3D Virtual Classroom Based on Multi-agent

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Abstract. By examining and analyzing present studies on existing 3D virtual classroom based on multi-agent, we realize that most researchers pay more attention to role-agent’s design and function rather than environmental intelligence and support for teaching interaction. In contrast, we have created a 3D virtual classroom based on multi-agent technology as a teaching platform. In this paper, we describe the system structure, intelligent control of complex behaviors of user’s avatar agent, intelligent tracking of teaching scenes and avatar’s intelligent routing, etc. Finally, we demonstrate the actual visual effect of the 3D virtual classroom. User tests demonstrate that it presents intelligence well and can effectively support instructional interaction.

Keywords: Virtual classroom·Multi-agent·Intelligence·Teaching interaction.

1 Introduction

Designing and using virtual classroom (VC) is a hotspot in the field of e-learning. Our interest is the VC’s intelligence. Numerous scholars have done research on how to apply multi-agent technology to the design and development of VC: Zhu Wansen simulates the real teaching process by using teacher agents, assistant agents, classmate agents and attendant agents [1]. Laure France designs an architecture of teacher agent, student agent and server agent to achieve a multi-agent system which collects information through activity traces to help the teacher visualize a virtual classroom and interaction [2]. Huhns and Stephens use the multi-agent to build an agent wall for teaching [3]. J. V. Santos-Fh applies multi-agent technologies to the development of a RECOLLVE platform that enables collaborative learning in 3D environment [4].

We have found, through examining existing research, that researchers all over the world pay more attentions to 2D virtual classroom intelligence rather than 3D VC intelligence. They also focus more on teaching activities and less on the visualization and operability of these activities. We believe that the 3D VC is more realistic and conducive to immersion than 2D VC. Therefore applying multi-agent technology in the design and development of 3D VC is a more effective methodology because it empowers the characters with more intelligence, and makes teaching activities more...
diversified in presentation and richer in content. The result is a more optimized system that is easier to operate, which can recreate a more realistic classroom-teaching situation and afford a more convenient platform for instructional interaction.

Nevertheless, existing 3D VC systems have their own limitations in intelligence function and teaching activity [5]. For example, user avatar behavior is monotonous with poor coordination; scene switch is not instantaneous and users cannot operate their own avatars at will.

We believe that a successful learning system should not impose too many restrictions on its users, as well as its scope of application; on the contrary, it should optimize the simulation of teaching content and free interaction between teachers and students in the real teaching environment. Our attempt is to improve 3D VC's intelligence and optimize the 3D VC's integral performance to enhance teaching interaction. In the following, we will discuss the architecture of a 3D VC based on multi-agent and elaborate on the design of the user avatar agent behavior, the dynamic intelligent tracking of teaching activity scenes, and avatar's intelligent routing. We are also showing a few instructional interaction scenes and discuss our conclusions as well as future work.

2  3D VC Architecture

In order to create a vivid virtual classroom, achieve a basic teaching function and ensure free interaction between the teacher and students, multi-agent technology is used to coordinate system functions, scene scheduling, teacher-student behaviors and server farms, and to create an ecological, distributed 3D VC to resolve problems brought by virtual classroom teaching in e-learning.

![Virtual Classroom System Architecture](image)

**Fig. 1.** Virtual Classroom System Architecture