Personalized Agent-based E-Learning System for Distributed Environment

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Abstract - E-learning refers to learning that is delivered or enabled via electronic technology. It is the effective learning process created by combining digitally delivered content with support and services. E-learning is classified as synchronous or asynchronous. Agent-based E-learning system retrieves relevant learning materials, process and analyzes data to enable meaningful E-learning recommendations to instructors and learners. E-learning intelligent agents are sets of independent software tools that are linked with other applications and database software running within a computer environment. Personalized agent-based E-learning system provide a set of personalization functionalities such as personalizing learning plans, learning materials, test and necessary instant messages etc., to online learners. In recent years, numerous efforts have been made in the direction of automating the content acquisition and distribution, but personalized content delivery, access and interaction remain research challenges. This paper entitled “Personalized Agent-Based E-Learning System for Distributed Environment” includes intelligent agent technology that can be employed to achieve personalization in E-learning system and as a consequence to improve E-learning effectiveness dramatically. While retrieving learning content in distributed environment traffic loads take place. Therefore the learning process should be enhanced by having many agents collaborating and competing towards achieving the prescribed goals to provide personalized learning content and provide algorithms to incorporate load balancing to reduce traffic loads.

Index Terms – E-learning, Agent based learning, Personalization, Load Balancing.

I. INTRODUCTION

E-learning refers to learning that is delivered or enabled via electronic technology. E-learning is defined as “the effective learning process created by combining digitally delivered content with support and services.” It is the instruction delivered electronically wholly by a web browser, through the Internet or an intranet, or through CD-ROM or DVD multimedia platforms. It is also defined as a technology that fully leverages the distributive power of the Internet and encourages investors to consider the ‘e’ in e-learning to represent ‘effective’ [11].

E-learning is classified as synchronous or asynchronous. Both terms refer to “the extent to which a course is bound by place and/or time,” Synchronous simply means that two or more events occur at the same time, while Asynchronous means that two or more events don’t occur at the same time.

An agent is a computer system that is situated in some environment, and that is capable of autonomous action in this environment in order to meet its design objectives. An intelligent agent is one that is capable of flexible autonomous action in order to meet its design objectives, where flexibility is achieved by reactivity, pro-activeness and social ability.

Agent based e-learning provides tools and techniques to manage the information overload, serve as academic experts, and create programming environments for the learners E-learning intelligent agents are tools that can manage the information overload, serve as academic experts, and create programming environments for the learners [5]. In this way, the learning process is enhanced by having many agents collaborating and competing towards achieving the prescribed goals. Intelligent agents should be able to model the user in order to remember his/her knowledge, skills and learning style.

Personalized Agent-based E-learning system provide a set of personalization functionalities such as personalizing learning plans, learning materials, test and necessary instant messages etc., to online learners. In recent years, numerous efforts have been made in the direction of automating the content acquisition and distribution, but personalized content delivery, access and interaction remain research challenges.

This paper entitled “Personalized Agent-Based E-Learning System for Distributed Environment” includes intelligent agent technology that can be employed to achieve personalization in E-learning system and as a consequence to improve E-learning effectiveness dramatically. While retrieving learning content in distributed environment traffic loads take place. Therefore the learning process should be enhanced by having many agents collaborating and competing towards achieving the prescribed goals to provide personalized learning content and provide algorithms to incorporate load balancing to reduce traffic loads.

Section 2 describes the various Agent-based e-learning system and then section 3 gives the proposed methodology for Personalized Agent-based system and section 4 concludes the work and future enhancement.
II. RELATED WORK

There are number of research regarding agent-based e-learning system. Most of the papers have described the architectures of agent-based system but have not illustrated the problem of personalization and load balancing in distributed environment.

Chih-Ming Chen et. al [1] proposed a genetic-based personalized e-learning system that generated appropriate learning paths according to the incorrect testing responses of an individual learner in a pre-test. Judy C.R. Tseng [10] proposed an adaptive learning approach by combining two main sources of personalization information, namely learning behavior and personal learning style. In this approach a questionnaires had been used to determine the initial learning styles of the students. The interactions and learning results of each student were analyzed while adjusting the subject materials. But this approach was very difficult in developing six versions of subject materials to meet the personalization requirements.

C. J. Huang [2] incorporated the PBL (Problem-based learning) activity into an open software e-learning platform Moodle, and a learning diagnosis tool was added in the platform to alleviate the loading of the instructors. Learners' transcripts on discussion board and chatting room, were first preprocessed by the learning parameter extraction module to detect whether the learners plan wrong solutions.

The extracted parameters were then fed into a classification algorithm to examine the quality of the learners’ suggestions and some appropriate feedback was issued to the learners/instructor if needed.

E. Reategui et. al [8] presented an alternative approach to educational AHS (Adaptive Hypermedia Systems) in which a virtual character is used to personalize the interaction between the user and particular recommender system. The virtual character identifies and proposes navigation paths to each user. The character has natural language communication abilities so that it can learn students' profiles and use knowledge to recommend appropriate contents and activities.

Through its interaction with the user, the character was able to collect and organize information about students in order to identify appropriate suggestions of contents. The recommender system employed a knowledge representation to understand and modify, teachers/tutors to explore the types of recommendations made.


Desislava Paneva [6] presented approaches and methods for adaptive learning implementation, which were used in some contemporary web-interfaced Learning Management Systems (LMSs) to provide the contents in the personalized way. One big limitation of the web-based interaction is the smaller communication bandwidth than traditional face-to-face interaction.

Peter Brusilovsky et.al [14] focused on user modeling and adaptation in distributed E-Learning systems. Here they described CUMULATE, a generic student modeling server developed for a distributed E-Learning architecture, KnowledgeTree and introduced a specific, topic-based knowledge modeling approach which has been implemented as an inference agent in CUMULATE and used in QuizGuide, an adaptive system that helps students select the most relevant self-assessment quizzes. Mahmoud Neji et. al [12] proposed a framework for agent based collaborative affective e-learning. They also explored the possible use of the affective communication in virtual environments.

Eliane Pozzebon et. al [7] proposed a group learning management method for Intelligent Tutoring System. They proposed a group management specification and execution method that seeks a compromise between simple course design and complex adaptive group interaction. This was achieved through an authoring method with the scenarios include complex learning interaction protocols in which student and group models use and update are automatically included. This method adopts ontologies to represent domain and student models, and object Petri nets to specify the group interaction protocols.

Mahmoud M. El-Khouly et. al [13] presented an agent-based tutoring system in presence of agent and internet technology. The Multi-Agent Internet Based Tutoring System (I-ATCL) consists of two agents, a Personal Assistant Agent for Teachers (PAA-T) and a Personal Assistant Agent for Students (PAA-S). The PAA-S resides on the client side and communicates via HTTP and IIOP with the PAA-T on the server side. Jian Huang et. al [9] presented a new framework named the Multi-Agent Inductive Learning System (MAILS) that tightly integrates processes of induction between agents. This approach used for inducing declarative program fragments in a multi-agent distributed programming system.

Darina Dicheva et. al [4] proposed a development tool for e-learning applications. They discussed the effectiveness of context-based hyperext and hypermedia to enhance student learning in computer science courses. Victor Pankratius et. al [16] presented a distributed, Service-Oriented Architecture (SOA) for e-learning systems based on Web services, and described the extensions to support software agents. They also proposed the use of intelligent software agents for the distributed retrieval of educational content.

III. PROPOSED METHODOLOGY

The main objective of the paper is to give a new methodology for Personalized Agent-Based E-learning System
for Distributed Environment. It includes intelligent agent technology that can be employed to achieve personalization in E-learning system and as a consequence to improve E-learning effectiveness dramatically.

Load balancing is an important factor while retrieving learning content in distributed environment as the loads varies dynamically at different time and in different situation. Therefore the learning process should be enhanced by having many agents collaborating and competing towards achieving the prescribed goals to provide personalized learning content and incorporate load balancing to reduce traffic loads.

The main idea of the system is to personalize learning support in a distributed environment and to handle distributed electronic content. In distributed computing environment, the tutoring system can take advantage of networking to provide online learning with the help of agents. Personalized agent-based E-learning system use the students’ learning profile such as learning style and background knowledge in selecting, organizing, and presenting the learning material to provide the online learners. While retrieving learning content in distributed environment traffic loads take place. An efficient and reasonable decision should be made to balance the load. So the dynamic load-balancing algorithm has been used to provide adaptive solution.

In the proposed methodology of learning environment students, tutors and corresponding student learning material are distributed across the entire network. Similarly the potential users as student or tutor are also widely distributed. This system consists of a number of agents such as Student agent, Activity Agent, Modeling Agent, Planner Agent and Load balancing Agent.

Student Agent generates an adaptive interface for a particular online learner based on the learning plan. Activity Agent manages the student’s personal profile, which includes knowledge background; learning style, learning duration on a particular task, etc are captured and stored in the learner profile by the Activity Agent. The Modeling agent abstracts learner model, based on the learner profile. Based on the learner model. Planning agent updates the learning plan.

If there is increase in the numbers of users then the load to E-learning server make the system slower and the risk of crash increases. So there is a need for a method to balance the load, therefore dynamic load balancing algorithms can be used.

A. Implementation Detail of the Proposed Methodology

The personalized Agent-Based e-learning system for distributed environment contains five types of decision making agents that already discussed above. The agents collaborate with each other in XML messages through different communication channels. XML language is used to represent course contents, learner models, and learning plans. The agents run concurrently on the servers and workstations in the distributed environment. The agents that are discussed above can be developed using java programming language.

The Load Balancing Agent keeps on monitoring the student agent because the student agent is the one which acts as the interface to the student. Student Agent gets the requests from the user and there exists some threshold value for requests received by the user in the distributed environment. If the request exceeds the threshold value, load balancing agent gets activated. Process migration and remote execution are used as the basic mechanism to achieve the load balance. Depending on the workload and process characteristics, the load balance agent should decide which process to migrate and where to migrate effectively. The load balancing agent is nothing but a mobile agent, so the Mobile Agent-Based Load Balancing Algorithm is used here to distribute the incoming load on participating nodes. Thus the load on the server can be reduced on the network and so we experience the efficient and personalized environment for e-learning system.

IV. Conclusion

E-Learning has become a part of education in recent times. Agent-based E-learning system retrieves relevant learning materials, process and analyzes data to enable meaningful E-learning recommendations to instructors and learners. This paper provides a new methodology for Agent-Based E-learning system that provides set of personalization functionalities such as personalizing learning plans, learning materials, test and necessary instant messages etc., to online learners. This proposed methodology also overcomes the load-balancing problem in E-learning systems that are situated in distributed environment by providing a suitable load balancing algorithms to reduce traffic loads.

REFERENCES


