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AN APPROACH TOWARDS REDEFINING GRANULARITY OF LEARNING OBJECTS FOR EFFECTIVE AND ADAPTIVE PERSONALIZATION.

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ABSTRACT

Learning Objects (LO) have been used for designing e-learning paradigms. Granularity of learning objects is related with the concept of reusability. The reused learning objects are henceforth used for effective personalization .Personalization based on the learner's intuitiveness is preferred using preference based and correlation based algorithms. Based on the user preference and learning style with domain ontology, the effective personalization can be attained. The performance measures and evaluation aids in deciding the learner's effective personalized experience of the system.

Keywords: *Learning Objects, E-learning, Learning object repository, Ontology, Granularity, Personalization.*

1. INTRODUCTION

Learning object granularity is one of the most critical unsolved issues which is handled by many researchers Learning objects was introduced as an idea for educational resources in the form of broken modular components which are later recombined by the authors or instructors and learners. Due to its digital nature it is used and reused in different scenarios by different people unlike the traditional classroom teaching method.

Wiley [2] elaborates on the two most important properties of learning objects as granularity and reusability. The most effective technique is the aggregation concept. The term granularity is directly proportional to reusability which says that the more granular an object is, the more it is reusable. A finer level of granularity is expected as the size of the learning object is reduced; the factor of reusing it also increases.

By using conceptual modeling, which includes the different levels and styles of learning, the concept of granularity can be established. Any new proposed application of LO should narrow down to a specific need and it should be kept emerging within the prevailing metadata standards. To bring about more personalization using LO the methodology of combination of algorithms for adaptive learning is proposed. The domain ontology is devised for the repository wherein the Learning Objects are stored. The evaluation and performance measures decide the level of reusability and personalization achieved for a learner.

The granularity of learning objects is achieved with effective personalization using the proposed adaptive methodology and ontology based retrieval of learning objects.Preffered personalization using the preference based and correlation based algorithms provide adaptive and effective personalization which also evaluates the performance of learning objects by using the recall and accuracy metrics.

2. THE CONCEPT OF GRANULARITY FOR EFFECTIVE PERSONALIZATION

Granularity refers to the size of the learning object. The learning object approach to establish intuitive personalization has the features of granularity. Granularity is difficult in case of large monolithic contents. The higher the level of coupling the greater is the reusability. This is possible with digital learning materials. The reusability in different situations for different people is the base for personalization. Learning Objects development includes a variety of tasks like multimedia content which has animation, pictures, texts and images. Personalization is attained by identifying the unique learning experience of learners with respect to capacity, skill, efficiency and the needs and knowledge of every individual. This is effective when there is a combination issue.

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The complexity of the content and the size of the object are related and thereby the fine granularity levels establish the reusability of the content.

The greater the reusability the higher is the level of personalization. The effective reuse is the success of the course content which in turn gives the maximum reusability based on personal intuition depending on the complexity of the course. The better level of understanding is done by fine granular objects which in turn reflect effective and efficient reuse of the learning object.

2.1 Personalization

The learners retrieve data from the semantic web through learning objects. There are various types of metadata available for an e-learning paradigm. The learning objects are retrieved from a repository and are reused. Sometimes the data retrieved from various repositories may not be relevant, well organized and not suitable for reuse in organizing a specific course for a specific learner. Thereby knowing the users intention and preferences and their awareness in relating the subjects is known as the concept of personalization.

3. OVERVIEW OF RELATED WORK

According to David Wiley, 'The main idea of learning object is to break educational content down into small chunks that can be reused in various learning environment, in the spirit of object oriented programming'. Various standards of learning objects have evolved.

SCORM- Sharable Content Object Reference Model by Advanced Distributed Learning initiative (SCORM ADL2004) This standard is deployed by Advanced Distributed Learning Initiative. This creates Learning Objects as instructional objects for web based learning as well. Key contributors for SCORM are AICC, ARIADNE, and IEEELISC. This model is considered to be too difficult but its implementation is considered to be very consistent

The IEEE (Learning Object Metadata)LOM-(IEEE 2002)-This was the first important standard created for defining the metadata for LO and now considered to be too simple and outdated.

Virtual Mentor System (Zhang et al,2004)-Focuses that better learning outcomes have been identified compared to traditional class room settings.

Synchronized Multimedia Integration Language (SMIL) was developed by the World Wide Web Consortium (W3C), (2005).- This standardization was adopted by the World Wide Web Consortium and is an easy-to-learn XML-style, allowing easy design

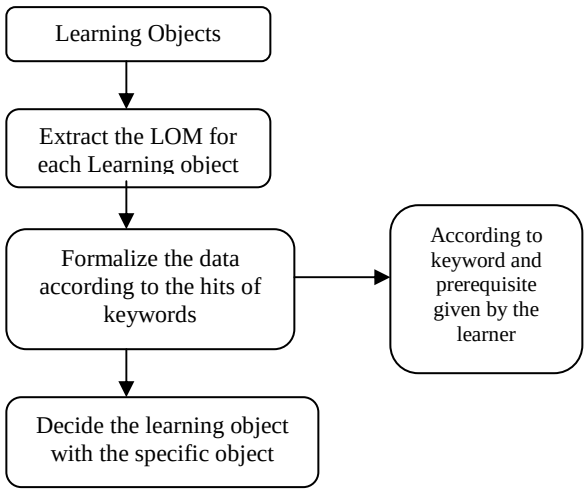
Educational Modelling Language (EML)-This is defined for different fields providing presentations in education and training process.

4. PROPOSED ADAPTIVE APPROACH

4.1 An ontology approach

The ontology to build a repository is proposed for the reuse of learning object. The related and relevant objects are retrieved from the repository for effective personalization. The data retrieved are based on the key words according to the learner's request and selection of course based on the prerequisite of the course.

Learning Object Repository



4.2 Preferred Personalization.

It is proposed to have a personalized LO with respect to the preference of the learner. Preferred Personalization Learning Object Model (PPLOM) is proposed for an effective and adaptive personalization. Specific domain ontology is identified for proposing the PPLOM.

This identifies the learner's preference based on the past history, where the prerequisite of the course is known for the current course chosen. Thereby it is easy for the learning object to suggest a course based on the user's preference according to prerequisite. Therefore it provides an adaptive and preferred personalized learning object for the user.

4.3 Methodology

- It is proposed to enhance the concept with the preference based algorithm and correlation based algorithm.

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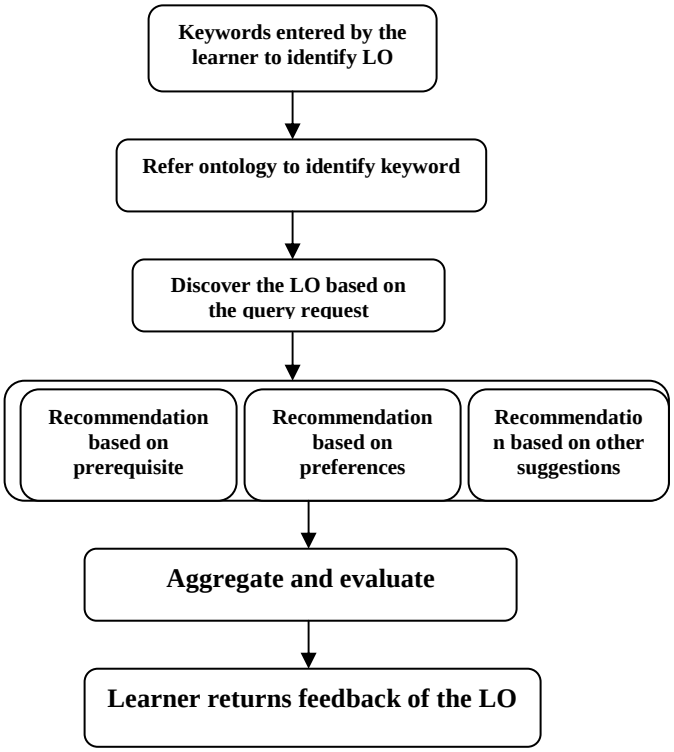
- Use a specific ontology to find out the relevant learning object.
  LO features =feature included in the repository which includes the field of learning object metadata and feature a≠ feature b, if a≠ b.
- The methodology associates the learning object with the concept of ontology.

A special ontology approach can be used to classify the learning objects. Learning Objects have very little metadata. If there is no metadata the object is put in the repository where it creates a learning object metadata. When the learner's request matches the keyword of the LOM it will relate it to the PPLOM.

The PPLOM approach helps to navigate the course content not only with keywords, but also with prerequisite and additional search algorithms for indexing document with context and meaning.

Proposed PPLOM model.



4.4 Learner's Feedback

Content wise feedback and the feedback related to prerequisite which helps the user to use the course effectively can be obtained by the number of hits of the keywords used for the system. Based on this feedback of the preference of the learning object the feature value can be assessed. The feedback of the usage of a course in the ontology domain gives the usage of the levels of learning objects. The granularity level is assessed by the usage of the LO. This also indicates the levels of adaptive personalization of the learner.

4.5 Proposed Evaluation Methodology.

4.5.1 Experimental Evaluation

a. The learner enters the key words and prerequisite from the user interface

b. The key words are inferred and are expanded by using the learning object repository ontology.

c. For each learning object the degree of preference and correlation based on suggestion is obtained from the learner's feedback and the aggregate is taken as the recommended score for the learning object.

4.5.2 Evaluation criteria

The evaluation of the information retrieved using learning object, is carried out using methods such as accuracy and recall. The two formulae help in evaluating the learner's personalization.

$$\text{Recall} = \frac{\text{No.of retrieved related LO}}{\text{No.of all related LO}}$$

The recall rate is achieved by the number of retrieved learning objects divided by the number of related learning objects of the documents which are identified by the domain experts.

$$\text{Accuracy} = \frac{\text{No. of retrieved related LO}}{\text{No.of all retrieved LO}}$$

The accuracy rate is achieved by the number of retrieved learning objects divided by the total number of retrieved learning objects for a course.

Both identify the Mean Identified Error (MIE) which is used to evaluate the results. The error between the learner's feedback and the system's prediction is given as

$$MIE = \frac{\sum_{i=1}^{N} \left| p_i - q_i \right|}{N}$$

where N represents the number of comparisons. The accuracy is better when the value of MIE is lower when comparing the preference MIE and suggested MIE.

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5. OBSERVATIONS AND FUTURE WORK

E-learning will become more popular and its usage will be extended to a varied set of learners who have to access a bulk database for the preferred courses from the vast object repositories on the internet. This paper suggests an effective and adaptive model for the personalization of the learner for the courses opted from the vast repository. This paper focuses on retrieving the learning objects, based on the preference of the learners as well as ontology to opt a course and narrow down to the specified topic according to the learner's intuition. With the learners feedback and the usage of the preference based algorithm the history and the level of usage of learning objects can be identified for effective personalization.

The proposed approach can be easily embedded into an ontology based E-learning tutoring system of the vast repositories on the internet.

6. CONCLUSION AND LIMITATIONS

In the near future E-learning is becoming more popular and the issues are to be resolved for effective personalization of large databases .The methodology identified in this paper can be used to obtain an effective and adaptive personalization of the learner while accessing the large data on the web. The recommendations based on prerequisite, preferences and suggestions provide better recall and accuracy of the learning objects used. The feedback of the learner provides the level of personalization which helps the learner to access the data related to courses for future references. The proposed evaluation methodology helps to identify the granular level of the learning objects and gives the Mean Identified Error rate for effective personalization

This paper also showcases the need to automate the identification of granularity levels for effective personalization. Issues have to be solved before the learner starts to really benefit from the large database as the intention of the learner is understood by the learning objects on reusing them.

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