

# The Practice and Exploration of Virtual Roaming based on 3Ds Max

Zhanzhan Duan

Advanced Vocational technical of Shanghai University of Engineering Science, Shanghai  
Technician School, Shanghai, China.

duanzhaz@foxmail.com

**Abstract.** This paper focuses to build a completely immersive campus roaming system with taking Shanghai Technician School as the object of 3D virtual roaming system by using 3Ds Max and Quest 3D platform as development tools, combining WebGL and three.js library programming language, and integrating with HTML5 pages. The technology of camera creation, lighting setting and trifold screen release of VR scene in the integrated development stage of the system are studied, and the complete scheme of virtual simulation roaming system based on the fully immersive case of campus is proposed and implemented, which provides a reference for the application of the fully immersive virtual simulation roaming system.

**Keywords:** virtual reality, Roaming, WebGL and Three.js, Immersion, VR scene three-fold curtain release.

## 1. Introduction

In this paper, Shanghai Technician School is taken as the research object. First, the basic model of campus architecture is created with 3Ds Max tool[1]. Then, the Quest 3D platform is imported to create a 3D fully immersive virtual roaming system close to the real campus, and finally realize viewing through the browser with the help of the WebGL and the Three.js libraries. The basic software and hardware required in the development stage of this paper mainly include 3Ds Max, Quest 3D platform, WebGL, three.js library file and cave type trifold screen hardware environment. The overall design framework is shown in figure 1.

Currently, 3D modeling software mainly includes 3Ds Max, Maya, Softimage, etc. The Autodesk 3Ds Max 9 64-bit adopted in this project was developed by Discreet company, a subsidiary of the internationally renowned Autodesk company. Autodesk 3Ds Max 9 64 bit is a 3d production software integrating modeling, rendering and animation production. It is widely used in advertising, film and television, industrial design, architectural design, multimedia production, games, auxiliary teaching and engineering visualization and other fields. This paper mainly uses a simple 3d model built in the initial stage of the project through 3Ds Max so as to obtain a usable VR scene model. Quest 3D development platform can install corresponding plug-ins in 3Ds Max, realizing seamless connection with 3Ds Max, which is very convenient to use. Finally, realize the function of viewing in the browser through WebGL and three.js library files.

So far, the software of virtual reality editors is a lot of software, like the 3Ds Max platform of Canada's Discreet corporation, the Dutch Act 3D corporation's Quest 3D platform, the Virtools platform of the French Dsoe corporation, and the EON platform adopted by Beijing Yiyong viewpoints company, etc. The 3Ds Max used in this paper is an easy and effective real-time 3D construction tool. 3Ds Max was developed by Discreet Corporation and is a good work among its graphic products developed. The feature of it is that it owns a powerful editor which creates graphical application almost without writing code, a strong network module support, special effects system of beautiful particles. And it can show amazing high-quality graphics effect through simple editing [2].

The hardware environment adopted in this project — cave type tri-fold screen environment is mainly composed of 7 parts (as shown in the first 7 parts in table 1, and the control logic by main control machine and the rendering method controlled by renderers are adopted.

## 2. Design and Development

3Ds Max is a real-time execution program, which means that it continuously executes the entire project and continuously updates the execution results. During execution, the system executes the entire channel program from left to right and from top to bottom, as shown in figure 2, in the order of  $1 \rightarrow 2 \rightarrow 3 \rightarrow 4$ .

The channel program will be performed exactly once, called a frame, and the final result of the calculation is called rendering [3]. This article takes the most basic channel structure, as shown in figure 2. In this channel structure, the function of the Render channel is to Render the 3D objects in the Scene, while the function of the Start 3D Scene channel is to do some initial work before the rendering starts, such as setting the 3D environment, screen resolution, background color, etc., which can be set by double clicking the dialog box for opening its channel properties.

### 2.1 Creation of Cameras in VR Scenes

The camera defines the user's view of observing the scene. Quest 3D provides users with a variety of camera templates that can simulate camera types from various perspectives, such as object observation camera, third-person camera, 3D browsing camera, animation camera and roaming camera. In this paper, a more complex roaming camera is used, as shown in figure 3. The role of some of the important channels in figure 3 is shown in table 2.

### 2.2 Objects in VR Scenes

The application model of virtual reality is dominated by the feature of "simplicity". The building of the model only needs to show the main lines with the chart-lets, and the overall and detailed presentation effect is shown. According to different production methods, virtual reality models can be divided into environment scenes, buildings, people, animals, plants, particles, colliding objects and so on. The materials of the virtual reality model must use standard materials, and Vray, Mental Ray and other advanced materials are prohibited. It is also forbidden to use multi-layer sub-materials, mixed materials, upper and lower materials and other composite texture materials, and it is forbidden to use the wireframe model of the material. In addition, zooming, clipping, and other operations in the material editor are not valid for virtual reality platforms. Avoid "Cropping/Placement" Settings in texture panels [4]. The requirements for making virtual reality scene model are very strict. Its scene is exported from 3Ds Max software, and when it is imported into Quest 3D, a patch is needed to change the scene into ".x" or ".cgr" format. In this paper, a completed and simple model is adopted as the basis to assist in the realization of 3D fully immersive roaming scene.

### 2.3 Lighting in VR Scene (Light)

Lighting can illuminate the scene, bring dark changes to the scene, and produce a deep effect. There are three types of lights in Quest 3D: Direction Light, Point Light and Spot Light. The environmental properties of the light, equivalent to the "spontaneous light" properties of the light, can improve the brightness of the light as a whole, thus making the illuminated object brighter. At the same time, it can also realize other lighting technologies, such as: shadow, real-time shadow, light chart-let and so on. In this case, three lights are mixed and placed in different spatial positions according to the needs of the scene to enhance the sense of reality of the virtual scene.

### 2.4 The VR Scene Published in the Three Curtains

This case is visually programmed in Quest 3D. After obtaining the VR scene channel structure corresponding to the campus environment in figure 2, it needs to be processed separately. For the main computer end of the program, the network\_master template is needed to be imported. For the program of the rendering machine, the network\_render template shall be imported. It is important to note that there is a G-Cave channel in the network\_render channel structure with 6 sub-channels as shown in figure 4. The sub-channels from the left to the right is respectively used to connect the camera; to data update; to connect scenes needed to be rendered; to set the distance between eyes,

which has an effect on stereo effect; to connect action capture equipment and collect data; for near clip plane of the scene and for far clip plane of the scene [5]. When all is done, users can publish them as ". Exe "file or web plug-in file, and the main control program should be put on the main control machine and the renderer program on the renderer. At the same time, configure the G-Cave plug-in on the renderer, to implement the up-down bias of the scene with the G-Cave channel in network render. Finally, the main control machine will control the logic, and the rendering machine will control the rendering.

## **2.5 Web Development Technologies and Roaming**

Web front-end development uses HTML 5 and three.js. HTML5 is designed to support multimedia on mobile devices. Compared with the traditional web design, the situation of web page display has been greatly improved. HTML5 has obvious advantages in the application of modern smart phones, which promotes the development of Web front-end technology. Three.js is a source project from GitHub with rapid development [6]. Three.js runs on a browser and can be considered as 3 + js. 3 refers to 3D, and the full name of js is JavaScript. In other words, three.js uses JavaScript to write 3D programs. JavaScript is a scripting language that runs on the Web, which not only could be run in a browser, but also could write efficient 3D programs. With WebGL and the Three.js library files, only three steps (scene, camera, renderer) are needed to render the object as a web page.

## **2.6 Case Presentation Pictures**

The following shows two groups of pictures of college main control computer terminal and college rendering machine terminal, as shown in fig.5 ~ fig.6. They are all made, released and built with the same design mode. Among them, for the program on the rendering machine, 3D mode is adopted when rendering, and there is a double image visually when viewing with naked eyes. In a completely immersive virtual reality environment, it is necessary to wear 3D active shutter glasses to achieve the three-dimensional effect and make people feel immersive [7]. Connect the main control computer terminal with the wireless mouse or the wireless rocker, transmit the data of moving, looking up or looking down to the renderer in real time, so as to achieve the interactive effect with the virtual environment.

## **3. Application and Prospect**

Before Campus roaming system is mainly used to display the school building distribution, location and other information, so that people inside and outside the school only need to scan or input relevant web pages to look through the campus distribution. It mainly uses 3ds Max for modeling and HTML5 and Three.js for Web front-end development. It uses a few skills to create a landscape view of the campus and a programmatic campus that makes people feel vibrant and fun, and ultimately upload all the resources and source code to the service. Users can interact by using mobile devices or Web browser load scenarios.

Virtual reality technology is the technology that uses computers to generate a simulation environment, uses a variety of sensor devices to enable the user to engage in the environment, and allows users to achieve natural interaction with the environment [8]. It is a technology that can create and experience virtual environments. Based on the fact that the number of the campus environment building model equipment's is increasing, and some equipment is very expensive or dangerous to operate, it is very common to design corresponding virtual model specially for training. To display buildings in the popular real estate market, the traditional real estate demonstration means, such as floor plan, performance diagram, sand table, model house, etc., are broken, and the virtual way can bring customers more direct and immersive feeling [9]. In the urban tourism exhibition project, fully immersive virtual simulation technology will enable tourists to instantly land in the scenic spot and fully experience the charm of the scenic spot, which will bring greater attraction. In terms of movie entertainment, the market for 3D virtual effects is beyond doubt.

## 4. Experimental Result

### 4.1 Figures and Tables

Table 1. Hardware Device

Hardware Device	
<i>Name of the Hardware</i>	<i>Number</i>
Tri - fold cave curtain	3 or 5 pieces
DP active stereoscopic projectors	3
Special short focus lens for projector	3
Main control computer	1
Rendering computer	2
3D active shutter glasses	several pairs
3D space mouse	1
Network cables	several
Stereo multifunctional sound amplifying system	optional
Motion capture position tracking system	optional

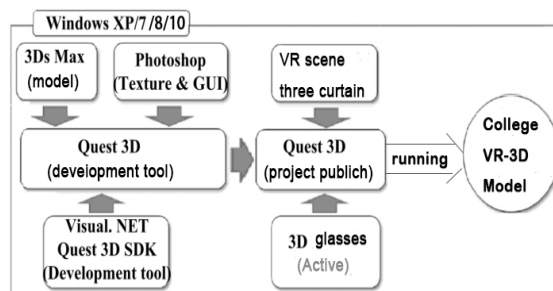


Fig 1. Overall design framework

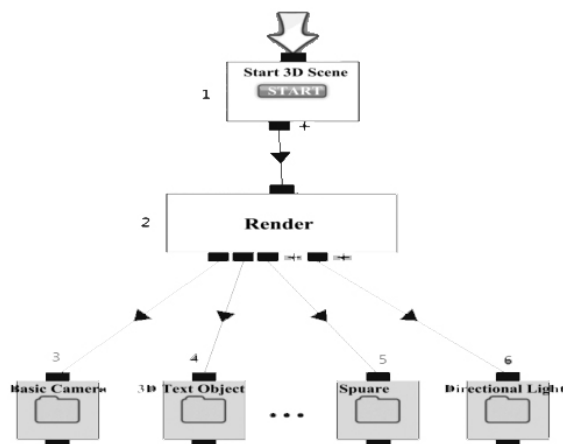
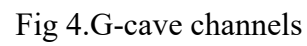
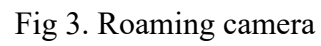


Fig 2. Channel structure diagram





(c)

Fig 5. College main control computer terminal

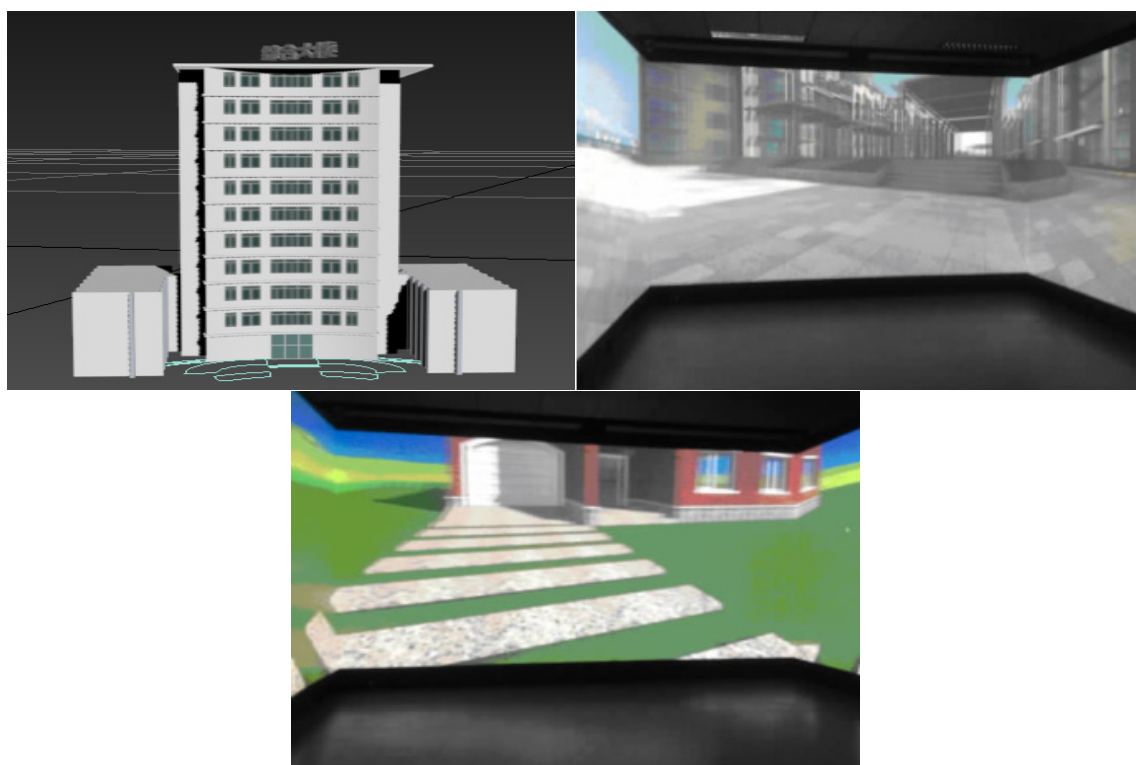


Fig 6. College rendering machine terminal

## Acknowledgments

I would like to thank my college for providing an advanced network environment in the computer room and related equipment of the virtual reality laboratory for this project, so that I can focus on the research topic. I would like to thank my leaders and colleagues for their help, as well as my family for their support and understanding of my work. The subject of this thesis takes six months and it achieves the desired results through the efforts of trial, comparison, and data collection. And I would also like to thanks the experts who helped with the research on this subject.

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