The Design of Teaching System Based on Virtual Reality Technology

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Keywords: virtual reality technology, virtual teaching system, virtual teaching model.

Abstract. Virtual reality technology taking the computer technology and the artificial intelligence technology as the core, can give people a feeling of being personally in the scene. Using 3D-Max and computer simulation technology, this paper designs a teaching system based on virtual reality technology, and using that system, simulation and experiment are perfoemed. The results indicate that the teaching method of that system is superior to the traditional teaching methods, and has certain application prospects.

Introduction

After the multimedia and the computer network technology, with the rapid development of the computer technology, the new teaching methods are emerging. In the modern teaching field, that emerges the virtual reality technology by creating a computer system with high executive power, which provides a kind of interacted feeling with the environment. The rising and realizing of this technique are creating the better condition for the development of the man-machine interface and the visualization of the projects.

The Working Principle of the System

Virtual reality technology is an integrated technology setting the integration of the computer graphics, the computer simulation, the human-computer interaction technology, the sensor technology, and the artificial intelligence technology. Of course, it is creating the virtual environment with the help of the computer technology and the hardware, which can be feeled by people with seeing, hearing, touching, smelling and other means [1]. As cutting-edge and hot technology, virtual reality technology on internet is the result of integrating of a variety of technology including intelligent calculation, which is based on the rapid development of network technology. The working principle of the teaching system based on virtual reality technology which includes virtual scene, real scene, virtual model rendering, tracking, registration, DSP control system, and human-computer interaction, etc. is shown in Fig. 1.
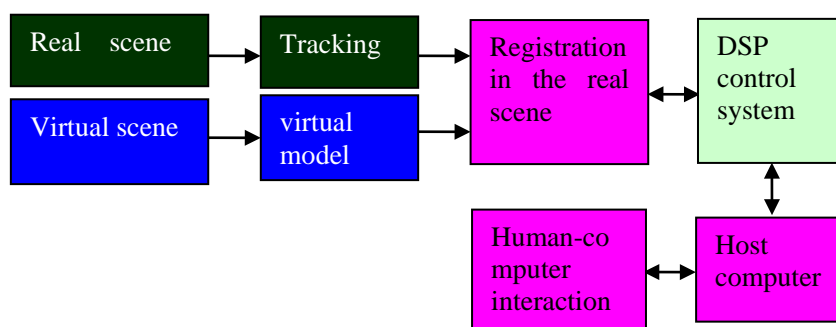

Fig.1: The working principle of the system

From the Fig. 1, the system constructs 3D digital model by the computer graphics, and it can organize them in the compute, which gives people a sense of reality and telepresence by creating a comprehensive and perceived environment. In the visualization and human-computer interaction, people can freely manipulate any object in the virtual world, and the manipulation is real. Virtual reality technology has opened up a new field of human communication. It overturned the traditional mode that people will cognize the environment nly through the personal experience or indirectly understanding [2]. In this system, DSP controller based on TMS320LF2812 chip is the control

center, it will refer the informations which collect from the real scene and virtual scene to the host computer, and receive control commands which send to the virtual reality environment from host computer.

The Design of the System

The Overall Structure of the System

The Fig. 2 gives the overall structure of the system which includes web server, navigation module, simulation training system, virtual learning environment, virtual laboratory, virtual campus, and virtual library, etc..
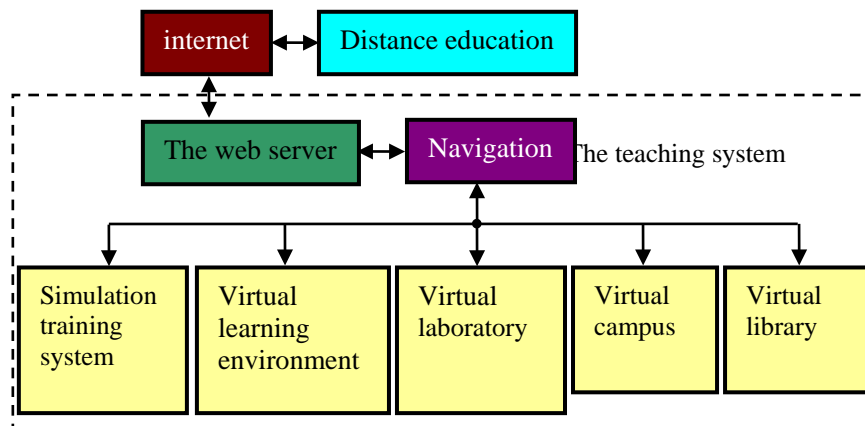
Fig.2: The overall structure of the system

Simulation Training System

Simulation training system is a typical application of the virtual reality technology in teaching. It is designed for some high, difficult, dangerous subjects, such as toxic gas experiment like CO and CH_4, pilot training, etc., and this system can not only save the cost of training, but also ensure the life safety of the trainer. Using the 3D-MAX technology and computer simulation technology, The real environment is simulated, which will give the trainer an immersive experiential feeling. By the way, using the sensor technology and the contact sensing technology, the contact feeling of the trainer and realistic of the virtual environment is improved.

Virtual Learning Environment

Such as the chemical experiment, which will have danger of combustion and explosion. At the same time, the students are usually unable to have experience, but they can participate directly in the virtual reality technology. The virtual reality technology can provide vivid, lifelike, safe and reliable learning environment for the students. At the same time it can provide virtual experience in the wide subject areas, and thus it can accelerate and consolidate the process of the learning for students.

Based on virtual reality technology, we can bring out teaching model of coaching. Virtual learning environment can construt the various characters such as the historical figures, the giants, the stars, the teachers and the students, and it can create personalized learning environment for students. As is shown in Fig. 3. The students can be more easily integrated into classroom learning. In the virtual learning environment, students can learn freely and interactively with "teachers" and "students". So, the virtual learning environment can greately mobilize the initiation of students, and improve the learning efficiency[3, 4].
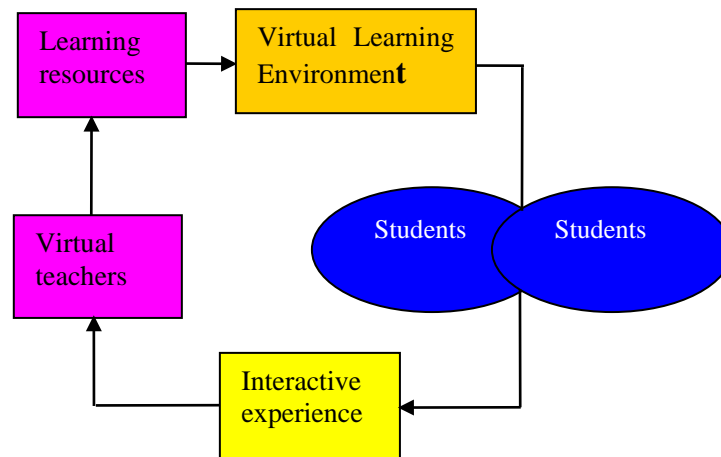
Fig.3: The learning process in virtual learning environment

Virtual Laboratory

The physical, chemical and biological laboratories can be build up by the virtual reality technology. The laboratories have not only the traditional functions, but also they can save and maintain the cost of construction. At the same time, it can avoid various hazard and danger of error operation in the experiments.

Virtual laboratory is composed of two parts: hardware and software. The hardware part includes the computer, the network equipment, the sensor and the motor feedback devices,and the software includes the operating interface, the simulation system, the image processing, the speech recognition and the virtual reality.

Virtual Campus

Virtual campus is the earliest application of the virtual reality technology in the modern education[5, 6]. It is the extension of the virtual learning environment, and it can provide low learning cost and dense atmosphere in the learning environment.

There are three main aspects for effection of the virtual campus. First is to simply construct virtual campus environment for the user to roam; Second is to construct the visual 3D campus environment, which can provide the comprehensive studying environment and the living environment.Third is to provide a more humanized life, learning environment and testing environment in the center of users, which can join people that we need such as the teachers, the students and the faculties[7, 8].

Virtual Library

The virtual labrary is connected with the internet, and the reader can choose any books convenient[9, 10]. The Fig. 4 gives the overall structure of the virtual labrary system which includes the library building and the surrounding environment.
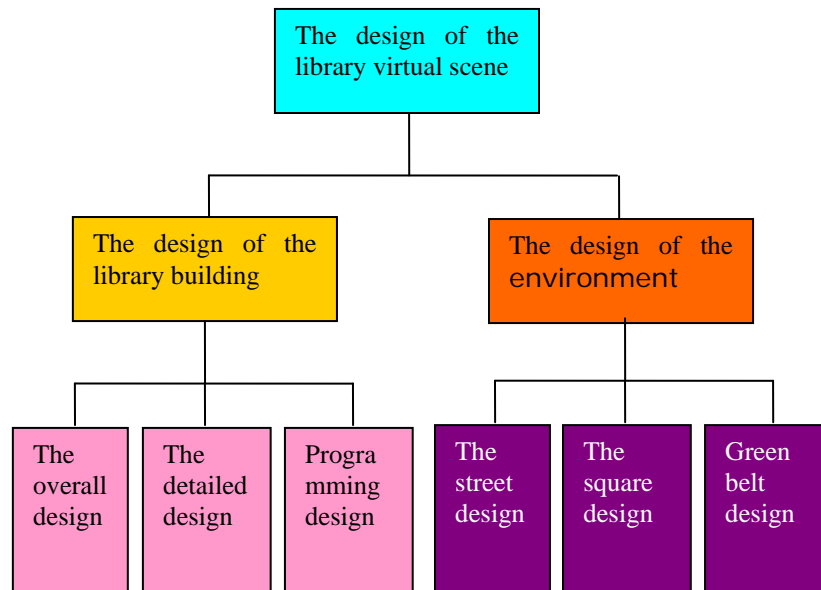
Fig.4: The overall structure of the virtual library

Simulation and Experiment

Simulation of the System

Using 3D-MAX and computer simulation technology, this system is built include simulation training system, virtual learning environment, virtual laboratory, virtual campus, and virtual library. The virtual laboratory is shown in Fig. 5.
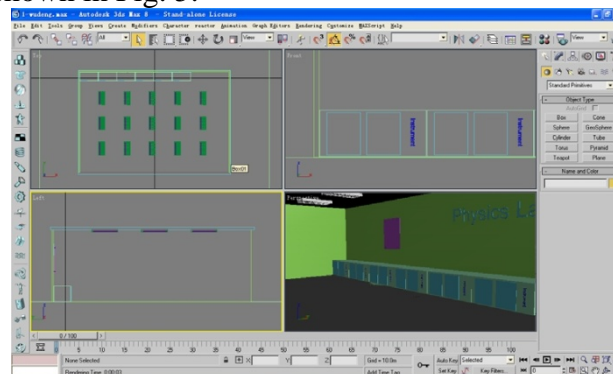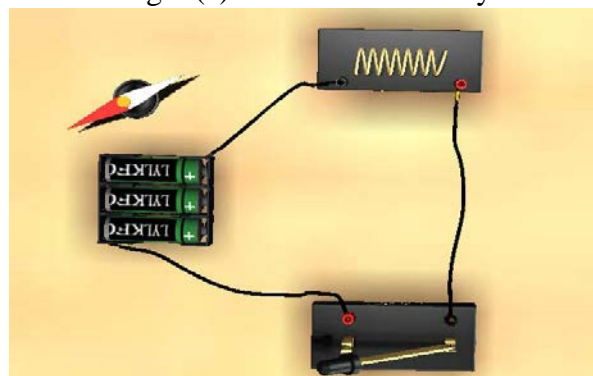

Fig. 5(a)：Virtual laboratory

Fig. 5(b)：Virtual experiment

Fig. 5：The virtual laboratory

Experiment of the System

We are making an experiment on the undergraduate class 1 and class 2 whose learning performance is roughly the same, and the class 1 uses this teaching system, but the class 2 uses traditional teaching methods. After a semester,there is a sensible difference between class 1 and class 2 on the mark of the theoretical test and practical ability test. The results comparison are shown in table 1.

From the table 1, the average of theoretical test of class 1 which teached with this teaching system is 85.75, and the advanced of the test on practical ability in class 1 is 62.5%, which are superior to the class 2 based on the traditional teaching methods.

Table 1: Cpu time of the two approaches for

Class	Average of theoretical test	The test on practical ability					
		Advanced (man)	Proficient (man)	Basic (man)	Failed (man)	total students	Advanced rate
1	85.75	25	13	2	0	40	62.5%
2	77.25	17	15	7	1	40	42.5%

Conclusions

Virtual reality technology not only has a wide range of applications in the aerospace, military, medicine and other fields, but also it will bring the indelible far-reaching influence for the development of modern education and teaching. The perceptibility, the interactivity and the reality of the virtual reality technology are unable to be substituted by the traditional teaching method. It will become the direction of the research and development for the future teaching.

Using 3D-Max and computer simulation technology, this paper designs a teaching system based on virtual reality technology, and using that system, simulation and experiment are perfoemed. The results indicate that the teaching method of that system is superior to the traditional teaching methods, and has certain application prospects.

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