



A Framework for Ontology Based Course Recommendation System

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Abstract: E-Learning systems are all based on Learner-centered approach, which means a learner has the liberty to choose and study the Course of interest. However, because of lots of choices available to select a course, learners would not be comfortable to make a decision or to choose what to learn and what would be more appropriate for them. In such a Situation, recommender system can help in making suitable course selection. However, recommendation systems haven't been adequately used in E-learning as compared to other Domains.

Identifying the learners need and area of interest and then suggesting the courses can make it possible to suggest an appropriate course to a learner. Based on this concept of personalization, we have introduced an Ontology-based recommender system to support learner-centric learning and suggest different courses to a learner that are more suitable for their technical needs in order to maximize their learning experience. Personalization occurs when such Recommender systems tailor the learning and technical needs of learners such that it suits their area of interest, and helps them in increasing their performance and the quality of learning as well.

Keywords— Recommender system, E-Learning, Learning Management System, personalization,

I. INTRODUCTION

E-Learning provides the learner-centric environment with the help of learning management system, where learners have a choice to select the learning topic and task to complete. Such flexibility can motivate a learner and help them to improve their performance [1]. However, due to huge number available courses, learners would be uncomfortable to make a decision what course to choose and what would be more appropriate for them. In such a time consuming and brainstorming Situations, a recommender system can help in making appropriate course selection.

The Recommendation systems are the most employed tools nowadays, for personalization in e-commerce businesses, Educational Scenario etc because they provide the basic and the relevant information that is likely to the interest of the user of the system. Personalization is to tailor the needs of learners which can be based on the

technical needs and requirements, knowledge, style of learning and other preferences of learners. The Learners are provided with the content which is relevant and suitable for their needs, obtained through different methods like

Learners profile, choice of selection etc [2]. Recommender Systems can manage information load by filtering and personalizing the data according to user's requirements.

During past few years recommendation systems offer more relevant and personalized recommendations by using information on the basis on some situations like learning objects, context, and area of interest, location and task. E.g. the resources recommended to a learner of who is searching for "Network Security" for writing a research article are different than those to a graduate student writing an assignment on the same topic, because their requirements and the level of education is different, which are treated as contextual information and by using the contextual information has been measured as a major source of correctness of recommendations [3-4].

Therefore, we have proposed a recommender system in this paper, which supports learner-centered activities by selecting the appropriate courses and recommend it to the learner. This paper proposes an Ontology-based recommender system for E-learning domain to help the learners finding courses they need to learn according to their requirements.

II. RECOMMENDER SYSTEMS

Most of the E-learning systems have some common problems associated with them one among those problems is the time a learner has to spend to find the right course content as well. However, due to the proliferation of learning courses and the content, it became a time-consuming task for learners to get access according to their requirements and needs. That is the reason traditional E-learning systems lack flexible delivery of the learning resources [5]. Conventional E-learning systems with inadequate searching technique and the due to the absence of personalization are facing challenges.

A Recommender approaches presented in Fig. 1 can help us to solve these problems by offering appropriate learning resources to a particular learner using different rules, filtering techniques and Ontology as well.



Recommender Systems have been an area of significant research interest since its inception from the mid-1990s. A Recommender system is nothing but software applications which employs different techniques to provide suggestions to numerous online users. These suggestions depend on particular decision-making purposes, e.g. what Course to choose, what items to buy, and to listen etc. Therefore, a recommender system is directed towards the learners or

Users who lack in experience and cannot assess the huge number of unconventional items that a repository contains.

All these EDM techniques provide a learning environment which is more effective [9].

However, there are challenges for classical recommenders systems in certain domains and contexts where either their performance is low or they cannot perform at all. Some of the Problems are like Cold Start, Sparsity, Trust, Performance etc. Therefore, we have proposed a system which can overcome most of these problems as our system is context sensitive and is based on rules and Ontology approach [10].

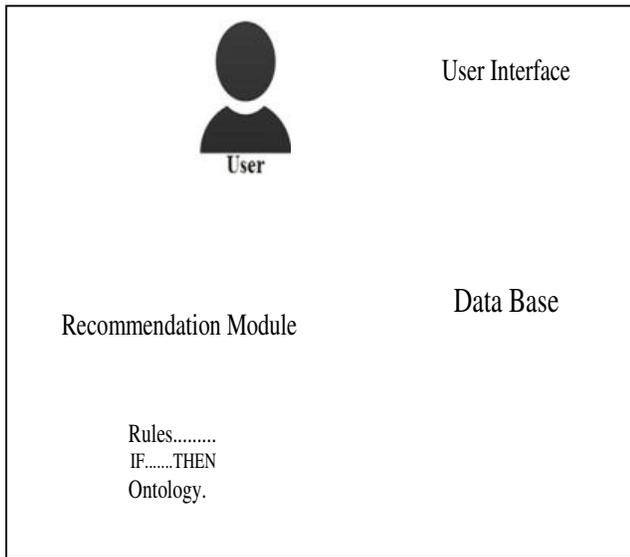


Fig. 1: A recommender Scheme

Recommender Systems has been explored and implemented in various domain applications, which includes E-learning, E-health, and E-commerce etc in the last decade [6]. The basic aim of Recommendation systems is to prioritize or personalized the information about items such as Courses, Books, Articles, Web pages, to a particular user with respect to their area of interest, and for that purpose the items are selected on the basis of user knowledge, user behavior, context in which recommendation is to be required. All of these recommender systems use algorithms in order to identify similar users [7].

At the heart of every recommender system is a search, based on similarities and methods from data mining [8], and the Educational data mining covered different methods of data mining with respect to educational data. EDM deals with an analytical study of learner related data in order to understand the behavior of the learner (Student).

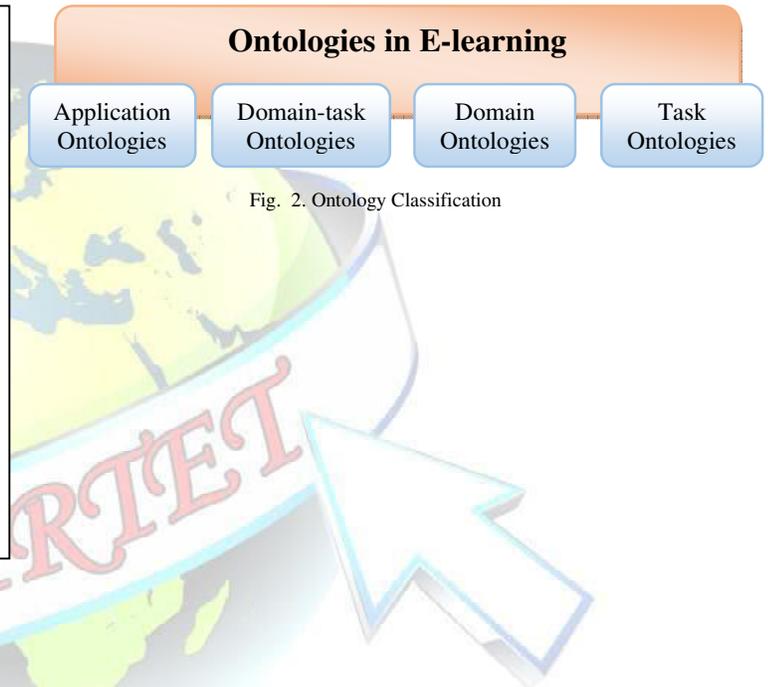


Fig. 2. Ontology Classification



III. ONTOLOGY-BASED RECOMMENDER SYSTEMS

A new trend in recommender systems is being witnessed now day's, which is based on the concept of an ontology. The Ontology is unambiguous, formal and shared conceptualization of certain domain which is defines set of concepts related to a particular domain and the relationship between the concepts in some machine understandable language [11]. According to some relationship Ontology interprets terms with another term and its hierarchical organization allows an examination of preferences at various abstraction levels. Ontology is used to store and utilize the personal preferences of a user and has powerful reasoning and modeling capabilities. It allows a high degree of knowledge sharing and reuse

The main components of Ontologies are Classes (which represent a unique concept of a domain), Objects (Some specific Items and values for each item feature belonging to that class, properties (present some binary relationships between two or more classes E.g. "is-a" relationship shows that some class "B" is a subclass of class "A") [12]. There are various classifications of Ontologies presented in literature which has characteristics of reuse and sharing characteristics and that could be helpful in solving the problems related to communication that is why ontology is considered as a powerful tool to construct and maintain an information system. There are four Main Ontology Classifications which are communication, content, indexing, and meta-Ontologies [13].

In figure 2 another Ontology classification on the basis subject conceptualization is distinguished as Application Ontologies, domain-task Ontologies, domain Ontologies, and task Ontologies. **Domain Ontologies** are reusable within a particular domain E.g. Sports, Medical, Tourism, History etc the key feature of these Ontologies are that they are independent of any Particular task or application and they provide a vocabulary for concepts and represent knowledge within a specific domain. **Task Ontologies** explain terminology relevant to a general task or activity E.g. Selling and Buying and are Independent of a domain. **Domain-Task** Ontologies are not reusable across domains and correspond to the vocabulary for a task within a specific domain. **Application Ontologies** describe vocabulary relevant to a particular application i.e. they are application-dependent and can expand their domain and task Ontologies, with much more relevancy to a specific application or problem [14]. In our study, we are employing Domain Ontology for Courses present in a particular domain.

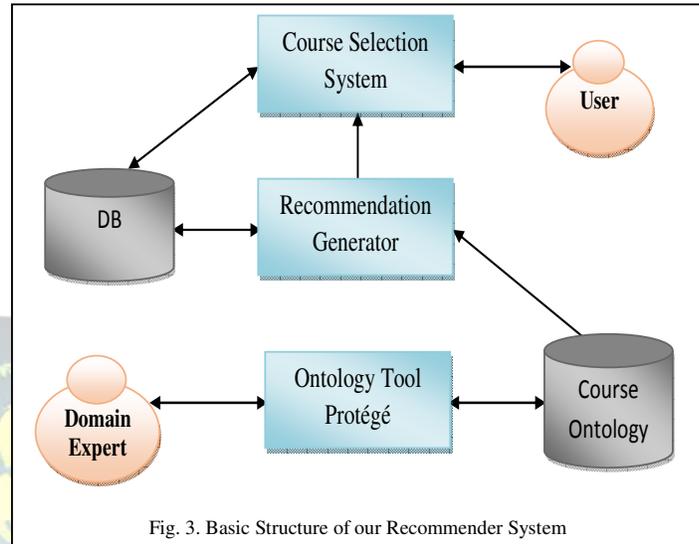


Fig. 3. Basic Structure of our Recommender System

IV. SCOPE OF RESEARCH

There are various types of Recommendation systems based on different methods and approaches. Among them the prominent categories Collaborative filtering, Content-based, knowledge-based, demographic-based Semantic and hybrid systems. In this paper, an Ontology-based approach is used and the intention of using Ontology formation is to create the best match of courses for learners based on their area of interest and requirements.

The first requirements for Ontology require course ontology that should be based on the some relationship i.e. "is-a", "related-to", "has-credit", "Subset-of" "Part-of", "associated-with" etc. that should be flexible and predefined. This paper proposes a model for recommendation system based on ontology rules for to support E-learning personalization. In order to build a recommender system, it is mandatory to define some recommendation and personalization algorithms.

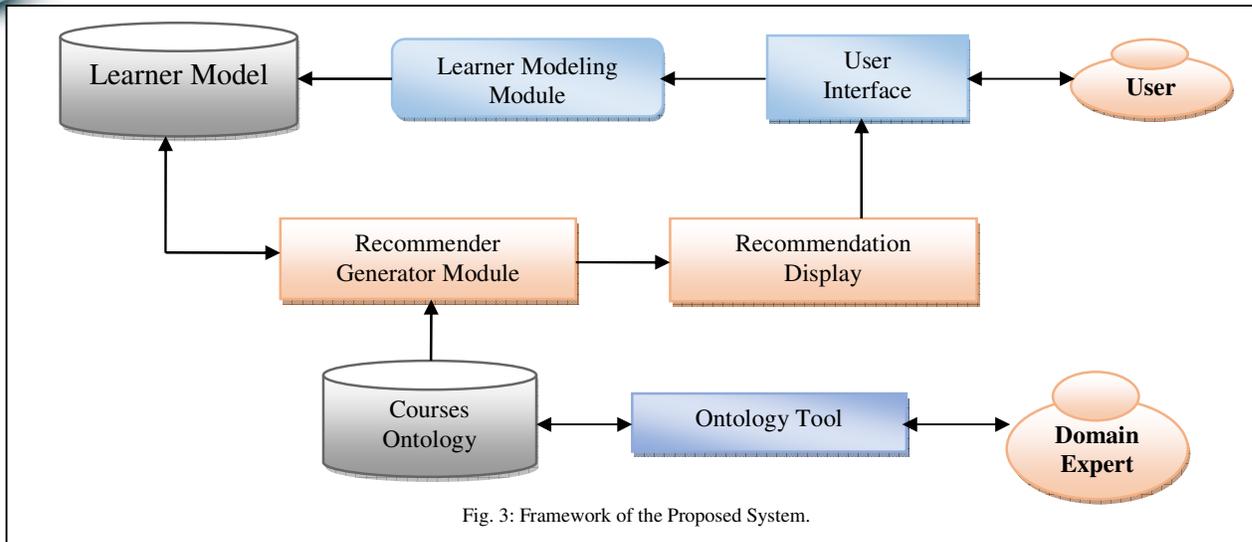


Fig. 3: Framework of the Proposed System.

Hence, Context and Domain Ontology were preferred for personalizing the recommendation and the Ontology will be used to create relation among learning courses and present it to the learner. Our Recommender generation module will be based on some rules. The learner model is built is on learners profile and the context of the course requirements and finally with the help of ontology courses will be recommended and stored in recommendation storage with the user profile for generating future use.

V. THE ARCHITECTURE OF THE SYSTEM

In Fig. 3 the system structure reveals that domain expert and the user (Student or Learner) are the two users of the system and among them students are main users of Recommender system. If Student or learner want to use the system, with the help of interface the recommendation systems will be automatically called to find the best courses to recommend.

The Domain or Ontology expert use ontology tool to build course ontology based on the some relationship which might exist between different courses in single or different programs that can offer reference material to recommendation generator to generate recommended Courses.

PROPOSE SYSTEM FRAMEWORK

The recommender system we have proposed (see Fig. 4) consists of following modules:

1. **Learner Profile Generation:** The aim of learner modeling module is to gather the Information

2. about the learner, the technical requirements and his area of Interest which will be filtered based on the context. The Learner model holds information provided by the learner E.g. Area of Interest (DBMS, Networking, Data Mining, and Warehousing etc), previous knowledge (course related), and personal information as well.

3. **Recommender Generator:** This Module is responsible for generating the suitable recommendation for target learners and later supplied the recommendations to display module and also updated it to learner model for future use. The recommendations are being generated on the basis of some predefined rules (Context and Domain Ontology).

4. **Recommendation Display:** Here the actual recommendations are being displayed and send to the user Interface. The main advantage of our proposed system is that instead of learning style, expertise level, knowledge, performance and ratings from learners, the system uses Domain Ontology and the requirements of the learner to identify which course may be best suitable for them to increase learners experience level.

5. **Course Ontology:** Ontology will describe the relationship between the courses in the domain and to represent this ontology Protégé tool will be used. This is the main part of the whole recommender system on whose basis courses will be recommended to a learner. Ontology rules will be applied to the courses available in the database



and the relationship among courses will be created by a domain expert. These relationships can be increased or decreased or the same ontology rules can be applied to other domains once the relationships are over.

VI. CONCLUSION.

This paper introduces a recommender Information system to provide course recommendations which are more suitable and helpful to the learner by considering his learning interest and requirements in an E-learning environment. The main offerings of our work are: first, to check the context of learner requirements creates ontology for courses and find a better combination of Courses. Our proposed system does not take rating system into consideration, as it is being followed in most of the conventional recommender systems. It uses attributes and different characteristics related to learners like Domain and their requirements. In addition to that, most of the work presented here in relation to Recommendation systems in E-learning systems.

VII. FUTUREWORKS

For future work, we are going to create ontology for all learning courses using a tool known as Protégé and design recommendations based on it. Further, we are going to store Recommendations generated for every User which later can be used for searching similar learners, which may be helpful in improving the performance of our Recommender system.

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