Design and Implementation of Campus Roaming Platform Based on Virtual Reality Technology

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Abstract. The concept of digital campus has gradually become an important trend in the development of colleges and universities. Virtualized campus is an important part of the digital campus. Virtual campus based on virtual reality technology, it builds a virtual campus scene that is immersive and interactive on the basis of campus real scene. This paper uses the Unity3D engine as a development platform to construct a virtual campus roaming system with interactive functions through simulation and 3D modeling. Compared with the traditional picture display way, the virtual reality system can show the campus landscape more intuitively.

Keywords: Virtual Reality Technology · Campus Roaming · Development Platform

1 Introduction

With the development of virtual reality technology, the application of virtual reality is becoming more and more popular. Virtual reality technology can be used in many scenes in people's life, such as teaching, games, construction, tourism, etc. [1]. Virtual roaming is an important development direction of virtual reality technology. The virtual campus roaming in this paper can reproduce the campus landscape and teaching environment in the computer. In the computer, users can use the mouse and keyboard to move the viewing perspective, with a 360-degree comprehensive view of the campus environment [2]. Through the virtual reality campus roaming system, the unregistered students can have the opportunity to observe the campus environment and publicize the campus culture to the public. Virtual reality campus roaming technology can also be used as an auxiliary tool for campus development and construction to browse the campus globally and determine the direction and goal of construction. This paper uses the Unity3D engine and 3 D modeling technology to realize the basic interactive function of users in a virtual campus environment [3].

2 Virtual Reality Technology

2.1 Virtual Reality Technology

Virtual reality technology is a technology that uses computers to create a three-dimensional space similar to the natural world. Virtual reality technology allows users

to feel the visual, auditory, tactile and other sensory experiences similar to the real world in the virtual space [4]. Virtual reality technology, such as computer graphics, sensing technology, multimedia technology and other scientific technology, is a new scientific development direction with broad prospect. Users can produce an immersive experience in the virtual world created by virtual reality technology. An important reason why virtual space can bring immersion to users is the interactive function provided by virtual space. The user can operate in the virtual space, which generates the corresponding feedback along with the user's actions [5].

Virtual reality technology has the characteristics of multiple perception, interaction, sense of existence and autonomy. Multi-perception refers to the virtual reality technology can bring users multiple sensory simulation experience. Interaction refers to that the user can get the corresponding feedback effect when manipulating the virtual scene. The authenticity of the feedback effect determines the authenticity of the interaction. Presence refers to how realistic a user feels in a virtual environment. Autonomy refers to the movement of objects in a virtual environment consistent with the real laws of physics [6].

2.2 Unity3D

Unity3D is a multi-platform professional game development tool and a highly integrated game engine [7]. Unity3D is very popular in the current virtual environment creation, allowing users to easily create 3D interactive content such as 3D video games, real-time 3D animation, building visual simulation and so on. The Unity3D has a powerful PhysX physical effects engine, which can actually simulate real physical phenomena. The Unity3D has a scalable all-in-one editor. Unity3D's own editor supports both Windows and Mac, including many tools and functional developer components to design virtual worlds. Import images, audio, 3D models and other resources into Unity3D can easily build complex virtual scenes, and the workflow is very simple and intuitive [8].

2.3 Collision Detection Technology

Collision is an important concept in the virtual world. In the virtual world, the character stops moving when he comes in contact with objects and walks directly on the road when walking, all because of collisions in the virtual world. In the virtual world, the user's perspective is the same as that in the real world, so it cannot directly penetrate the surface of the object and see the interior of the model [9]. This setting can bring a sense of immersion to the user. Collision detection technology is an important component of the virtual roaming system. Colash detection in virtual scenes is to detect whether there is contact or penetration between two or more objects. According to the position of the collision object and the distance between them, the computer will calculate the intersection of the object, and then trigger the corresponding collision feedback [10].

3   Scene Modeling

At present, there are three modeling methods in virtual reality technology. The first is geometric graph-based modeling, the second is image-based modeling, and the third is

a modeling method that combines collection graphics and images. The scene modeling in this study used modeling techniques combining geometry and images. The scene model in the campus roaming platform uses the geometric figure modeling mode. The environmental object model uses an image-based modeling approach. Scene modeling of the campus roaming platform combines 3DXMax and DirectX.

Simple cube models can be used to achieve simple shape and regular building modeling in campus scenes. After modeling, photos of buildings were taken with each other and pasted onto the surface of the cube model using Photoshop processing.

Modeling of environmental trees is required in campus roaming systems. Modeling of the trees can be achieved by using the transparent processing of the texture. For transparency, you need to specify an ALPHA value as a reference. Where you need to render, compare the ALPHA value here with the developed ALPHA value to determine whether this is transparent. SetRanderState (D3DRS_ALPHAREF, Ox0f), D3DRS_ALPHAREF represents the reference value used for ALPHA testing during formulated rendering, and the second parameter represents the formulated specific value. The values for ALPHA range from 0 to 255. Specifies the test method as SetRenderState 3DRS_ALPHAFUNC, D3DCMP_GREATEREQUAL); D3DRS_ALPHAFUNC indicates the method for setting up the ALPHA test. Only the successful test points are shown in the final rendering results. Test failed points are transparent, no longer realistic in the final rendering results. The second parameter represents the specific test method [11][12].

4 Structure of Virtual Reality Campus Roaming Platform

The development process of virtual reality campus roaming platform includes two parts, namely, scene data creation and system function development. The specific development process is shown in Fig. 1.

There are three functional modules in the platform. The specific platform functional structure is shown in Fig. 2.

After the user enters the system, the system initializes, starts to read the building information files, loads the scene model data, and so on. After the user enters the roaming interface, the rendering system will view the initial position set by the rendering, and then the user will operate through the keyboard and mouse to move and browse in the virtual scene, and the scene screen will be updated in real time [13].The workflow of the system is shown in Fig. 3.

5 Implementation of the Interactive Function

In virtual space, the user's perspective observes and roaming the virtual scene with the keyboard and mouse, so a role simulator needs to be created in the system. Role simulators can help the platform to implement interactive functions. The role simulator includes rigid body components, camera components, collider components, etc. [14].The rigid body component simulates the role simulator into a mass entity with a collision volume, ensuring that the role can be above the scene terrain. The camera component can simulate the user perspective. As the character moves the cargo rotates, the camera moves together. The collision onset is used for the departure interaction and can be set to
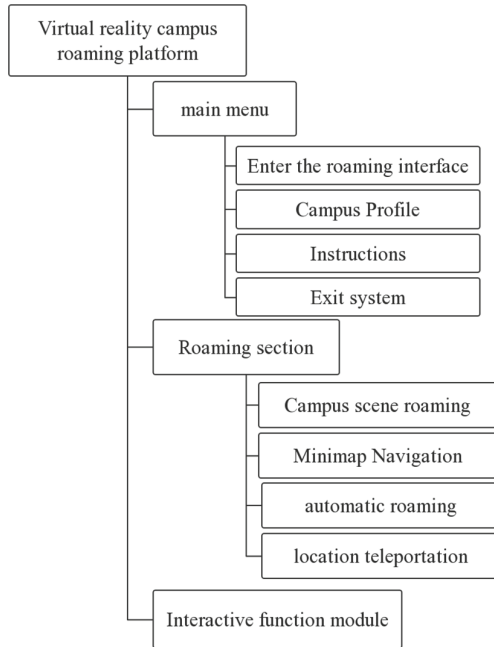
Virtual reality campus
roaming platform

main menu

Enter the roaming interface

Campus Profile

Instructions

Exit system

Roaming section

Campus scene roaming

Minimap Navigation

automatic roaming

location teleportation

Interactive function module

Fig. 1. Flow chart of the system development

Start

initialization

main menu

screen update   roaming interface   Display information

execute script   return data

move   user input   click menu

Exit system
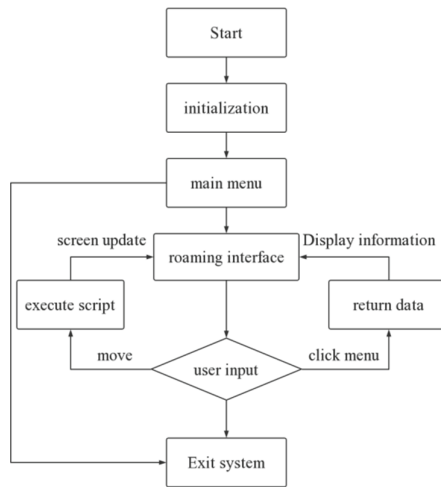
Fig. 2. Functional structure diagram of the system

trigger a specific event when the character collides with the inflated gas of other objects.
In the review panel, you can set the role simulator's bad speed, running speed, visual
height angle, gravity, and so on [15].
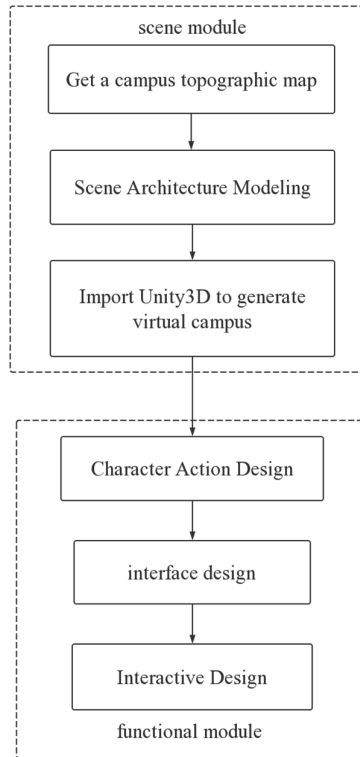
Fig. 3. Flow chart of the system work

Adding a script to the camera component of the role simulator controls the perspective of the role. The GetAxis function monitors the mouse movement input in the horizontal and vertical directions. The function returns a value of −1 to 1 to record the offset of the previous mouse contrast. When the user moves the mouse to start the statement, the system will multiply the distance of the mouse by the unit time, so that the camera component of the role simulator can rotate the corresponding angle along the set axis, which achieves the purpose of controlling the role's perspective.

6   Conclusion

The virtual reality campus roaming system constructed in this paper selects Unity3D engine as the development platform, modeling through 3DMax, and using the camera pictures to achieve the virtual reality effect similar to the reality. This paper also implements the interaction between the user role and the environment, and the user can realize the motion and perspective transformation in a virtual scene through the mouse and keyboard. This virtual reality campus roaming system can bring users an immersive campus tour experience, which is very beneficial to the development of digital campus.

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