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Review Article

Application of VR Technology in Industrial Experiment Teaching

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Abstract: Experiment is an indispensable link in modern education and teaching. However, because many experiments, such as large-scale industrial experiments, are complicated, difficult and dangerous. Many schools do not allow students to conduct field operations. Therefore, this paper introduces VR technology into industrial realization teaching. Using its ability of virtual reality, it can simulate the real experimental environment, create an industrial experimental teaching simulation laboratory based on VR technology, and effectively make up for the problem that students cannot practice and learn.
Keywords: VR technology; Virtual simulation; Experimental teaching.

INTRODUCTION

Virtual reality, VR) is an advanced form of interactive simulation technology, which has the characteristics of multidimensional information and naturalness of human-computer interaction. It can also show the intelligence of computer analysis and reasoning [1]. The experimental teaching based on VR technology can comprehensively apply virtual reality, multimedia, human-computer interaction, database and network communication technologies, and create a novel teaching environment with students as the main body, stimulating active learning interest, highly interactive, hands-on practice, virtual experiment and visible process, which embodies the concept of "laboratories everywhere" [2].

Industrial experiments, especially large-scale industrial experiments, are very common in industrial disciplines. Experimental teaching is the best way for students to learn and practice. Through experiments, students can know the whole operation process of the experiment and the problems encountered during the experiment [3]. It's better to hear than to try. Through hands-on experiments, students can learn and understand the experiments faster, so as to truly master the learning content and comprehend knowledge. However, because of the complexity and huge scale of this large-scale industrial experiment, beginners simply don't know how to operate it step by step accurately, and school teachers may consider safety factors and

won't let them try it on the spot. Even if there is a chance to practice, because students are not familiar with the experimental equipment, the equipment may be damaged due to improper operation in the process of operation. Such expensive experimental equipment is often maintained or replaced, which makes it difficult for the school to really meet the experimental needs of students. Establishing a plaorm for large-scale industrial experiment simulation through virtual simulation technology can well solve the problems in experimental teaching in colleges and universities. At the same time, based on the prospect of the development of VR technology in recent years, this paper discusses the deeper attempt and research of this technology in this field, and makes some contributions to creating a new experimental teaching mode [4].

Establishment of Experimental Platform

For the construction of the whole experimental platform, we mainly use 3DMax to build the model. As we all know, 3DMax is a PC-based system. Three-dimensional animation and rendering and production software, and supports a variety of file formats. We use it to build the model and then import it into the unity engine in the form of fbx file, so that each experimental device is finished. In order to make the experiment as real as possible, based on the animator animation component of unity itself, we add animation made by 3DMax to each part of the model. By writing c# code, we can show the corresponding animation in the

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corresponding process of the experiment to simulate the experimental scene as real as possible. The platform

part is shown in the figure.

Figure 1: system start interface diagram

Figure 2: Simulation interface diagram

As shown in Figure 1, after entering the simulation interface through the start page, the interface is a laboratory scene. In the scene, the shooting angle of the camera has been adjusted and it is aimed at the picture position that will be put into the laboratory. There are models and help buttons in the upper left corner of the simulation interface. Click the model button, and many models will pop up. Select the model to be simulated and click to put it into the laboratory. The help button can help the experimenter to click the help button when he is unfamiliar with the experimental operation. The system will guide and prompt the experimenter to operate step by step to help them complete the experiment.

Simulation Experiment

The large-scale industrial virtual simulation platform contains many large-scale industrial experimental equipment models, and each model is composed of many components. Take the experiment of circulating fluidized bed boiler as an example. If a normal circulating fluidized bed boiler is built in real life, it needs at least the scale of a small factory. Equipment includes: coal decomposer, cyclone separator, combustion chamber, limestone silo, etc. Therefore, virtual simulation of this large-scale experiment can effectively solve many problems.

After the start of the simulation experiment, drag and drop the experimental model to be simulated into the scene. From the first step, click on the corresponding parts, and the control panel will appear. Set the corresponding parameters in the control panel, and then it will start to run, and there will be corresponding animation to simulate the reality to show the experimental process. Finally, complete the experiment and get the corresponding experimental results. Most importantly, we can change the parameters, keep experimenting, and finally evaluate the whole experiment through different results obtained by different parameters to find the optimal configuration. Then in the real large-scale experiment, this link can be omitted and resources can be saved. The experimental process is shown in the following figure.
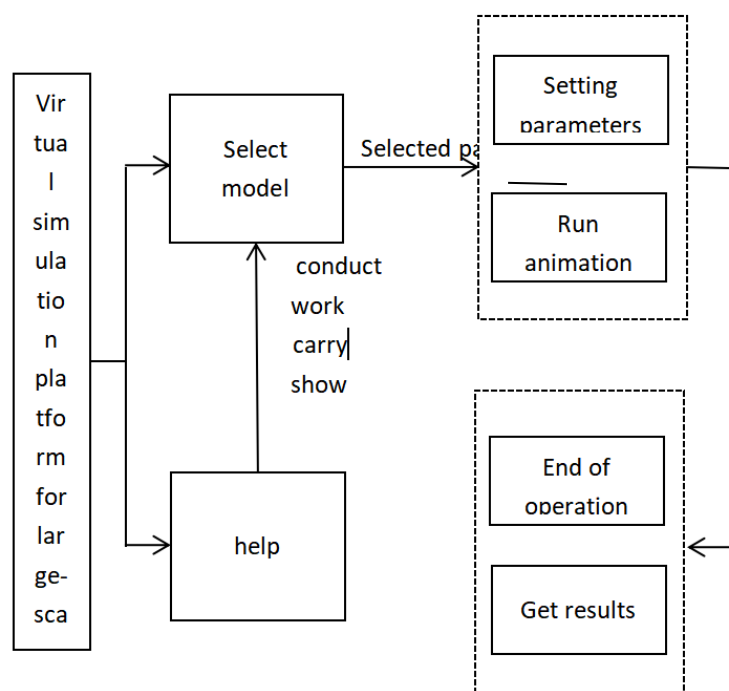

Figure 3: Simulation flow chart

Advantage and Prospect of Virtual Experiment

There are several problems in the teaching of traditional large-scale industrial experiments. First, the so-called experiment, first of all, requires experimental equipment. For such large-scale industrial experimental equipment, it will cost a lot to build. And after the construction is completed, every experiment needs to consume experimental resources. This makes it impossible for many schools to afford such expensive experimental teaching in this kind of world, thus making it impossible for students to really carry out effective experimental study. Second, for such a large-scale experiment, the degree of danger is extremely high. Even some experiments require loading trucks to load and unload materials. We can't expect students to learn how to drive loading trucks when doing an experiment. Then maybe we have to hire someone to operate them, which is another expense. At the same time, the experiment itself needs to burn the materials, and these processes are quite dangerous. When we do experimental teaching, the premise is to ensure the safety of the experiment, and it is essential to ensure that students can learn the experiment on the basis of safety. Third, the traditional large-scale industrial experiment is too large for many students to conduct many experiments. At most, students from one class can only be organized to conduct field operations once in a while. This kind of experimental teaching can't meet the experimental needs of students. Therefore, combining with such a virtual simulation experimental plaorm can avoid the above problems. It doesn't need expensive construction and experimental resource cost, and it doesn't need to consider the danger degree of the experiment to students. At the same time, it can meet the experimental needs of all students (30). The most important thing is that students can be allowed to

conduct experiments all-weather and unconditionally, thus realizing a new experimental teaching model (31) in which experiments is everywhere.

Of course, such a virtual simulation experimental platform is not without its drawbacks. Otherwise, any experiment will not need real experimental equipment in the future, and all experiments can be conducted through such a virtual simulation experimental platform. However, the biggest problem at present is the authenticity. For the existing virtual simulation experimental platform, it can simulate the experimental equipment and running process. However, for the operator himself, the method of his operation is still through the mode of human-computer interaction. Students can only operate by clicking the mouse and other instructions, but can't operate by pressing the power supply, toggling the switch and other real methods as in real life, so that students don't have an immersive experience. For such a problem, I have made the following outlook:

With the rapid development of technology, the virtual reality function brought by VR technology has been widely concerned by people. Using VR technology to create a panoramic virtual space can well simulate the real scene. Therefore, in order to be able to bring students immersive real experimental operations. We can use virtual reality technology to create a set of virtual 3D realization scenes, as well as a whole set of dedicated equipment, including VR helmet, gloves, etc. [7, 8]. In this way, students can enter a virtual laboratory through VR helmet, and by putting on gloves, they can carry out the experimental operation process almost indistinguishable from reality. No matter walking or operating a certain experimental part, we can simulate the feedback effect through the VR device we wear, as if we were really operating. All the data obtained from subsequent experiments are transferred to the database for later use.

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