Reserch on Intelligent Tutoring System Model Based on Multi-AGENT In Mobile Environment

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Abstract—**Along with the mobile network techniques become more progressive and perfect, the mobile terminal is as a kind of tool, way and assisting power.Its role and status has become more and more significant in the field of intelligent teaching system development. It combines the traditional intelligent teaching system and mobile learning system and make full use of them, in order to adapt to the intelligent teaching system development needs in mobile environment.It is a hot research direction of the current intelligent teaching system.Based on the analysis of the development history of intelligent teaching system, Multi-AGENT system key technology and mobile environment requirement on intelligent teaching system, this paper puts forward a intelligent teaching system model under four layer structure of the mobile environment based on Multi-AGENT.**

Keywords- Intelligent Tutoring System(ITS);Mobile Learning;MAS; Personalized Learning

I. INTRODUCTION

Artificial intelligence is applied in early education and it produces the Intelligent Tutoring System (ITS). ITS is based on artificial intelligence, cognitive science, education psychology, and computer science, etc multi-discipline research results and establishes in order to promote the students to learn computer teaching system effectively.It is a comprehensive subject. Intelligent teaching system teaches according to the different needs of each student.It is a private tutor who does separate teaching and counselling to students [1]. The ultimate goal is to make the computer system as learners' guidance and aid, namely gives computer system intelligence. In a certain extent a computer system instead of human teachers achieves the best teaching.

ITS application has changed the traditional teaching mode.It has been brought the students' learning enthusiasm and initiative into full play, and improves the teaching efficiency .It helps students' intelligence development and the cultivation of students' ability. Intelligent teaching system has become the hot spot for computer aided teaching research and application.

II. MULTI-AGENT RELATED CONCEPTS

A. The concept of AGENT

The Agent is developed and distributed by the Massachusetts Institute of Technology, so far, the experts and scholars have not yet reached agreement on the definition of Agent. Specialists in different areas have the different definition and understanding.

Wooldridge and Jenni ngs in 1995 put forward the current more authoritative,and universal accepted definition, and it includes two sub- definitions [2] :

Definition 1 (weak definition) : Agent is a computer system based on software (in many cases) or hardware, it has autonomy, reactivity, sociality and dynamic characteristics.

Definition 2 (strong definition) : Agent is based on the characteristics of weak definition, but also includes emotional human characteristics, such as knowledge, belief, obligations, intentions, etc.

Usually, the Agent is with intelligence, autonomy, reactivity, sociality, goal orientation, mobility characteristics.

B. MULTI-AGENT system

MULTI-AGENT system is a set by multiple computable AGENT. Each AGENT can effect on their own and environment, control part of the environment, and communicate with other AGENT. It simulates the realistic society swarm intelligence activities through the AGENT cooperation, consultation, coordination, alliance, and completes the complicated task [3].The choice of MULTI-AGENT system structure influences system autonomy, the degree of adaptability. Document [4] divides the MULTI-AGENT system structure into several kinds.

(1) The centralized structure. The similar star structure network and the Agent is divided into several groups. Each group within the Agent take centralized management, namely each group Agent provides a control Agent, by which it can control and coordinate different Agent cooperation in group, such as task planning and distribution, etc.

(2) Distributed structure. Each Agent group and the Agent between group are distributed structure. Each Agent group or Agent are without primary and secondary division, in equal status.

(3) Hierarchical structure. Set the centralized and distributed two kinds of structure together. It contains one or more hierarchical structure,and each hierarchy has more than one Agent.The Agent can use distributed or centralized form. Adjacent layer Agent can have direct communication, or use control Agent for broadcast communication.

III. THE RESEARCH STATUS OF INTELLIGENT TEACHING SYSTEM

Computer education research was from the 1950s.It used a linear program. Teaching knowledge is divided into a series of knowledge in advance. Make the students master the new knowledge constantly and the teaching aim can be achieved. It was into the Computer assisted instruction (CAI) research and application from 6 0 s,and appeared teaching system that is realized by the branch program structure. After the 1970 s, artificial intelligence technology had the very big development, and the expert system appeared in great quantities.It made computer teaching researchers apply artificial intelligence technology in the teaching system in order to make the teaching behavior more effective. It promoted the development of the intelligent teaching research. The 1990 s, with development of intelligent learning environment and intelligent teaching system development tools research, intelligent teaching research continued to move forward [5].

Table 1 lists several typical intelligent teaching system in the history, including application field and key technology. Table 2 lists hot spot in the field of intelligent teaching system research since the 1970 s[6].

IV. MOBILE NETWORK ENVIRONMENT'S REQUIREMENTS ON INTELLIGENT TEACHING SYSTEM

Since the 1980 s, the mobile communication has taken a great change, and obtained the rapid development. With the rapid development of the Internet, mobile communication and internet technology is going to merge. Mobile education system is a product of the combination of mobile communication and internet[7]. Mobile education system relys on the relatively mature wireless mobile network, internet technology and multimedia technology. Students and teachers implement interactive teaching activities more conveniently and flexibly through the use of mobile equipment (such as mobile phone, PDA, Palmtop computer, mobile education platform, etc.). Mobile education system greatly enriched the modern distance education teaching means,and make people no matter when and where all can accept education .It meets people's life education needs for the knowledge explosion during the modern information society.

Compared to traditional computer assisted learning, mobile learning fundamental change is to enhance the learner's physical space mobile ability in learning environment. Mobile learning is by the use of light equipment, such as PDA, mobile phone and so on. These devices can connect to the internet through the wireless communication technology, and can realize anytime, anywhere learning. However, in this kind of environment, the computer cannot embed in learners' surrounding environment well. Learners can not be free to get the required learning content.

The emergence of the mobile network platform provides a new platform for the development of intelligent teaching system.It makes traditional intelligent teaching system development technology change, and provide the possibility for intelligent teaching system function expansion.

Mobile environment intelligent teaching system development is by no means simple invariable transplantation from traditional intelligent teaching system to mobile network environment, and it must be in new perspective on the function of intelligent teaching system and the development of technology according to the mobile network environment characteristics,.

With the development of mobile network, mobile network resource is more and more abundant.Intelligent teaching system must also make the next development from how to effectively use the mobile network resources angle. In mobile network environment, the goal of structuring intelligent teaching systeml is to make full use of the rich network learning resources to provide complete intelligent teaching services in the learning process for learners.

Mobile environment intelligent teaching system should be combined by the traditional intelligent teaching system and mobile learning technologies. ITS is usually in a particular sector, more dependent on knowledge modeling and learners modeling. But mobile learning technology deploys in a wide range of environment.It mainly studes how to establish a connection in learners and learning content, and between learners under mobile environment. Mobile environment puts forward requirements on the intelligent teaching system structure and complexity. This paper intends to give a "simple, fast, practical and useful" system architecture model.

V. KEY TECHNIQUE

MULTI-AGENT technology is suitable for solving large complex system simulation problem.In order to realize the true sense of the intelligent teaching system design based on MULTI-AGENT, in order to support AGENT autonomy, sociality, adaptability features,and ensure that the system Agent can cooperate through the interaction, the following key technology must be solved.

(1) Multi-Agent communication. Multi-Agent cooperation is on the basis of interaction, and the interaction between the Multi-Agent is mainly through the communication to achieve[8]. Communication protocol must be defined between Multi-Agent. It determines the communication content understanding and response between agent to agent, thus decides the Agent cooperation mode. This is the first key technology for intelligent teaching system.

(2) Knowledge representation and processing. Intelligent teaching system core data is knowledge, including the professional knowledge on the description of the teaching content and knowledge on the description of professional knowledge relationship. In order to describe professional knowledge reasonably and accurately ,we need to make necessary decomposition on teaching content and give relevant knowledge on each part and relationship between each other.The artificial intelligence method puts these knowledge into knowledge expression that a computer can understand and disseminate. This process is called knowledge representation [9].

(3) Intelligent teaching evaluation. Teaching evaluation is the most important part for teaching system . The teaching system without good teaching evaluation function is no vitality. Teaching system should monitor the user's all behavior, and carries on the scientific and accurate evaluation, thus determine the personality characteristics, learning habits, thinking mode etc characteristics of different groups. System presents personalized learning content and process arrangement according to the user's different characteristics and different teaching strategy guidelines for the user.

(4) The rich teaching strategy. Different teaching strategies provide personal study interface for learners.Teaching strategy is rich or not is an important index to measure a intelligent teaching system. As the number of users and use record increase, intelligent teaching system should possess the function of teaching strategy formation. Through the mining of system knowledge base, study result library, student information database, it finds out the relationship between the relevant data, so as to find different learners' learning behavior habit, then generate teaching strategy adapted to different learners.

VI. INTELLIGENT TUTORING SYSTEM MODEL DESIGN IN MOBILE ENVIRONMENT

In paper [10] proposes the intelligent teaching model based on MULTI-AGENT.The whole system in logic is structured by six components of data providing layer, access control layer, the public service layer, teaching application layer, user cooperation layer and user layer. The model is applicable under the Internet network environment, and due to the too complicated system design ,great computational complexity, and higher terminal equipment requirements , it cannot be normally applied in the mobile network environment.

The basic framework of ITS was first put forward by Hartley&Sleeman (1973) .They think ITS must deal with three kinds of knowledge: (1) domain knowledge, namely Expert Model; (2) the learner's knowledge that is student Model (Student Model); (3) the teaching strategy knowledge, namely Tutor Model [11]. Based on this thought in this paper under the mobile environment the intelligent teaching system based on MULTI-AGENT is mainly for three types of users: students, teachers and managers. Study and simulate its behavior through the corresponding AGENT, which can guide the user's personalized use of the learning system. For the system's smooth use in mobile environment, this paper puts forward a new 4 layers structure intelligent teaching system model.

(1) Terminal application layer. All users of teaching system can be divided into the students, teachers and administrators three parts. Different users may come from different mobile network platform, such as mobile WAP network, GPRS network, various types of terminal equipment. System design can integrate all heterogeneous network platform. Users can use system normally no matter what network platform.

Terminal application layer is responsible for all users' identity authentication .To the user who has logged in ,it is responsible for cooperative learning among multiple students and more teachers' teaching collaboration. According to the characteristics of different students users, and the system mastered teaching strategies and rules, the system will properly divide student user according to different principle, or send students with similar levels in all aspects into a group, or different program students into a group in order to simulate the actual teaching environment.
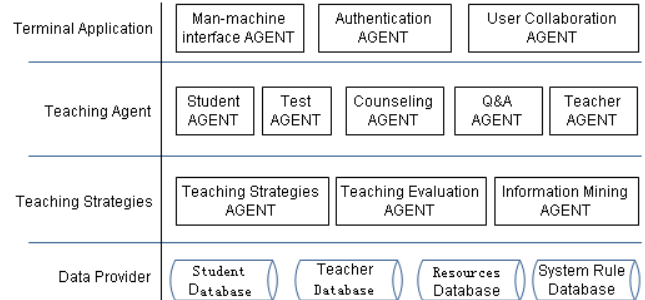

Figure 1. Architecture Model

(2) The teaching agent layer. Student users and teacher user's teaching activities finish in the teaching agent layer. Student user unique applications mainly include learning, practice, experiment and test. The teacher user peculiar application includes curriculum management, teaching content maintenance, teaching resource management, item management. Student and teacher users' application are mainly discussion q&a function, operation management function, curriculum report management functions, etc.

(3) Strategy providing layer. Strategy providing layer provides teaching strategy intelligent choice service and intelligent teaching evaluation service for teaching agent layer of the teaching system.

(4) Data providing layer. Intelligent teaching system needs mass data to support, including course content providing, all kinds of user information, students' history score data, teaching resources and system knowledge rules library, etc.Store the above every kind of data in a database.It is convenient for data classification and management, and format data warehouse.

VII. CONCLUSION

This paper combines the characteristics of themulti-AGENT with the theory of intelligent teaching system. The author puts forward intelligent teaching system model of six layer structure, and combines with the special requirements of mobile communication environment. The author gives the model based on the MULTI- AGENT intelligent network teaching system under mobile environment and discusses key technology based on MULTI- AGENT intelligent teaching system. The author proposes improved train of thought in order to solve the traditional teaching system defects.

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TABLE I.   SEVERAL TYPICAL ITS SYSTEM

System name	Developer	Time	Teaching field	Key technique
SCHOLAR	Carbonell	1970	Geography	Natural language dialogue, the semantic web
SOPHIE	Brown, Burton & dekleer	1975	Electronics	Natural language dialogue
MYCIN	Shortliffe	1976	Medicine	Expert system
CIRCSIM-Tutor	Byung-incho, Joel A.Michael	1989	Medicine	Natural language dialogue
SQL-Tutor	Mitrovic	1996	SQL Language counseling	Constraint model
Vcprolog Tutor	Chritophpeylo, tobiasthelen, Cl	2000	PROLOG language	Internet technique
Slidetutor	Rebecca Crowley, Olga Medvedev	2003	Miniature diagnosis	Model tracking
AHP-Tutor	Alessio Ishizaka	2004	Multiple attribute decision making	Experts model

TABLE II.   INTELLIGENT TEACHING SYSTEM RESEARCH EMPHASES

Times	Technical objectives	Main technical
70 s	Problem solving	· simple student model · knowledge representation,Socratic teaching · skills and strategic knowledge · equation learning environment · error set, expert system,cover model
80 s	Model tracking	· more rich error library ·analysis based on the case · explore the world · mental model evolution · simulation, work tool system · natural language processing
90s	Learners control	·autonomous and collaborative learning · scenario learning and information processing · virtual reality
From now no	Learning environment design The study process design	·construct collaborative Learning environment · E - Learning and ITS based on Web · complex dynamic student model · intelligent Agent (Agent) design · intelligent question-answering system · education game