ISSN 2522-6398 Vol. 6, Issue 5: 41-45, DOI: 10.25236/FER.2023.060508

Effective Application of VR Equipment Disassembly and Assembly System in Equipment Teaching

Feifan Han[1,*], Yichen Guo[2]

[1]*Changjiang Institute of Technology, Wuhan, China*
[2]*Shenzhen New Philosophy Academy, Shenzhen, China*
420051246@qq.com
[*]*Corresponding author*

Abstract: *With the development of virtual reality technology, virtual reality (VR) technology has been used in equipment teaching to achieve greater teaching effect. Virtual reality technology, instant technology, can directly improve the quality of learning even with the initial technology, and play an important role in training. The most important function of virtual reality technology is that it can grasp the future learning process of the learner, so that the learning goal of the learner can be better achieved. This paper studies the effective application of VR equipment disassembly and assembly system in equipment teaching. It analyzes the advantages and disadvantages of the original equipment teaching, points out the advantages of VR technology in teaching, and designs a set of VR equipment disassembly and assembly system. This system combines hardware HTCVIVE to realize virtual assembly, learning evaluation and other functions. It provides reference for the research in the field of equipment teaching.*

Keywords: *VR device; Disassembly and assembly system; Equipment teaching; Effective application*

1. Introduction

At present, there are two main ways for students majoring in equipment to learn and understand equipment: to discuss theoretical learning and equipment disassembly and actual debugging. Among them, the training of disassembly and assembly of equipment is an important course combining students with theory and engineering practice. The disassembly and assembly training of equipment in most colleges and universities in China still uses the conventional teaching method, that is, students go to the scene to disassemble and map the equipment. This teaching method really helps students to have an inherent impression of a device. However, the routine experiment and training teaching takes fixed experimental instruments as the object and standard experimental methods as scripts, so that students can perform a single repetitive operation, which restricts the cultivation of students' enthusiasm and innovation. The disassembly and assembly teaching environment is often difficult to be guaranteed and easy to make students conflicting. Therefore, "Disassembly and assembly teaching" students are not interested in the course, the disassembly and assembly process is not rigorous, and the teaching quality of the course is not guaranteed. [1-2]

Taking the petrochemical industry as an example, there are many types of equipment used in this industry. In order to cultivate talents who are proficient in various equipment, a large amount of funds for purchasing equipment is required. The storage of equipment requires site and daily maintenance. In addition, with the development of equipment technology, the equipment required for disassembly and assembly teaching also needs to be updated. However, often with the advancement of technology, it is difficult to update the equipment used in teaching, and students cannot timely recognize and understand the latest technology in the industry. During disassembly and assembly by students, due to improper operation by students, the equipment may be damaged or parts may be lost, so parts need to be replaced. Based on the above points, disassembly practice will undoubtedly increase the cost of equipment education, which is not conducive to the development of students' knowledge.

2. Introduction of Virtual Reality Technology (VR)

The concept of virtual reality (VR) technology was proposed by Raniel, the founder of VPL Company in the United States, in the early 1980s. VR technology or artificial environment is a modern scientific and technological means taking computer technology as the core to create a virtual environment for users

ISSN 2522-6398 Vol. 6, Issue 5: 41-45, DOI: 10.25236/FER.2023.060508

to communicate with. Simply put, VR technology can bring the user's perception into the virtual environment that is created, use VR, and have an immersive experience. The working principle of VR is to simulate a virtual world with three degrees using computer or other smart devices, such as graphic technology, artificial intelligence sensor, etc. to provide users with visual, auditory, touch and other sensory simulation, so that users can feel immersive.[3] The feature of this technology is to immerse people in a virtual real environment, which not only simulates the real world environment, but also enhances the participants' perception of the real environment. Because of its multi-sensibility, immersion, interactivity and imagination, VR technology has attracted the attention of researchers from all over the world. In China, VR technology was introduced in the 1990s, and has been fully applied and optimized in 2016.

3. Understanding and Learning the Structure of Equipment

3.1. Using Skills of ACer Restore Card

(1) First, check that the ACer restore card is properly placed in the computer's external slot or CD-ROM drive to ensure that the restore card is fully inserted into the external device.

(2) Turn on the computer, after the interface of Acer restore program appears on the computer screen, select the method of "Restore factory settings" as prompted.

(3) Select yes to proceed with the content mentioned in the restore program interface.

(4) Next, select "Install" as prompted for recovery.

(5) Because important data loss may be involved during installation, we recommend that important files be backed up and stored.

(6) Finally, wait for the restore operation to complete and let the computer complete the new system installation.

3.2. Cloud Host Management

Cloud host management platform is a complete set of solutions for users from order to delivery, from fine slicing, management to monitoring and troubleshooting of resources, in accordance with the existing system of physical computer room, efficiently organize and divide various resources according to the "location, computer room, node" and other elements. Cloud computing is an important part of infrastructure applications, located at the bottom of the cloud computing industry chain pyramid, and products are derived from cloud computing platforms. The platform integrates computing, storage and network as the three core elements of Internet application, and provides public Internet infrastructure services to users. Cloud Host is a virtualization technology similar to VPS host.[4] VPS uses virtual software, VZ or VM to virtualize multiple parts like stand-alone hosts on a single host. Each part can be used as a separate operating system and managed in the same way as the host. Cloud hosts, on the other hand, are parts of a cluster host that are virtualized as multiple independent hosts. Each host in the cluster has a mirror of a cloud host, which greatly improves the security and stability of the virtual host. Unless all hosts in the cluster have problems, the cloud host will not be accessible.

3.3. HP Easysafe Card

The function of HP Easysafe Card can protect and restore the system. Independent of the operating system, it can ensure the security of the system and facilitate the maintenance of computer users.

VR device disassembly and assembly system can not only help students better understand each part of the device, but also enable students to explore the structure and function of the device more deeply. By using the VR device disassembly and assembly system, students can have a detailed understanding of each component, including its size, appearance, function and construction, and how they are connected. In this way, students can learn from practice to the specific methods of equipment disassembly, so as to better obtain knowledge.

3.4. Development Ideas of Disassembly and Assembly System for VR Equipment

For the teaching requirements of the course of equipment disassembly, a set of VR equipment

ISSN 2522-6398 Vol. 6, Issue 5: 41-45, DOI: 10.25236/FER.2023.060508

disassembly and assembly system is designed and developed with VR technology. Students use the operating handle in the virtual environment by wearing VR glasses.

The disassembly and assembly system of VR equipment can realize the following functions: First, disassembly and assembly function is the main function of the system. Students can disassemble and assemble selected parts through VR handle. The disassembly and assembly sequence of parts for each device can be recorded in the system database. Students only need to be familiar with the disassembly and assembly specification of each device. The second is the view switching function. When disassembling and assembling the device, the system simulates the scene of disassembly on the spot. Students can switch their perspectives by specifying a place in the virtual environment and pressing the confirmation key. It can switch the view angle 360 degrees in the virtual environment and observe the device from multiple angles to restore the real on-site disassembly and assembly. Third, learning evaluation function. Systematic scoring of students' disassembly process can intuitively reflect the quality of disassembly process, facilitate teachers to check and accept students' operation, and evaluate students' learning status. Scoring can provide teachers with materials to study the quality of VR teaching, help to innovate teaching methods, and help to improve the content and quality of VR system.

This system implements the design of the system by embedding the programming language C design scheme of Unity3D engine. The application of VR technology in the development of equipment disassembly teaching mainly goes through three steps: the interactive control of the database system of the model; the model building is an essential part of the VR equipment disassembly and assembly system. Shaping is mainly to fully show the appearance of process equipment, the appearance and details of parts, and the connection between parts, so that students have a basic understanding of process equipment. First, after using Auto-CAD and Proe or other three-dimensional modeling software to model the existing engineering equipment in reality, export the model file, and add the model file in Unity3D for scene building.

Unity3D provides support for loading model files into virtual environments. In order to let students know more advanced equipment, there must be enough models in the model library and update the models in time.

4. Effective Application of VR Equipment in Teaching

Virtual Reality (VR) technology combines technologies such as real-time three-dimensional graphics generation, dynamic environment modeling, application of system development tools, and so on. It enables users to perceive the virtual environment immersely, so as to achieve the goal of recognizing objective things. It has the characteristics of accuracy, authenticity, interactivity and real-time. At present, the application of VR technology in education has been studied in Chinese universities, such as: The three-dimensional electronic circuit experimental environment EVLAB system developed by BeiNormal University based on virtual space allows students to complete the operation of common instruments in electronic circuit experiments and realize the understanding of basic experimental circuits. Based on the teaching features and actual conditions of virtual experiment of electronic technology in Liaoning Normal University and combined with the practical teaching features of Vocational education, a virtual experiment platform of electronic technology is built to promote the improvement of students' practical skills. Weifang Vocational College of Engineering has carried out a research on how VR technology can realize three-dimensional virtual teaching in the field of machinery. For the development and application of VR equipment disassembly and assembly system, Northeast Electric Power University and Beijing University of Posts and Telecommunications have put forward the development ideas and methods of "Model File + Development Package". However, there is no research or reference method for the development process and use effect of VR equipment disassembly and assembly system.[5]

With the continuous development of China's economic construction, the scale and level of equipment manufacturing industry are getting higher and higher, and the demand for talents is also increasingly urgent. Some high-end and aeronautical fields cannot be separated from the talents in process equipment and control engineering, especially those with strong specialty and modern technology. Under such social conditions, the training requirements of over-controlled professionals need to be continuously improved, and for engineering professionals, training their engineering practice ability is the most important thing. There are many ways to cultivate the practical ability of engineering, one of which is the training of disassembly and assembly of equipment. However, this method is single in form and backward in means, which cannot meet the needs of modern engineering for high-quality personnel. To change the original teaching methods, it is particularly important to use information technology to train innovative personnel

ISSN 2522-6398 Vol. 6, Issue 5: 41-45, DOI: 10.25236/FER.2023.060508

of equipment to meet the needs of society.

Making VR technology and other emerging technologies fully integrated into personnel training is conducive to training talents with practical and innovative abilities. Therefore, it meets the requirements of training high-quality personnel and develops a disassembly and assembly system of VR technology equipment instead of the original training methods.

5. Advantages of VR Teaching

Teaching through VR virtual simulation technology is equivalent to placing traditional practice stations and engine benches in VR classrooms. Professional practice teaching is not just a component, but a kind of cognition. This technology can not only provide students with professional learning images and videos, but also students can directly participate in the simulated environment. In addition, a virtual practice site scene can also be built to provide students with a variety of visual experiences. Students can enter the real object in person, disassemble and identify the real engine in all directions, and the operation is more abundant. In addition, during the practical training process, if students feel bored, the platform can provide a game-like teaching mode to stimulate students' interest in learning.

VR technology is very interactive and immersive. The application of VR technology in classroom teaching can enhance students' learning experience and learning effect.[6] Compared with the conventional disassembly and assembly training in the field of equipment teaching, VR technology is mainly reflected in the following aspects:

5.1. Economic Issues

The training of disassembly and assembly of conventional equipment requires fixed sites, invest a certain amount of equipment, and carry out daily equipment maintenance and maintenance, so the teaching costs will undoubtedly increase. The disassembly and assembly system of VR equipment can avoid these problems. Schools only need to provide accessories that can support the system, such as VR glasses, operation handles, computers, etc. Students can wear VR glasses and open the disassembly and assembly simulation system to simulate the disassembly and assembly of equipment. A set of VR accessories can simulate the disassembly and assembly of a variety of devices, which solves the problem of disassembly and assembly training that takes up a large area and invests a lot of equipment. At the same time, the storage conditions of the VR accessories are lower than those of the actual disassembly and assembly equipment, which makes it easy to maintain and reduces the equipment maintenance costs in the actual operation.

5.2. Ageing Problem

The timeliness of VR devices is good, mainly in two aspects:

(1) When the number of equipment provided by the school is insufficient, the method of disassembling and assembling one device at the same time with several students is often used. Because students are not familiar with the equipment, many people will be busy when disassembling and assembling, which will affect efficiency. With the VR device disassembly and assembly system, it is possible to disassemble and assemble manually separately.

(2) Due to the limitation of class hours, students often can only disassemble and assemble one device in the process of disassembly and assembly training, but they do not have time to disassemble and assemble to understand a variety of devices. When using VR equipment for disassembly, each disassembly step can be completed more quickly. Students can disassemble multiple devices in a limited time, so that students can easily understand the structure of multiple devices.

5.3. Security Issues

Although the disassembled equipment is in the stop state, because the equipment is mostly metal and some parts are heavy, students are prone to accidents during disassembly, resulting in injuries. VR equipment is used for disassembly and assembly to avoid parts handling accidents that may occur during disassembly and assembly.

ISSN 2522-6398 Vol. 6, Issue 5: 41-45, DOI: 10.25236/FER.2023.060508

5.4. Realizing Comprehensive Training

The failure that students may encounter during the training process and the operation they can experience are limited. Most of them can only be abstracted from books, which makes it difficult to get practical experience. The disassembly and assembly system of VR equipment can be combined with maintenance and operation. During the operation, students can not only know the internal structure of the device, but also experience the operation of the device under abnormal conditions.

5.5. Updatable Content

The renewal of petrochemical technology and equipment is very rapid. The original experiment and training equipment and methods often cannot keep up with the pace of petrochemical development, which causes the teaching content of experiment and training to be severely disjointed from the actual development needs of petrochemical industry. It is not conducive for students to master the cutting-edge technology of petrochemical industry and affects the development of students. Using VR equipment to disassemble and assemble the system, when a better technical performance equipment appears, only need to set up a three-dimensional model of the equipment, and then import it into the system so that students can have a faster understanding of the technological development in the industry, and facilitate the training of students' innovative thinking, so that they can have a better quality of employment.

Applying VR virtual simulation technology to automobile practice teaching is an inevitable trend in the development of colleges and universities. First of all, it can improve the practice site, optimize the teaching process, and cultivate new skilled talents with craftsman spirit. Secondly, it can help students solve high-risk experimental operation problems, and at the same time solve the problems of insufficient training equipment and outdated equipment in colleges and universities. The comprehensive use of information platform technology is conducive to promoting the "inspiration" education of teachers. While demonstrating in the classroom, teachers will convey the teaching content to students in the most direct form, which is conducive to greatly improving the quality of teaching and cultivating practical talent programs.

6. Conclusion

Under the social conditions that require a large number of innovative equipment talents, only by constantly improving the training mode of equipment talents can we meet the social needs. The development prospects of VR technology combined with education are very promising, which can not only promote the development of VR technology, but also meet the requirements of educational innovation. By analyzing the advantages and disadvantages of the original equipment teaching, and analyzing the advantages of VR technology in teaching, a set of VR equipment is designed, which combines hardware HTCVIVE to achieve virtual assembly, learning evaluation and other functions. The use of disassembly and assembly system can not only stimulate students' interest in device learning, but also has some reference value for the teaching application of virtual device disassembly, which changes the original teaching methods and improves the teaching quality.

References

[1] Li Zhihai, Liu Yan, Liang Wenlin, etc. (2021). Application of VR equipment disassembly and assembly system in equipment teaching. China's modern educational equipment, (19): 3-6.
[2] Ji Zhenning, He Weizhen, Shen Jiangyan, Gao Junyi, Luo Jiang, Cao Yi, etc. (2019). The design and application of a teaching system for structure disassembly and maintenance of CT equipment based on VR technology. Chinese Medical Education Technology, 33(3), 3-8.
[3] Li Guanchen, Qiu Feng, Zheng Jiafu, Shi Hao. (2022). Design of an an24 aircraft maintenance and troubleshooting teaching platform based on VR. Computer Knowledge and Technology: Academic Edition, 18(29), 3-10.
[4] Zheng Jiafu, Qiu Feng, Li Guanchen, Shi Hao. (2022). Design and manufacture of an an24 aircraft maintenance and troubleshooting platform based on VR. Computer Knowledge and Technology, 1, 18-16.
[5] Shi Chengyu, Qiu Feng, Shi Xinyu, Shi Hao. (2021). Design and simulation application of teaching platform for maintenance of turbojet 6 aeroengine based on VR. Computer Knowledge and Technology: Academic Edition, 4, 1-6.
[6] Shi Xinyu, Qiu Feng, Shi Chengyu, Shi Hao. (2020). Design and manufacture of virtual test platform for turbojet six aeroengine based on VR. Computer Knowledge and Technology: Academic Edition, 16(1), 3-9.