

Design and Implementation of Virtual Campus System Based on Open Scene Graph

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Abstract

The three-dimensional virtual school system proposed in this paper is based on open scene graph (OSG, three-dimensional graphics engine) and Nb IOT communication network. It is built under the legitimate rise of modern 3D graphics simulation and communication industry. Firstly, this paper understands the overall structure of the school, obtains the required building sample information based on the rational use of space, combined with the terrain and appearance, and then uses 3DMAX modeling tool to scale the campus. Finally, a virtual campus system based on OSG is realized by using VS2010 development tool and C + + language. The system designs a user-defined menu bar, which can realize many functions, such as positioning, view viewing, weather system, information reality, building editing, campus roaming and so on. Virtual reality technology has the characteristics of strong realism, interactivity, multi device compatibility, remote projection and dynamic. Now it is applied to the information construction of virtual campus to make up for the inherent shortcomings of traditional campus and provide services for campus publicity, planning, information management and so on.

Keywords

Open scene graph; 3D simulation; Virtual reality.

1. Introduction

Most of the traditional college publicity is carried out through the combination of printed words and pictures. The introduction of all kinds of school information still stays at the level of the combination of pictures and words. The information can only be displayed in a static way, which is not vivid and intuitive. At the same time, the school is a large area, and all kinds of information are changing dynamically. In order to follow and adapt to social development and enhance its competitiveness, the school continues to carry out reform in all aspects. All kinds of changes have brought a lot of trouble to the school management, as well as inconvenience to outsiders and even students included in the school itself. Therefore, the school urgently needs to change the current situation, so as to more vividly publicize and promote itself to the public. With the continuous development of science and technology, artificial intelligence (AI) and virtual reality technology (VR) are becoming more and more mature, which provides help for us to solve the above problems. The 3D virtual school system designed in this project is based on open scene graph in the field of virtual reality technology (VR) and wireless communication technology. The three-dimensional virtual campus system can solve all the above problems from three aspects: timely updating the campus environment, strengthening the communication between students and schools, and storing a large amount of information, and bring teachers and students better spiritual and emotional experience, so as to expand the influence of the school, improve the competitiveness of the school and establish a good image.

2. Technical Principle

This project establishes a 3D virtual school system based on 3DMAX and open scene graph (OSG, 3D graphics engine for short), carries out architectural modeling through 3DMAX and imports 3DMAX files in OSG, and combines the functions provided by these two applications to achieve the goal of establishing a 3D virtual campus system.

2.1. Introduction to OSG Principle

Open scene graph, OSG for short, is an open source high-performance 3D image rendering toolkit. It adopts OpenGL and C++ programming to establish an object-oriented program framework, which can greatly save users' writing of underlying code, bring great convenience to model modeling and scene interaction, and is conducive to users' development and management of application programs with OSG as image rendering engine. OSG carries a large number of numbered toolkits, which brings great convenience to users.

2.2. Coordinate System and Matrix

OSG coordinate system is to confirm the direction according to Cartesian coordinate system. Its direction is: X to the right, y to the inside and Z to the top. The standard transformation of three-dimensional objects in virtual scene is to transform the vertex matrix of the object itself. The three-dimensional coordinate transformation adopts 4×4 matrix, which needs to be calculated in the form of matrix multiplication through unified translation and scaling.

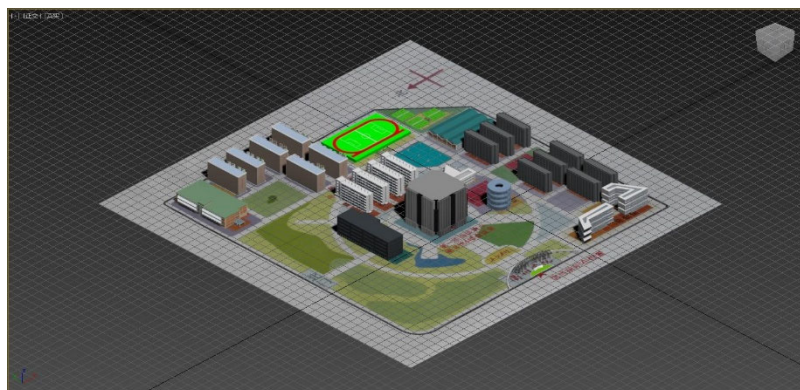


Figure 1. 3DMAX model of Campus

2.3. VPW Matrix of OSG (Core Principle of Camera Transformation)

M (window matrix) is the abbreviation of window matrix. By mapping the above projcoord coordinates to the preset two-dimensional interface, the viewport transformation is realized. The OSG::viewport viewport class is used to describe the properties of the viewport. Its source file has the function computewindowmatrix. WM can be obtained by calculating the known viewport space coordinate values and width and height values. Use the following formula: $\text{windowscoord} = \text{projcoord} * \text{WM}$ to obtain the final viewport coordinates $\text{windowscoord} (x, y, 0)$. After integrating all the formulas, the viewport coordinates are: $\text{windowscoord} = \text{worldcoord} * \text{VM} * \text{PM} * \text{WM}$. When rendering an image, OSG will calculate the coordinates of each node step by step according to the above VPW process, and finally display the objects in space on the two-dimensional screen.

2.4. Number of Scene Nodes

When creating a scene with OSG, the 3D model is put into the scene in the form of node tree. The usual approach is to add a switch node on the root node, which is a switch node and can close any node under the node; Add matrixtransfrom node below to set attributes such as displacement and scaling, and special effects node. This node is generally rain and snow effect

or light source and other nodes; Finally, add leaf nodes under matrixtransform, that is, the 3D model. In this way, a scene tree structure can be built layer by layer. Finally, in the viewfinder viewer - > setscenedata (root); The 3D model can be displayed intuitively.

3. Functional Analysis

3.1. System Interface

After entering the main interface through 3D school software, users can see the background display framework in a unified style. The main interface of the system is divided into two areas, of which the blue part in the figure above is the menu bar, including five functional operations of flying, dragging, viewing angle, special effects and roaming and their respective detailed operations. The black area in the figure below is the main display area. The main display area takes Asia as the default display state. When you click any operation, the earth will automatically rotate to the corresponding area and change accordingly for user operation.

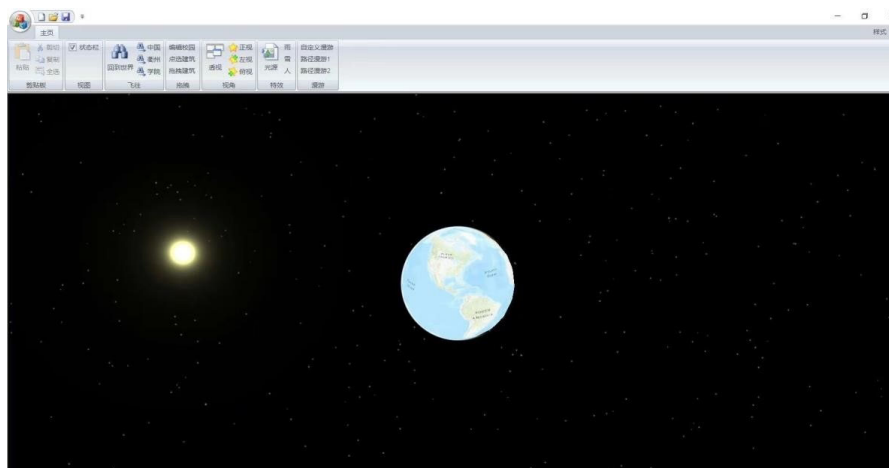


Figure 2. System interface

3.2. Specific Functions

- 1) Positioning, including "back to the world" returning to the main interface and more detailed "China", "Quzhou City" and "Quzhou College" shuttling to the destination;
- 2) Drag, the user can view the building information through "click Select building" and "drag building" to zoom in, zoom out and move a single building.

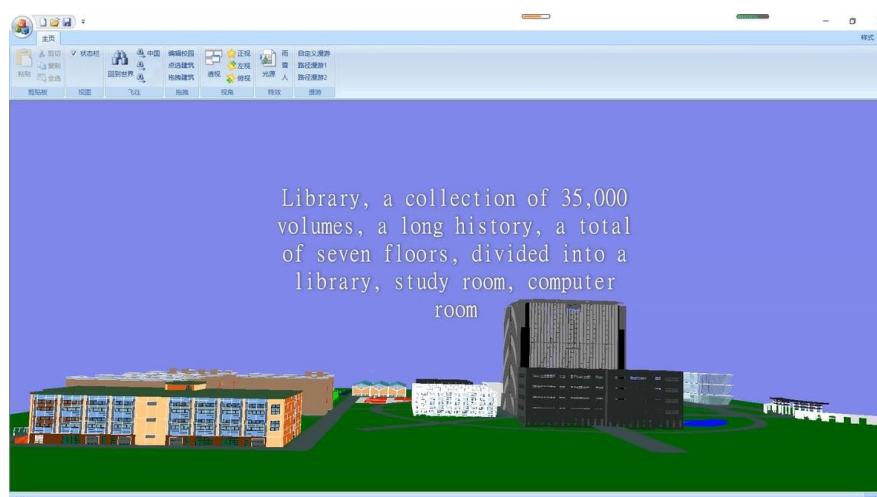


Figure 3. Point selection architectural drawing

3) Perspective switching, that is, observing the school from multiple perspectives, such as perspective, front view, left view and top view, is helpful for users to understand the overall layout of the campus.

4) Special effect display, which adds additional display effects such as light source, rain and snow, so as to enrich and diversify the content of the virtual campus system.

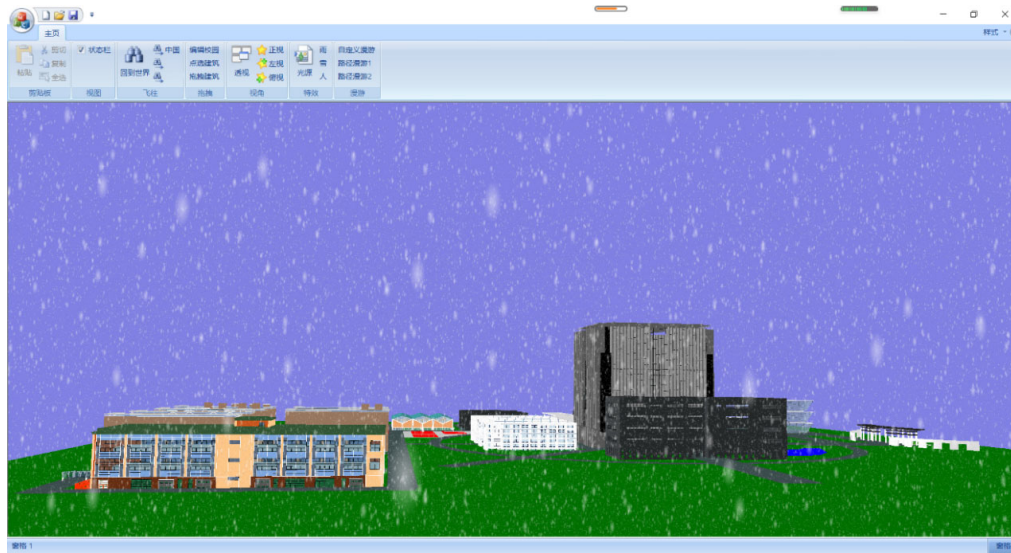


Figure 4. Rain and snow effects

5) Roaming system, users can choose the two existing roaming routes of the system to enter the campus and enjoy the campus scenery in an all-round way. They can also customize the roaming path according to their preferences and ideas to enjoy the roaming experience with a stronger sense of participation.

6) Query and positioning: the spatial information of the virtual campus system is managed by database, which can quickly query the buildings to be queried and output the data information

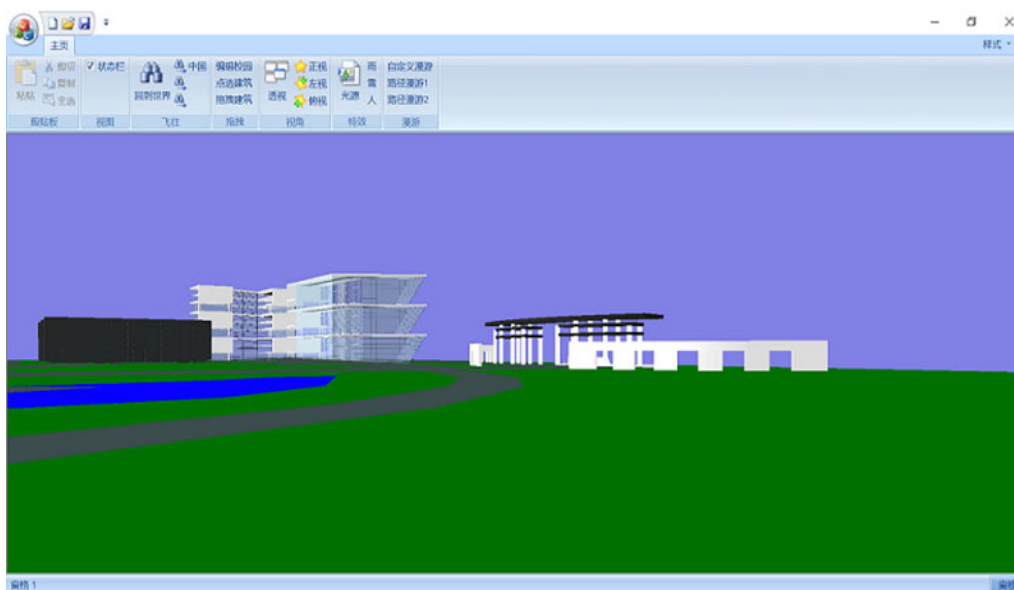


Figure 5. Path roaming

4. Application Prospect

The project has developed the first generation of prototype software, and there is still a lot of room for development in the future. The project comprehensively uses virtual reality technology, 3dmax technology and OSG technology to process the school's three-dimensional building data, campus network structure, attribute data and other data, and establish a network-based, interoperable and three-dimensional digital virtual campus system, which plays a very important role in building a harmonious campus, expanding enrollment, campus celebration, School appearance display, etc, It will become an important part of campus information construction. In addition, industrial intelligence (AI) and virtual reality technology (VR) have gradually become hot fields, attracting many people to join them one after another. Virtual campus is an important embodiment of virtual reality technology in education. Coupled with the rise of digital campus construction, virtual campus will become an indispensable part of the school in the future. Virtual reality technology has the characteristics of strong realism, interactivity, multi device compatibility, remote projection and dynamic. Now it is applied to the information construction of virtual campus to make up for the inherent shortcomings of traditional campus and provide services for campus publicity, planning, information management and so on. It has a good development prospect.

Acknowledgments

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