectively to re-generate the knowledge for better decision making. Here the attempt is to capture the little basic implicit knowledge to be stored in the knowledge base.

III. Conclusion

In the last few years' ontology has become a silver bullet in the area of knowledge discovery, knowledge representation and knowledge modelling. The next generation of eLearning systems and applications and their main components – learning objects, learner models, services, etc. cannot be developed isolated. This ontology offers a conceptual knowledge level representation for describing users and history of users in collaborative learning environment. Applying heuristics and machine learning on it the more refined knowledge can be generated that helps the expert system to make better decisions. This is based upon the structure and the knowledge contained in previous ontology together with knowledge which was not explicitly represented in other collaborative learning ontology, i.e., knowledge about the study and analysis of the learning process.

IV. Future Work:

This explicit representation of the knowledge,the heuristics shall be applied to generate new knowledge by the agent (Expert System) that initially finds the basic competency level of the user by applying the Multi-Objective Grey Situation Decision Making Theory. And then the system puts a watch on the ontology to discover and monitor the growth of the user and accordingly system updates the statistics.

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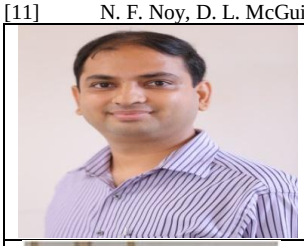	Currently working as an Assistant Professor at ShrimadRajchandra Institute of Management & Computer Application, UkaTarsadia University, Bardoli - Gujarat. Pursuing Doctorate in Computer Science in the field of Artificial Intelligence (Knowledge Management) from Sardar Patel University VallabhVidyanagar since March 2013. Cleared UGC NET in Computer Science in December 2012. Completed M.Phil.(Computer Science) in April 2010.
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