A Multiagent Architecture for Distance Education Systems

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Abstract

This paper describes a multiagent architecture for web-based distance education systems that presents characteristics of intelligence and adaptability. This architecture is based on techniques of Distributed Artificial Intelligence, Planning and Intelligent Tutoring Systems. As a result, the system allows adaptation of a given course to different types of students.

1. Introduction

The goal of this work is to propose an architecture for web-based distance education with adaptability and intelligence features.

An important aspect to consider is that the most distance education systems do not provide personalized and intelligent assistance. The differences among the students should be taken into account and this is another issue to be tackled. In this aspect, a multiagent approach can offer important contributions.

Our proposal architecture for web-based education system uses an approach based on intelligent tutoring systems and multiagent systems and its development was divided into two main parts. Firstly, we developed a Course Management System (CMS) that it is similar to the most existent web-based distance education systems. Secondly, we have been developing a Multiagent Intelligent System (MIS), which integrated to the CMS component make up a multiagent architecture. The next section will present the MIS. In the section 3 we describe the architecture proposal. Finally, the section 4 presents the conclusions.

2. The Multiagent Intelligent System

The MIS is the system responsible for providing adaptability and intelligence to a web-based distance education system through the introduction of agents. In the figure 1 we show the structure of this system. Below, we describe the agents that make up the MIS.

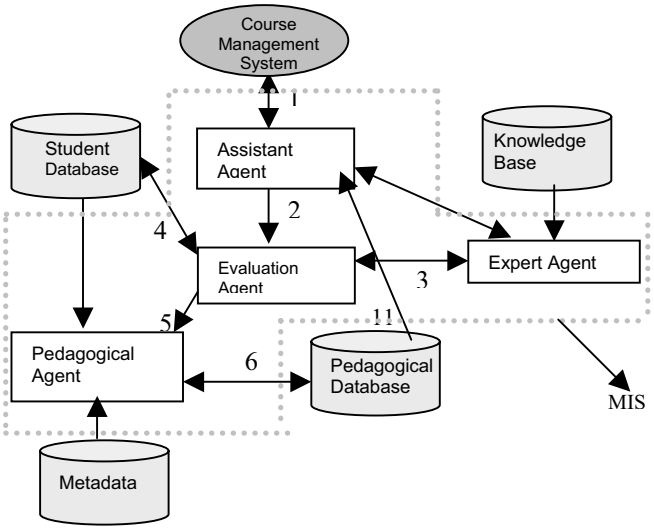

Figure 1. The Multiagent Intelligent System

Assistant Agent – It is responsible for the interaction with the student providing help and guiding, presenting immediate reactions as answers to a specific student behavior, which brings great benefits to the learning process [1].

Evaluation Agent – It is the responsible for updating the student profile as a result of evaluating the student.

Pedagogical Agent – It is responsible for the automatic generation and updating of the content sequence. This agent has been developed with instructional planning techniques following the IEEE LTSC LOM Standard [2]. More details about the pedagogical agent can be found in [3, 4].

Expert Agent – It is responsible for solving problems and exercises related to a course.

According to figure 1 the assistant agent receives information from the student (1) and sends it to the evaluation agent (2). In order to evaluate a problem solved by the student, the evaluation agent can request help from the expert agent (3). As a result of this interaction, the student model is updated (4) and this is communicated to the pedagogical agent (5). Based on the student model, the pedagogical agent can update the content sequencing (6), which is passed on to the student.

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3. The Architecture Proposal

Some examples of architectures for web-based distance education systems are presented in [5, 6]. In general, these architectures are based on Intelligent Tutoring Systems and multiagent systems. So, we propose a multiagent architecture, where now the CMS and the MIS are the main components. The figure 2 shows this architecture.

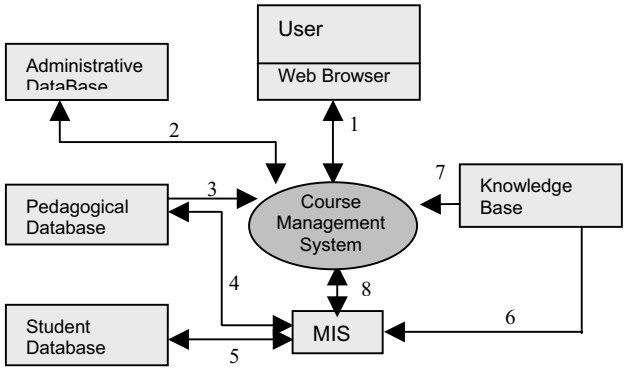

Figure 2. System architecture

Knowledge base: The component includes the course contents that are stored in formats that can be visualized with web browser and stores metadata information about the course contents. These metadata are organized as IEEE LTSC LOM Standard [3].

Student database: This component is responsible for storing the student model and it will be specified using fuzzy sets.

Pedagogical database: contains the set of learning goals and the content sequence of the courses of each student. These content sequences are customized for each student and can be modified during the course.

Administrative Database: It contains necessary information about user identification (student, tutor or auxiliary tutor).

Course Management System: This component presents the course content to the students and provides the communication tools. The CMS was implemented using the PHP language and the MySQL database system.

As we can note in figure 2, the student interacts with the learning environment using a web browser (1). The CMS uses the information inside the administrative database in order to verify the users login and the tools available to be used in a course (2). In addition, the CMS uses the content sequences stored in the pedagogical database in order to present the course content accord the student preferences (3).

The MIS component accesses the content sequence of a student in order to modify it and correct the learning problems that occurred during a course (4). After the modifications, the updated content sequence is stored in the pedagogical database. The student database needs to be accessed in order to detect learning problems in the student profile and update the content sequencing properly (5). It updates the student model regularly, as the student goes along with the course. The MIS uses the knowledge base to correctly evaluate the student (6).

The CMS component retrieves the content to be presented (7), according to the pedagogical database.

We can see that MIS introduces the desirable characteristics for a web-based distance education system since it allows adaptability and intelligence.

4. Conclusions

The implementation of this proposal will have as result a system for web-based distance education with innovative characteristics in relation to the adaptation of the course to the students and the evaluation of the teaching/learning process, that are still not present in the actually developed environments.

The characteristics of this system make possible a large participation of the student in its process of learning and the construction of its own knowledge.

5. References

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