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Design of Visual Simulation System for Logistics Engineering Teaching Based on VR Technology

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ABSTRACT
The application of visual simulation system based on VR technology in the teaching of logistics engineering can make students better experience the process of the operation in the virtual environment and enhance their subjective initiative and autonomous learning ability. Combined with the current situation and demand of logistics engineering teaching, this paper establishes a logistics engineering teaching model of 3D classroom scene, analyzes the simulation requirements of the system in visual compensation, data import and teacher-student communication, discusses the problem of model optimization, studies the application of VR technology in three different levels of operation teaching, and summarizes the application characteristics and effects of virtual reality technology in the visual simulation system of logistics engineering teaching, which makes it play a better role in the experimental teaching of logistics engineering.

Keywords: *Virtual reality, Logistics engineering, Practical teaching.*

1. INTRODUCTION

In recent years, with the rapid development of China's logistics industry, the social demand for logistics and transportation has increased significantly. The design and implementation of high-quality logistics system directly affects the development of national economy, and puts forward new requirements for the cultivation of logistics talents [1]. Only when the teachers and students really touch the core business of logistics, deeply and systematically understand the components and key links of logistics system, and have strong practical ability, can they meet the requirements of future work. In the training of logistics talents, the rational use of VR technology and the application of virtual simulator to build a real logistics environment can make students feel immersive, thus increasing their interest in learning and improving their practical ability.

VR technology is currently used in practice teaching in many disciplines [2]. For example, Lin Lin studied the use of VR in Architectural Design Teaching [3]; Zhao Pengcheng introduced virtual reality technology into civil air defense teaching and training [4]. Wang Kaiying and Liao Mingjun discussed the use of virtual reality in the teaching of Shangmu engineering [5]. But in the practical teaching of logistics engineering, there is little research on the use of VR technology.

The scholar Ivan suzelan published an article in the International Federation for Information Processing (IFIP) in 1965, which laid a theoretical foundation for VR system and described what is now called "virtual reality". It combines many other technologies with virtual reality technology to realize the visual simulation system of engineering teaching. A classroom teaching mode based on VR is presented in Figure 1.

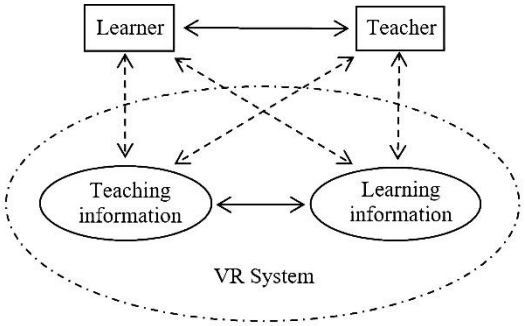

Figure 1 Classroom teaching mode based on VR.

One of the key points to change the teaching mode is to design the teaching system with the student as the center [6]. In the process of teaching, the role of teachers is only to guide students in the construction of the system to help them understand, digest and really master the knowledge they have learned [7]. If the traditional way of "teachers speak and students listen" is blindly followed

constantly, there may be problems such as low teaching quality, many mistakes in practice, and difficult practice management [8]. Teaching students to skillfully use VR technology can solve the above problems and improve students' learning efficiency [9].

2. VR TRIANGLE AND TECHNICAL PROCESS

2.1. Concept and Classification of VR

The essence of the concept of virtual reality is to create scenes that are infinitely close to reality and provide people with real sensory experience. VR technology, also known as "cyberspace", is to build a computer environment as close to the real world as possible by integrating many technology applications. It is a comprehensive computer system that combines multimedia technology, perception technology and simulation technology. It creates a virtual reality world through modeling, in which users can see, listen to, touch, perceive and experience objects in the virtual world, and interact in the virtual scene [10].

Virtual reality system can be divided into desktop VR system, immersive VR system and distributed VR system. In the virtual space environment, through handheld input devices, voice devices and so on, users' real environment experience can be improved, and the purpose of collaborative work research can effectively be realized.

2.2. Technical Features of VR

Two scholars Philippe Coiffet and Burden G put forward "VR virtual technology" in the Journal of Virtual Reality System and Application, which represents the immersion, imagination and interaction of VR technology [11]. This is the VR technology triangle shown in Figure 2.

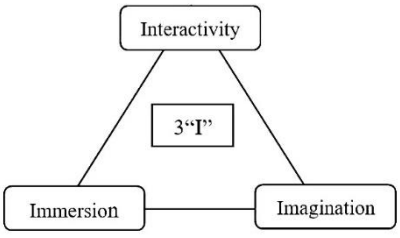

Figure 2 Triangle of VR technology.

Among the three features shown by the three vertices of the triangle in Figure 2, immersion is the most important technical feature of VR technology. It refers to the investment of users in the virtual environment, which has its own sensor system. The system uses external interactive devices in a pure natural state to achieve the effect of "immersing".

Interactivity is the convenience of using objects and the natural response speed of users in the virtual environment. Users can acquire new knowledge, improve perception and common sense, and create new ideas in the virtual environment.

Perception refers to the fact that in addition to the visual and auditory perception of ordinary computers, VR virtual technology also has various sensory functions of human beings, such as taste, touch, smell and motion perception.

With the help of special tools, such as VR glasses, users can directly participate in and check the role and change of simulated objects in the environment. Figure 3 shows the basic process of VR experiment.

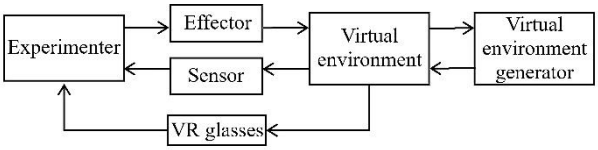

Figure 3 VR experiment process.

3. DESIGN OF LOGISTICS ENGINEERING VR TEACHING SYSTEM

The design of logistics engineering VR teaching system is to establish the system architecture, analyze the needs of the system, and determine the process of the system, in order to obtain the ideal simulation effect.

3.1. Requirement Analysis of Simulation Teaching System

Logistics engineering includes many functions and links. Real logistics engineering usually involves a lot of scenes and equipment, which not only costs a lot, but also is difficult to achieve the desired results. The teaching of logistics engineering needs to use lots of skills, to reasonably choose the teaching technology of logistics engineering, and to complete the corresponding teaching activities at different time points [12]. In order to achieve more realistic imitation operation, improve students' interest in learning, change the boring knowledge point learning into visual vivid perception and interactive participation in the process, and reduce the hard investment of facilities and equipment, it can be realized by establishing a virtual simulation environment and selecting appropriate functional modules. Teachers and students who participate in the practical teaching can complete the operation process as long as they wear VR glasses, and there is no need to buy expensive physical equipment.

3.2. Topology and Event Driven Method

Logistics engineering teaching system is a complex system, which performs multiple tasks at the same time [13]. In order to better explain the characteristics of the

process, it is capable to investigate the characteristics of the logistics engineering teaching system and clarify the specific requirements [14]. The topology of the prototype system s shown in Figure 4 can be defined in advance.

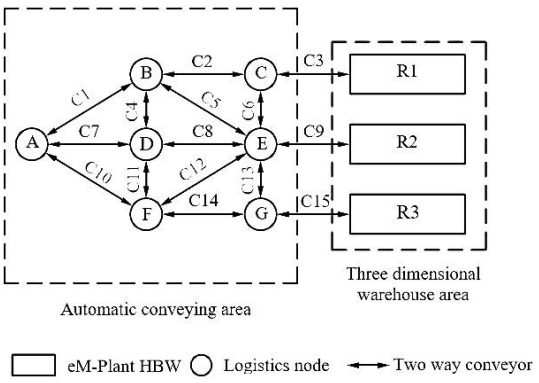

Figure 4 S topological structure of logistics engineering teaching system.

The storage system shown in the Figure 4 is mainly composed of "three-dimensional warehouse area" and "automatic conveying area". The prototype system S consists of an input node, a transportation system with mesh topology, and three target cargo areas. The corresponding relationship of all nodes in S is bidirectional, which simulates the general function of warehouse operation from workflow. For such a complex logistics engineering teaching system, specific events can be defined according to the actual situation [15]. The whole system adopts event driven mechanism. The "start", "run" and "stop" of one equipment will trigger the "start", "run" and "stop" of the next equipment, thus completing the workflow of the whole system in a given order.

Event driven mode defines a new event sequence driven data operation processing method, which helps to prevent the conflict problem caused by concurrent update, because it can avoid the direct update of objects in data storage.

3.3. Simulation Experience Analysis

The implementation of visual teaching simulation system needs to consider the user experience and the constraints of practical technology [16]. The process of simulation experience is mainly realized through the following three aspects: visual compensation, data import, and teacher-student interaction.

(1) Visual compensation

In the actual teaching of logistics engineering, students can "see" and get a variety of perception from VR glasses to carry out practical operation, which is actually a comprehensive experience. The current virtual simulation is mainly in the form of visual imitation. When the system involves multi-sensor operation, it will provide a relatively perfect solution, based on the visual information, through more information feedback to achieve better simulation results.

(2) Data import simulation

In the simulation teaching system, a data import operation can assist the realization of system simulation. Put the imported data into a space under the system directory, call these data when necessary, and play a role in explaining the name, number, attribute and characteristics of the system related components.

(3) Simulation of teacher student communication

VR virtual technology is the key element of logistics engineering teaching. Using VR virtual technology to simulate the communication between teachers and students can maintain certain operation information according to the teacher's instructions and the needs of the actual scene, achieve a higher degree of real simulation experience, and effectively improve the quality of teaching.

Aiming at the problems of long running time and poor time sensitivity of traditional logistics engineering visual simulation system, the modeling technology supported by VR is used to realize the simulation of logistics process and system, which can greatly improve the experimental teaching level of logistics engineering visual simulation system and achieve the expected teaching effect.

4. DESIGN AND IMPLEMENTATION OF SYSTEM FLOW

The design of logistics engineering teaching simulation system is to design a system that can meet the teaching demands based on the requirements of personnel training and professional knowledge teaching. In this way, the purpose of knowledge learning and operation skills mastering can be achieved through virtual scene experience and learning without adding too much hardware facilities and equipment.

4.1. Establishment of System Architecture

Establish the system architecture, assemble the required components in the voltage transformer, and design the coincidence, coaxial and parallel relationship between them according to the requirements, so as to form a 3D classroom scene.

The total flow of logistics engineering teaching system design is shown in Figure 5.

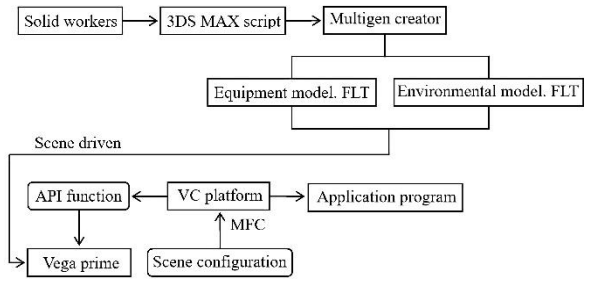

Figure 5 Design process of VR teaching system.

There are three parts at the top of the figure 5, among which, SolidWorks is used to provide different design schemes, reduce errors in the design process and improve product quality; 3ds max script is applied to complete the rendering and production of 3D animation; Multigen Creator software package is to create real-time 3D models for visual simulation. With the support of these three items, the device model and environment model in the middle of the figure are established to realize the scene driven. Through VC platform and application program, with the help of the scene configuration of Microsoft Basic Class (MFC), the visual simulation is completed with the support of API (Application Programming Interface) function [17].

4.2. Verification of System Results

In order to verify if the simulation system meets the requirements of logistics engineering teaching and training, it is a good way to invite logistics engineering teaching experts to test each simulation unit of the system. The purpose is to test whether the activity unit of the system is perfect, whether the simulation is accurate, whether the surface of the system is safe, and whether the interaction of the system is fair.

The system test results answered by the experts show that the simulation teaching system has ideal interaction and high stability, which can better realize the teaching process of logistics engineering.

5. CONCLUSION

VR technology has been gradually integrated into the teaching process of many subjects. Through the teaching module of "virtual reality technology", people can better realize the teaching and research of different disciplines, use "virtual reality", provide more practical teaching methods, expand the content of educational technology, and provide simulation experimental environment for experimental learning.

In the field of logistics engineering experiment teaching, virtual technology also began to get some applications. Through the three-dimensional scene built under the support of VR technology, students and teachers participating in practice can directly enter a simulated scene with the help of various tools including VR glasses, experience the operation process of different links of logistics engineering, and check the implementation effect. This provides a strong guarantee for improving the practical teaching level of logistics engineering.

Nowadays, universities and scientific research institutions are increasing the research and support of VR technology. With the continuous development of virtual reality technology and the reduction of VR equipment cost, this technology will gradually become a general technology of logistics engineering and other disciplines education, and will be more widely used in the field of engineering experiment.

6. ACKNOWLEDGMENTS

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