

# Research on Practical Teaching Based on VR Technology in the Environment of MOOC

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**Abstract**—Three-dimensional virtual experiment system to create a highly realistic learning situation, MOOC for the rise of virtual experimental teaching provides technical support, so that it has the characteristics of experimental resource sharing and remote collaboration. "Virtual classroom" virtual experiment system to support multi-user online operation at the same time, to a certain extent, improve the traditional experimental resources, the shortcomings of the lack of resources. Through the use of virtual instruments, analog devices to achieve long-range practice teaching process, the formation of knowledge, learning and practice integration of the new education system.

**Keywords**-MOOC; Virtual Laboratory; 3D Scenes Mode

## I. INTRODUCTION

In recent years, with the rapid development of science and technology, the traditional experimental teaching mode can not meet the current needs, and the mature development of virtual experimental technology has become a powerful means of teaching aids. It not only solves the constraints of the experimental resources in the traditional experimental mode, but also saves the educational cost and enables the students to carry out the curriculum experiment without the geographical space and time limit, and makes the information display and interaction more intuitively and conveniently. The introduction of virtual reality technology into practice teaching has become a trend of inevitable reform, which

is conducive to cultivating students' practical ability and creative ability, and speeding up students' knowledge and understanding of knowledge.

## II. VIRTUALIZATION TECHNOLOGY IN UNIVERSITY LABS

Virtual Reality (VR) is a virtual real-time virtual environment by computer integrated technology, which has three basic characteristics: "immersion", "interaction" and "idea". There are many objects in the virtual world, the hierarchical structure is more complicated, through the capture of various types of real data modeling, three-dimensional visualization and virtual reality scenes.

### A. Three - dimensional environment modeling

Three-dimensional modeling needs to use the acquired data to model all the scenes involved in the whole system [2]. Data acquisition stage in the CAD drawing object based on the standard drawing of the object modeling, and then import 3DMAX, in this way to reduce the complexity of modeling objects when the error occurs, not only can improve the efficiency of modeling, and can achieve both Accurate and effective purpose. After the virtual scene model is established, it is necessary to carry out physical modeling, including the shape of the model, material, texture, movement and so on.

### B. Real-time rendering technology

Render and model of virtual reality scene scale determines the effects of the size of the virtual reality scene, virtual scene rendering frame rate directly affect the user experience, to do try to have a high level of virtual scene and model rendering

do users browse under the condition of no cat on, scene frame refresh rate should be higher than 20 frames per second.

*C. Impact checking*

Collision detection technology is in the scene of the object to increase the collision body, to prevent the characters through the wall and increase the realism. It is possible to detect collisions between two objects, to detect collisions between specific colliders, and even to detect collisions in advance using light projection. Common collision detection strategies include basic collision detection, trigger collision detection, ray projection and so on.

At present, virtual reality technology has been widely used in aviation simulation, military training, game entertainment, education and other fields. The use of virtual reality technology to establish a virtual laboratory to provide integrated network management teaching functions to achieve the virtual instrument and experimental operation process demonstration, so that students on the Internet to complete the relevant experiments, virtual experiments to improve the traditional experiment due to the constraints caused by the results deviation. Virtual experiment with its good flexibility and the complexity of the hardware resources and other advantages of the advantages of network experiment teaching favor, teachers can build a wide range of students involved in the update at any time to update the professional dynamic resource library to achieve remote sharing of resources, but also Can achieve online communication, assessment and evaluation of teaching activities.

**III. TEACHING REFORM OF VIRTUAL EXPERIMENT BASED ON MOOC**

MOOC school education concept is to high-quality education resources through the online way to show low-cost. Mu class education has the characteristics of scale, openness, linearity, participation in autonomy and so on [3]. With the network teaching platform, the practice of teaching content, assessment and other aspects

of the liberation from the laboratory, so as to minimize the teaching investment, improve teaching quality. The construction of the practice teaching network reform also promoted the improvement of the construction of the "MOOC" platform, avoiding the phenomenon of breakpoint in the teaching platform of online teaching, and realizing the sharing of quality teaching resources.

*A. Research on the Framework of Virtual Experiment Teaching Resources Development*

Experimental teaching is an important part of students 'access to knowledge. It is an important means to cultivate students' practical ability. The remote virtual laboratory system under the platform is designed to realize the remote practice teaching which supports multi-user online operation at the same time. Its overall structure shown in Figure 1.

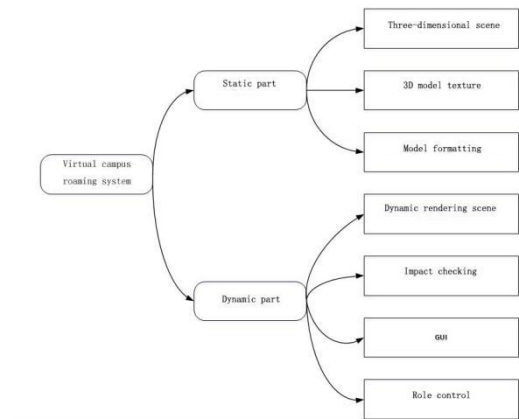


Figure 1. Virtual experimental teaching resources development framework

1) *Scene 3D modeling.* The virtual campus for data acquisition and data processing, and through static model building, material modeling and scene rendering these aspects with 3DS Max virtual scene modeling.

2) *3D model texture.* In view of the actual situation, the virtual campus roaming system involves the building and the object object image acquisition, the collected graphics image processing, so that it can form a realistic material texture.

3) *Format conversion.* Since the FBX format file is required when importing Unity3D, the MAX file needs to be formatted.

4) *Dynamic rendering scene.* Virtual campus roaming system which not only static object model, there are some scenes that need to be generated dynamically, such as navigation maps, lights and particles.

5) *Impact checking.* When the user browsing the system, the need for characters and scene objects to add collision detection, improve the scene of the realism.

6) *Role control.* In order to achieve a friendly human-computer interaction control, the characters in the virtual campus roaming using the mouse and the basic operation of the keyboard can complete the control of the system model, to achieve easy to learn, user-friendly requirements.

7) *GUI.* All the information needed to display through the GUI interface to show to the user, to do friendly human-computer interaction, a good GUI interface is an indispensable part.

Virtual experiment teaching system to provide users with network and open experimental environment, simulation of real experimental equipment and equipment, with low hardware resources and good interaction, etc., much of the network experiment teaching favor. Virtual experiment teachers can build a wide range of students involved in the updated library, to achieve remote sharing of resources, but also can achieve online communication, assessment and evaluation activities.

**B. Constructing Open Virtual Experiment Teaching Platform**

Combined with the concept of MOOC make full use of laboratory resources to build an open, interactive, shared virtual experimental teaching platform. In the whole process of completing the experiment goal, learning to become more immersive, more intuitive, help students understand the experimental process, learning experience has improved greatly.

**1) Virtual experiment teaching platform design and implementation**

Virtual laboratory teaching system consists of analog demonstration, interactive and analog terminals and other major modules, as shown in Figure 2. The user adds an

experimental scenario and an interactive event to the demo presentation, where the data exchange is forwarded through the interactive side.

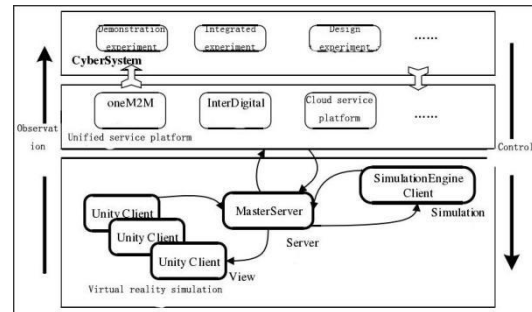


Figure 2. Virtual experiment teaching system functional structure diagram

a) *Simulation demo.* The simulation presentation is used as a client in the simulation platform to simulate the role of the role, the role data development, the role state information display, the equipment control command reception and the equipment state change function, provides a variety of visual scene display effect.

b) *Interactive end.* The core message forwarding mechanism of the simulation platform forwards the control information received from all the presentation terminals and the above service platform to the simulation side, and broadcasts the role status information and environment status events received from the simulation terminal to all clients and the above services platform.

c) *Simulation side.* The simulation side is the simulation platform environment and equipment simulation module, is to achieve the core of virtual reality. It mainly implements the construction of simulation environment and the access of various heterogeneous devices. The simulation side updates the device status and environment information in the environment by receiving the corresponding role control commands and device control commands, and the environment and equipment status information is fed back to all the demo and service platforms.

**2) collision detection function**

There are many moving and stationary objects in the virtual experiment teaching system. In the process of interaction, the user needs to detect the reliability of the simulation in order to prevent the phenomenon of " The

collision takes place. The specific flow chart shown in Figure 3.

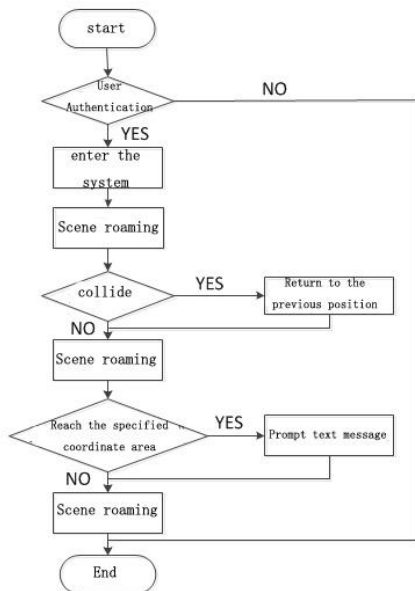


Figure 3. Collision detection flow chart

Clarifying the collision path and selecting the correct collision object is the key to collision detection. Here the use of AABB bounding box way to achieve collision detection, take the two vertices of the hypotenuse, calculate the middle point, and then let the midpoint up or down slightly offset, use these three points to determine a circle, by calculating the camera and the center To determine whether the collision occurred.

```

Ifpz (int p) //If it really is the collision
{float x1=fabs(p_e[2]-obpot[p].a);
float y1=fabs(p_e[0]-obpot[p].b);
r=sqrt((x1*x1)+(y1*y1)); //Calculate the distance
between the camera and the center of the circle
int z;
if (p_e[2]>-4926) c=0;
if(p_e[2]<=-4926) c=1;
switch(c){
case0:if(fabs(p_e[0]-obpot[p].x)< obpot[p]. sizew; break;
//Bounding box collision
case1:if(r<obpot[p].size); break;//Surrounded by round
collision detection}
  
```

By collision detection, if true, the camera position returns to the previous position, and if it is false, it continues to roam, thus completing the collision detection in the three-dimensional roaming. As shown in Figure 4.

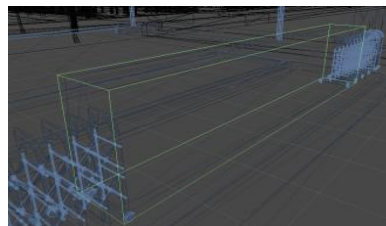


Figure 4. Collision detection of buildings

### C. Reform program

1) *Reform the experimental teaching model.* The application of virtual reality technology to build an open virtual laboratory, the use of Mu class of high quality resources to share this idea to achieve the sharing of teaching resources, students the purpose of comprehensive development. In the process of teaching the use of interactive classroom interactive advantages for students to create a "self-learning" and diversified, practical and personalized practice environment, give full play to the student's dominant position and the dominant position of teachers, students can choose online Experimental project and experimental time, to achieve full open practice teaching.

2) *Reform the content of practical teaching.* The use of virtual laboratory, the associated course of practical teaching links to integrate and optimize the "Mu class" concept to develop curriculum objectives, improve the evaluation system. In order to solve the problem (task) → solve the problem (do middle school) → induction analysis (summary improvement) → expand innovation "gradient progressive model organization experimental teaching content, combined with practical application and industry dynamic design and development of practical teaching content for students, To cultivate students' practical ability and creative ability in a phased manner, to turn practice teaching into a fun, challenging and practical work to enable students to master the computer, network and other related information technology through autonomous learning and training. Basic knowledge, students actively use information technology tools to analyze problems, solve the problem of awareness

and ability to improve students' information literacy.

3) *Reform the experimental teaching methods and means.* Through the virtual experiment teaching system, the new achievements of teachers' scientific research are applied to the experimental teaching, and the experimental project with new technology is added to the course content to strengthen the design, comprehensive and innovative experimental teaching. Through the opening of experimental projects, experimental courses and experimental resources, encourage and attract more students to participate in university students research study and innovative experimental project. This kind of teaching mode conforms to the characteristics of student operation and teacher guidance in the course of practical teaching, and provides a scientific and reasonable teaching system for the practice teaching network reform.

#### IV. THE CONCLUSION

The development of virtual instrument technology, network communication technology and remote control constitute the foundation of virtual laboratory implementation [4]. The combination of virtual reality technology and experimental cognition simulation in the MOOC environment improved the practice teaching environment, optimized the practice teaching process, and stimulated the students' experimental interest and enthusiasm [5]. Under the guidance of teachers, students

can learn, study independently, collaborate in learning, multi-dimensional feedback and diversified development. On the one hand, we should promote the reform of experimental teaching, actively guide students to contact new technologies, new knowledge, and develop students' intelligence, so as to better realize the training target of applied engineering talents [6]. On the other hand, more students can participate in the experiment courses indirectly, enhance the consciousness and innovation ability of interdisciplinary research, and maximize the sharing of teaching resources in the laboratory.

#### ACKNOWLEDGMENT

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