# A New Approach to Multi Agent Based Architecture for Secure and Effective E-learning

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**ABSTRACT:**

Multi-agent system is one of the emerging trends in computer science. It can provide new solutions to very complex and restrictive system. The application of multi-agent systems is spreading in almost every field though e-learning is also not left untouched. E-learning has provided us with the capability of providing quality education to masses without restricting them to specific time or place. We have lots of different existing systems, but most of them are lacking all the features like personalization, intelligence, accessibility and security in one single system. Here in this paper we have proposed a new architecture for Multi agent based system for e-learning environment wherein in addition to these basic feature, the focus is interactivity and ease of use. This architecture takes the personalized status of the student into consideration and accordingly provides interactive and effective teaching and learning process.

**General Terms**

Interactive E-Learning, Security

**Keywords**

E-learning, Agent, Multi-Agent System, JADE, Interactivity

## 1. INTRODUCTION

With the development of Computer networking and Information Technology e-learning is developing rapidly [1]. E-learning system could not only support the teaching and learning, but some intelligence interaction among the collaborative team members [2]. As the agent based technology is one of the emerging technologies in distributed Environment, it is widely used because it helps us to design complex system with less effort. Multi agent system in education field makes a great change in the society for the reason that the conventional education system required the presence of both the student and the instructor at the same time, same place and at the same interval of time, which is somewhat hard to manage every time [3 and 17]. In addition to this, it is also true that in this competitive world with increasing popularity and newly emerging technologies, people find less time for traditional method of study. Though the concept of learning with the help of tools and technology is being followed since the last decade, still an appreciable number of intelligent learning systems are being developed and proposed, but most of the developed systems suffer the limitation of security and efficiency in terms of complexity [10, 19, and 20]. In order to build an intelligent system, that removes these limitations of existing systems, we propose a system that is secure and user friendly. The security of the system lies in an abstraction layer between the user and the system and encryption of data transferred. The proposed Multi Agent Based educational system takes the personalized status of the learner into consideration and accordingly provides the study material. It also provide the means for a student and teacher to connect remotely and hence make the process of teaching and learning more effective, powerful and easily accessible The organization of paper is as follows.

Section II gives the overview of different agents used in the proposed system, section III gives the overview of the Multi-agent system section IV discusses the architecture of the proposed agent based secure e-learning system.

## 2. AGENT AND ITS PROPERTIES

Agent Technology is one of the most promising technologies for dealing with distributed collaborative environment [4]. Agents are the software program which work on behalf of human to carry some task which has been delegated to it and take their own decision according to the requirement [18]. It can move from one system to other system and have the ability to learn new information about its environment so that they can make some improvement on itself

**2.1 Properties of Agents**

The various properties of agents make them more suitable to environments where human intervention is very high. In such an environment the agent technology is suitable, because agents are capable to doing things on behalf of human being, and by the use of agents technology, we can solve the challenge in much better way. The various characteristics of agents [1, 5, 22 and 23]:

☐ **Autonomy**: Agent behaves according to their state without the direct human intervention.

☐ **Heterogeneity:** Independent ability of the designer to construct the components in free manner.

☐ **Proactive:** means that agents are able to initiate actions without any external prompts. It acts in anticipation of the future goals.

☐ **Reactive:** It works as a machine that receive input process it and generate output

☐ **Communication:** It can be defined as those interactions that preserve the autonomy of the parties concerned.

☐ **Dynamism:** the agents are dynamic as their reaction is dynamic and varies according to the environment

☐ **Social ability:** agent can interact with other agents in order to satisfy their design objective

☐ **Collaborative Behaviour:** agent working together to achieve common goal these characteristics of Agents are well suited in the e-learning environment. Agents in e-learning system perform various tasks at various levels. It develops an interest among the learner to learn, shape-up the behaviour of the learner, and also maintain the privacy of the student that his result should not leak to other student and also take the intelligent decision of whether the student should move to next learning stage.

## 3. INTRODUCTION OF MULTI AGENT SYSTEM

A multi-agent system (MAS) is a system in which multiple autonomous agents work together to achieve a common goal by using its own local information [11] see fig Figure 1: Multi Agent System The key principal of Multi-Agent system is that each agent is pursuing its own local goal and interacts with each other to attend the global goal [6]. In Multi-agent system all agents are loosely coupled so that if we make some change in one agent then it will have a least effect on the overall system[7].
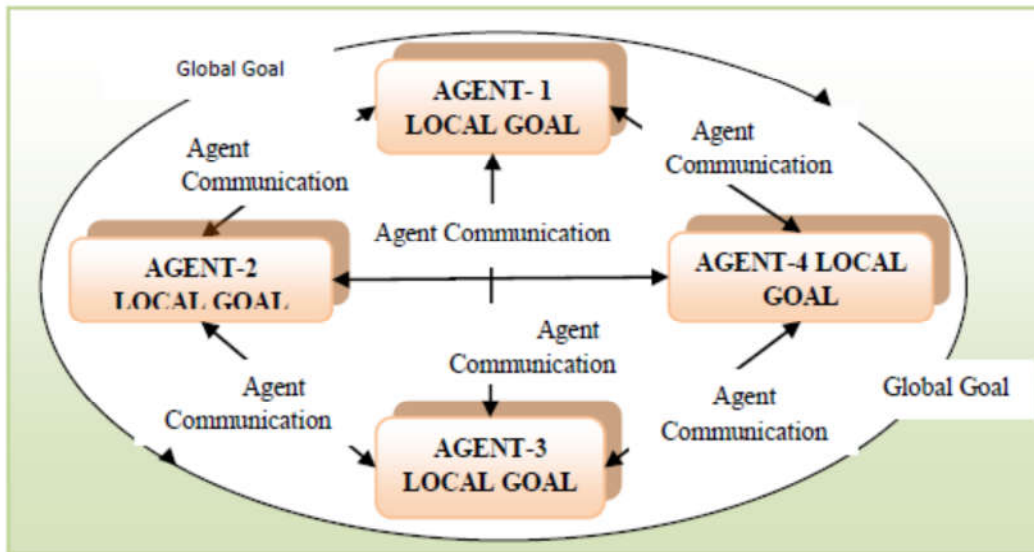
**Figure 1: Multi Agent System**

It is one of the rising technologies and to develop a multi-agent based distributed software system, lots of frameworks are available like JADE [12, 13 and 14], FIPA-OS, JACK Intelligent Agent [16], JIAC and etc. These environments provide some predefined agent models and tools which help developers in the system development and reduce the amount of effort required in designing a multi agent system. However, agent-based technologies need to be mature so that more work can be done to improve the quality of the system. Multi Agent methodology has recently seems to be appeared in learning environment and the main reasons for this is that it is much suitable for the complex, distributed collaboration environment[1].It is also suited to the web environment because of its flexible nature [8 ,9]. In e-learning Multi-agent system appear to be promising move toward the challenges in educational environment [30]

## 4. PROPOSED ARCHITECTURE OF A SYSTEM

The main objective of our paper is to propose a secure and interactive agent based architecture for e-learning environment. The highlight of this system is to provide the knowledge according to the student personalized status, ease of use and security against unauthorized access and manipulation of data. This system has two types of human agents Student and Tutor. Students are those who participate in learning activity according to their personalized status and tutor are those who actually prepare the content of the course. This system has two storages i.e Profile database and content Knowledgebase.

The proposed architecture is made up of eight main Agents

1. Security Agent
2. Student Interface Agent
3. Tutor Interface Agent
4. Personalized Agent
5. Intelligent Decision Making Support Agent
6. Collaboration Agent
7. Evaluation Agent.
8. Lesson Planning Agent

These agents work together to give a secure and effective E-learning environment.

**4.1 Storage**

It contains two databases Profile Data base and

Content Knowledgebase

***Profile Data base:*** This Database is used to store all the information about the student like learning style, educational qualification, name, age and etc. and also store information about tutor like name, Area of Interest etc

***Content Knowledge Base:*** The actual course content will store here in an organized format so that whenever IDMSA request data to the content knowledgebase then the data will easily be searched and send it back to the IDBMS

**4.2 Web Portal**

It is highly interactive website that takes data from the student as well as tutors and sent back to the system for processing and provides processed information to the users.

**4.3 Security Agent**

This Agent will be responsible for security issues in the E-learning system. Security of the proposed system will be in the form of authorization and encryption of the data. We introduce an authorization layer between the user and the system that will be responsible for providing access to the legitimate users of the system only. In addition, the security agent will be performing encryption of the data stored in profile database. This encryption will be carried out by using SHA-2 encryption algorithm.
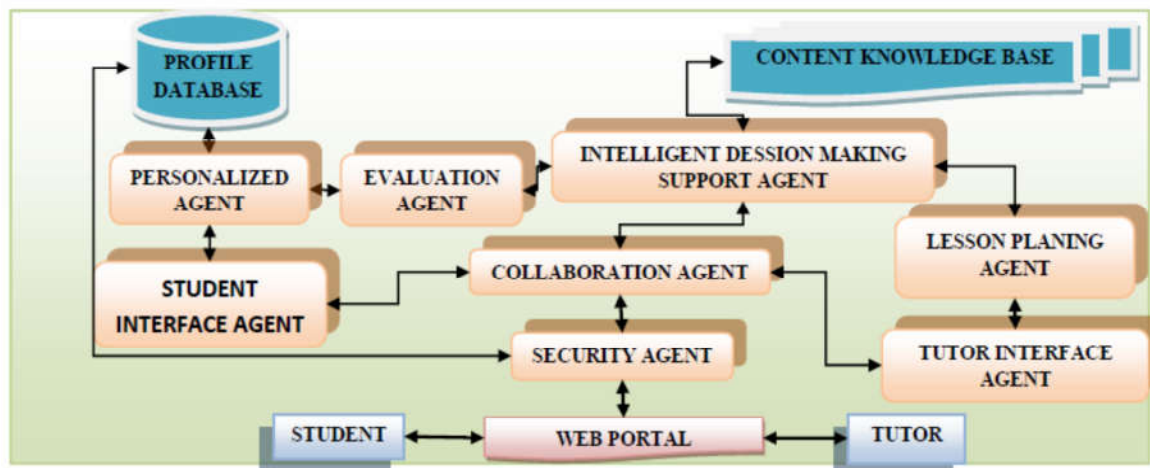


**Fig 2 - Multi-Agent Based Architecture for Secure and Interactive E-learning System**

**4.4 Student Interface Agent**

The student interface agent provides interactive operations to student. A typical web based application would provide an interface for the student to communicate over the network. The interface agent would also submit the necessary information to the collaboration agent. The Interface Agent should be platform independent, portable and easily accessible so that the Student only concentrate on their studies and do not waste their time in learning the interface itself.

**4.5 Tutor Interface Agent**

Tutor interface agent is responsible for providing the tutor an interface that makes the interaction with the system easy and help them with efficient planning in terms of resources available, teaching methods, lecture preparation and student performance evaluation.

**4.6 Personalized Agent**

Ascertain the age, area of interest and other physical and demographic details of the student check level of student intelligence by using some preliminary test or providing some comprehension. According to the performance of the student assign course work.

It will design the content of course work which will suit the student capability. To check student attention, conduct tests: If student does well, proceed further else, give student some interesting article or comprehension which will enhance student attention. Check how much time; a student stays on one page. If student spends significantly much time on one page: prompt him to take some interesting puzzle or to read interesting and amusing stories.

**4.7 Collaboration Agent**

The collaboration agent coordinates the communication balances among the information management agents. And also defines the communication protocols and handles the communication channels. Collaboration agent will take the request from the student agent and further send it to intelligent decision support agent IDSSA. This IDSSA will take the required decision also collaborate to knowledgebase and send the requested data to the collaboration agent and then the collaboration Agent will send back to the student.

**4.8 Intelligent Decision Making Support Agent**

This is designed as knowledge based reasoning system. The knowledge based system is developed in terms of experiences and would be ever evolving algorithm. The system would be learn from the user experiences and take an intelligent decisions. It will also suggest a particular student about the type of course; duration of the course he /she should opt for, based on his track record information, and also decide should promote the student to the next level. For example if a student has gain a better knowledge of C then only it will offer C++ else the student will continue to C language

**4.9 Evaluation Agent**

This agent is used to evaluate the student's marks. It will collect the information from the student interface Agent and sent it to the IDMSA who use this information for judging the progress of the student.

**4.10 Lesson Planning Agent**

This Agent is used by Tutor Agent to arrange their learning material. It will interact to the Intelligent Decision making support system and this IDMSA will decide how to manage the course content.

## 5. CONCLUSIONS

In this paper we have discussed different agents, their properties, interaction among different agents and their usage in an e-learning environment. We have proposed a new architecture for Multi-Agent e-learning system. The main focus of the system is to enhance the security level and reduce the complexity of system interaction at the user level. In this system, we have introduced an abstraction layer in the form of web portal that hides the complex details of system working from the end user and henceforth leads to easy handling of the system. Also we have used hash functions (SHA-2) and encryption algorithms to improve the security of our system.

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