DESIGN FOR INTERACTIVE E-LEARNING BASED
UPON MULTI-AGENT SYSTEM: I-MBLS

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Abstract

The multi-agent system is one of the emerging trends being used today and the application of multi-agent systems is spreading in almost every field. It can provide better solutions to very complex and restrictive system. Here in this paper, we propose a new Multi agent based Architecture named I-MBLS (Interactive Multi-Agent Based Learning System) that we have designed for distance learning on the web. This architecture makes use of six different agents named Student Interface Agent (SIA)- responsible for monitoring student learning activity, Tutor Interface Agent (TIA)- responsible for providing an interactive interface to the tutor, Decision support Intelligent Agent (DSIA)- responsible for important decision making, Collaborate agent (CA)- responsible for establishing collaboration among students, Test Agent (TA) – responsible for conducting tests, evaluating marks scored and lesson Planning agent (LPA) – responsible for helping tutor for preparing a course content. These agents collaborate with each other and provide an e-learning environment that is interactive, secure and efficient learning environment for the students as well as Tutor. This system will provide the course content according to the student personalized needs. Progress of a student can be assessed according to their test results. Students learning activity are also monitored, so that if the student doesn’t take an active participation in learning activity then the student Interface agent will buzz on student web page or pop-up a message and ask if student need a help.

The rest of the paper has been organized as follows. Section 2 gives the brief description of the existing multi agent based e-learning systems, followed by Section 3 describes the proposed architecture. Finally, the conclusion lists out the key contributions of the research work presented.

2 Role Of Agent In Education

Agent technology is growing day by day and almost every real-time application uses it. It plays a vital role in creating an interactive e-learning environment [22]. Today Agent technology is the key word which is coined in almost every domain of learning, whether it’s a design of peer-help environments, information retrieval, student information processing, distribution, feedback collection, pedagogical agents, teaching agents, tutoring agents, agents for assignment checking and agents for student group online support to perform mechanisms of interaction and collaboration in networked community environment.

3 Existing Multiagent Based System For E-Learning

As lots of multi agent based e-learning systems are available supporting different combination of agents, having implemented with different technologies and having different methodologies. These systems include F-SMILE [18], I-ATCL[8], i-MINDS[14,15 & 16], Eletrotutor (JADE Project) [11], EMASPEL (Emotional Multi-Agents System for Peer to peer E-Learning)[19] etc. In this section some of these multi agent systems have been explained by focusing on the description of the technologies used, and the pedagogical methodologies applied.

3.1 F-SMILE (File-Store Manipulation Intelligent Learning Environment)

F-Smile or web F-SMILE was proposed by Virvou, Maria, and Kabassi and Katerina at University of Piraeus. This system works as student monitoring and helping system. It always monitor the student activity, if it finds student encounter any problem, it will start helping him/her. For this
purpose system contains four agents which interact with each other to resolve the student’s problem.

Agents used: LM Agent, Advising Agent, Tutoring Agent, and Speech-driven Agent

Developed for: learn manipulation of file storage of their personal computer

3.2 EMASPEL (Emotional Multi-Agents System for Peer to peer E-Learning)

EMASPEL was proposed by Mohamed Ben Ammar and Mahmoud Neji. It is multi-agents based system for e-learning which makes it possible to recognize the emotional state running about learning in the peer to peer network.

Agents Used: Interface Agent, Emotional Agents, Curriculum Agent, Tutor Agent, The emotional embodied conversational agent

Platform: MadKit [19,20]

3.3 I-MINDS (Intelligent Multiagent Infrastructure for Distributed Systems)

I-MINDS was proposed by Soh et al. is based on computer-supported collaborative learning (CSCL) infrastructure, which provide an environment for learners in synchronous learning and classroom management applications for instructors. I-MINDS works on three agents i.e. Teacher Agent, Student Agent, Group agent.

Teacher agent allows the instructor to interact with students, manage Q&A sessions, administer quizzes, post evaluations, form groups and monitor individual and group performances.

Student agent monitors and models its user and carries out group formation with other student agents behind-the-scene.

Group agent is used for each peer group that monitors and evaluates its assigned peer group

Agents Used: Tutor Agent, Student agent, Group agent

Platform used: Java (SDK1.4.2)

Backend Used: MySQL [14,15 & 16]

3.4 I-ATCL

Proposed by Mahmoud M. El-Khouly, Behrouz H. Far and Zenya Koono this system is proposed for computer science teaching.

Agent used: personal assistant agent for teachers (PAA-T) and personal assistant agent for students (PAA-S) [8]

4 Proposed Architecture

As multiagent technology has spread its root in e-learning, lots of MAS based systems have been designed and developed for e-learning environment, different technologies & techniques have been used and implemented to enhance the learning, like Collaborative learning feature. Here in this paper we proposed an intelligent e-learning system named i-MBLS. It observes learning activity of the student, if found some change then action has to be taken and then the result of the action is sent back to the student. I-MBLS will help the tutor for preparing course content and also help out the student in learning process. For this, six different agents are used, which are loosely coupled with each other. In addition the two human agents involved are tutor and student.

Here two types of human are participated that is student and tutor and 6 different agents are used which are loosely coupled with each other

The problem is split in five different modules

- Check Authentication
- Preparing Course Content
- Provide Course Content to the student
- Observing Student learning Activity
- Testing student knowledge about the course

4.1 Check Authentication

Authentication for any kind of access is performed by the web portal who maintains a profile database of authorized person.

4.2 Preparing Course Content

Whenever a tutor feels the need of upgradation of course content, then IDSA will intimate the lesson planning agent, where in turn will take up the request and perform recommended & necessary suggestion. This suggestion will be given back to the TIA to provide necessary help during the upgradation.
4.3 Provide Course Content to the Student

If the SIA finds that student is in need. Then it will send the request to Intelligent Decision Support Agent (IDSA) this agent is the core decision making agent, which look at the previous history of the student and take the information from Profile Database like their learning style, learning history. After collecting sufficient information regarding the type of content student need, IDSA will search the required content from the content database.

Now this searched information will send to the Student Interface Agent (SIA). And also some course related information is also sent to the Profile Database for updating record of the student learning history.

“Felder-Silverman Model has been used for judging student learning style.”

If Student is taken 60% of the marks from the same type of course content then SIA will ask for promotion at this level student can take the course content from the higher level or he/she can skip this part and stay on the same level of learning.

4.4 Observing Student Learning Activity

SIA will thoroughly monitor the student learning track of any event that is triggered by the student. The event can be a mouse click, page scroll or frequency and direction of page scrolling. In case of a noticeable delay, the helper will generate a buzz on the concerned student Interface and also stop the delivery of content. If SIA find that student has encountered a problem then it will send the message to the IDSA and IDSA will take the appropriate action and try to resolve the student problem.

4.5 Testing Student Knowledge About the Course

After successful completion of course, the test has been offered to the student so that system will decide whether to upgrade the student level or not. There are two types of questioning

- Objective type’s question
- True/False question

SIA send a request to IDSA for conducting a test, IDSA will search the required profile information of the student and send it to test/ Evaluation Agent. Now the Test generator will generate the test for the student and send back to IDSA. IDSA will send the generated test to the SIA and also update the student profile DB. After the test has been done, for evaluating the marks the result has to be sent to IDSA so that the system will decide whether to promote the student to the higher level or student need more learning. IDSA also checks which section student done well and in which section student is weak. Also update the profile database of that student.
4.6 Collaboration among Tutor and Students

The collaboration agent is primarily responsible for enabling any kind of communication between tutor and students. The communication can take place between a tutor and students or between groups of students having similar learning habits.

![Collaboration Among Tutor and Students](image)

Figure 6. Collaboration Among Tutor and Students

The communication can be set up at the request of a student and any available tutor or in case of student to student interaction a student can approve for the communication setup. Once a communication has been setup and approved, the different entities can interact with each other. Such type of collaboration enables a student for 24x7 learning in an interactive environment and does not restrict the learning to a specific time.

Table 1. Agent used in i-MBLS and their working

<table>
<thead>
<tr>
<th>Agent Used</th>
<th>Working</th>
<th>Type of agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Interface</td>
<td>Provide an interactive interface to the learner. So that, learner won’t waste their time in understanding interface itself -It Provide content to the student as simple and in an interactive way -It always monitor learning activity if found some fault it gives a buzz so that students come to the track and start reading -Help the Student during entire learning process -Keep the record of the student learning history, information, learning styles</td>
<td>Interactive Agent</td>
</tr>
<tr>
<td>Tutor Interface</td>
<td>-Provide an interface to the tutor -help the tutor to create a course content</td>
<td>Interface Agent</td>
</tr>
<tr>
<td>Intelligent Decision Support Agent</td>
<td>-Work as a central decision making agent -Intract with other agents -Intract with content knowledge management - Taking decision when to provide a course</td>
<td>Reactive agent</td>
</tr>
</tbody>
</table>

Table 2. Database used in i-MBLS

<table>
<thead>
<tr>
<th>Database</th>
<th>Storage</th>
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<tbody>
<tr>
<td>Profile Database</td>
<td>This Database is used to store all the information regarding the Student as well as well as a tutor; it stores the learning style, learning history.</td>
</tr>
<tr>
<td>Content Knowledgebase</td>
<td>The actual course content will store here in an organized format so that whenever IDSA request data to the content knowledge base then the data will easily be searched and send it back to the IDSA</td>
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</table>

5 Conclusion

In this paper, we have proposed a new architecture iMBLS for multi agent based interactive e-learning system. The proposed multi-agent system is based on a four layer architecture which uses User Level this level describe human agents, web level describe web portal, System level describes the Artificial agents and at last storage level which describes Database. i-MBLS monitors the learning activity of the student and help student throughout the learning process. The learning style of a student will be accessed by Felder-Silverman learning style model. iMBLS will also provide an interaction among Students and tutor. This system integrates the features of interactivity and collaboratively of e-learning. In addition
iMBLS also provides security layer to prevent unauthorized access of content.

References


