Virtual Reality Teaching Design of Complex Equipment

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Abstract. This paper takes complex equipment as an example to build a virtual reality teaching system. The performance of complex equipment structure can be accomplished by virtual reality technology. This paper studies the key technology of virtual reality instructional design. Through the analysis of the virtual reality teaching needs to meet the overall function, we designed the system. This paper uses VIRTOOLS platform to realize the virtual display of complex equipment. This paper has also realized the system database establishment, the part component, the tree shape reality and so on.

Introduction

Nowadays, military technology is changing with each passing day. Our army's new weapons and equipment emerge in endlessly. The complexity and technological content of the equipment are getting higher and higher. It's updating faster and faster. The price is becoming more and more expensive. But the actual equipment quantity is few. If it is trained with actual equipment, it will suffer a lot of restrictions. Traditional video learning can only be demonstrated without simulation. It is impossible to complete the interaction between the trainees and the equipment. It has been unable to meet the needs of the new situation.

Virtual reality technology is a new and high technology appearing in recent years. It uses the computer to create a realistic 3D virtual world. It can bring people a sense of seeing, listening and touching. Users seem to be immersive and free to observe and manipulate the virtual world. In the virtual world created by VR technology, users are no longer limited by time and space. Many universities have successfully developed many kinds of products, such as virtual labs, by using virtual reality technology. Using virtual reality for teaching, we can effectively provide advanced experimental environment and simulation means for equipment structure characteristic introduction and technical service use training. We can train students to quickly understand the basic features of equipment. We apply virtual reality technology to our military equipment and develop a virtual instruction system. This is of great significance to the teaching of military service support. It effectively solves many problems in equipment training. Therefore, this paper designs a virtual reality teaching system with a series of equipment as the object. This provides an effective solution for the virtual teaching of equipment\textsuperscript{[1-6]}.

Design of Virtual Simulation Teaching System

In this paper, a virtual reality teaching system for complex equipment is developed based on virtools. After analysis, the system should have two major functions. One is the virtual display of equipment. That is to create a series of simulation equipment model. It can give users a full view of the 360 degree equipment. Users can change the viewing angle to observe the appearance and internal structure of equipment. Users can observe different parts, components and their connection. The system can realize such functions as amplification, reduction, global movement and movement of part components. Two is the interaction of customized functions, that is, users can choose the corresponding spare parts in the system. The user can be in a basically different configuration of equipment accessories to achieve various special function effects.
When designing the interface of the system, according to the principle of human-computer interaction, the system can be rationally arranged and the system can be divided into functions. The system follows the user's operating experience, logical and orderly layout of each function button. When considering interaction sequences and corresponding effects, the system uses a low fidelity prototype for much iteration to gain the best experience. The visual effects of the system interface are designed in accordance with high quality, sophisticated realism. According to the functional requirements of system analysis and selected implementation shows that this system is composed of several parts: the introduction of real and virtual display and display module. The software design of the system is as follows:

The system uses C++ and Virtools 5 as the development platform of the system. The system uses AutoCAD2012 3D design software and 3dsmax 2012 as modeling and animation generation tools. The system uses Access 2009 as the system database to store fault knowledge base, sample part library, special tool library, detection tool library and some service samples. In this paper, Virtools 5 software is used to study the non-immersive simulation technology in combination with the three-dimensional maintenance model.

The equipment model itself has a large number of parts. They generally belong to large assemblies. The three-dimensional modeling technology provided by AutoCAD2012 software has a good effect in dealing with large assembly.

Establishment of Model Display System

Virtools can create immersive virtual environments. It produces sensory information such as vision, hearing, touch, and taste. It gives participants an immersive feel. Therefore, this is a new development and a new meaning of human-computer interaction system. Virtools has a well-designed graphical user interface. It uses behavior modules to write interactive behavior scripts. This allows users to quickly become familiar with various functions. It includes simple deformation and mechanical functions. According to the actual size, the system can detect the maintenance environment. The system uses 3dmax2012 software to build a high-resolution three-dimensional digital structure model of equipment parts. The system performs illumination, texturing, animation, and adding cameras to the model. The system uses Virtools 5 graphics engine to drive the digital model. At the same time, the system adds the prompt function and so on. This makes the whole scene exquisite and realistic, and the operation is strong, and it can satisfy all levels of personnel learning.

Opening Animation Demo

In order to better performance of complex equipment series, the corresponding functions of the system are introduced, and the opening animation function is designed in the teaching system. We use the message sent to the system to call the camera rotation animation. This allows you to implement the intro animation of the system function, figure 1a, and the corresponding script, as shown in Figure 1b.
Establishment of System Model

The three-dimensional model of the equipment is the basis of the whole equipment maintenance simulation system. Its quality directly affects the authenticity of virtual maintenance. Because Virtools does not have the modeling function, the system needs to apply the modeling software to do the 3D solid modeling first. But because the object is a mechanical product model, the system uses the professional mechanical three-dimensional drawing software CAD to model. The system then imports the built model into 3dsmax2012 and then exports it from 3dsmax2012 to Virtools 5. Before the model is built, we should make a preliminary analysis. We decompose complex mechanical products into several simple parts and then perform 3D modeling of each part. The model is well established, and it is successfully imported into 3dsmax2012. After that, the job is to give the model a texture and texture to increase the realism of the model, reduce unnecessary polygons, and increase the refresh rate of the display. The three-dimensional model of a certain type of equipment is shown in figure 2. The left side of the diagram is an operation class, which can complete the global rotation of the model, move globally, generate larger and smaller operations, and also draw the sketch.

![Figure 2. Model display diagram.](image)

Design for Operation Interface

The virtual equipment display system is designed for the simulation equipment. So we need to look at the appearance and internal structure of the equipment from a different angle. Here are two ways to implement a camera or mouse trigger for camera animation using a keyboard. The two methods do not work at the same time, that is, when you use the keyboard to control the camera, you want to turn off the mouse and trigger the camera behavior, and vice versa. The specific script flow is shown in figure 3. The virtual model shows the interaction function of the system is quite complex. After the system has been set up, it is necessary to use modules to implement these functions. The specific script flow is shown in figure 4.

![Figure 3. Camera control.](image) ![Figure 4. Interactive function script.](image)

Component Display

In order to conveniently and quickly observe the parts inside the equipment model, the virtual system designs the part tree on the right side of the operation class. The tree structure diagram of all parts of the equipment is established. The user can directly load the part according to the needs of the tree and click on a part of the tree structure. Then, the details can be observed. If the observation is complete, the user can revert to the device’s global observation state by returning the key. In addition, the system has designed the atomization function. Highlight the user's observation parts and spray all other parts that are not selected. In this way, it can better display the structural features of the parts in the equipment. As shown in figure 5.

![Figure 5. Component Display](image)
Establishment of Parts Library

The system uses Access 2009 as the system database to store fault knowledge base, sample part library, special tool library, testing tool library and some service samples.

Conclusions

Compared with the traditional equipment, virtual exhibition has considerable advantages in improving training flexibility, breaking training conditions and reducing equipment maintenance costs. Virtools 5 software is powerful, easy to operate, very suitable for the development of similar systems. Especially in view of the fact that our army has more new equipment, relatively expensive price, complicated operation procedures, we can use virtual simulation training to improve training quality and improve the training environment. In our training, we can develop a more realistic and practical complex equipment virtual reality teaching system for further improvement of different content.

Based on the practical contradiction of equipment training, the basic framework of virtual product display system is put forward. In this paper, the design flow of the product display system is given, and the implementation process of the display system is expounded. Through the test, the system basically achieves the desired results. The system can display the product from different angles and simulate various functions of the product. The system can also play a very good role in publicity and improve the teaching effect.

References


[17] Virtools 5.0 Online Reference.