The key Techniques Study of Constructing the Roaming Modelin Virtual Environment*

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Abstract *Taking the digitization of Zhengzhou University campus as an example, the 3-D model of every buildings of Zhengzhou University were constructed with VR technology and 3D image processing technology. The paper has studied the questions that need to be solved in the construction process of digitizing campus and in the model roaming process, this solution has been successfully used in the scientific research item of digitizing Zhengzhou University. The study results can be summarized as follows：(1)the Texture Mapping Technology make the 3D model roaming more smoother;(2)the Construction Technologies of many trees models make the data volume worse;(3)the 3D digitization of Zhengzhou University campus provides a new idea to construct 3D virtual large scene model.*

Keywords *Virtual reality 3D module the roaming Virtual Reality-Geographical Information System (VRGIS) the Texture Mapping Technology*

1. Introduction

Nowadays, Virtual Reality-Geographical Information System which was the aim of establishing digital globe in the future, was a hot spot but difficult issue in the field of Geographical Information System and it was a high level to implement immersed roaming in the established virtual environment. Digital campus project, which was the demonstration project carried out by education ministry of Henan province, has realized the virtualization of campus. In the process of constructing the campus model a few difficult questions were solved. The used ideas which were less in the references about virtual reality were a few new thoughts to construct the 3D virtual large scene which was the bigger data volume model in the future[1][2].

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2. The Basic Principles of Establishing Virtual Campus

According to the basic principle that entity positioning in actual world is decided by both eyes of a person, virtual scenes which are composed of transverse wave and longitudinal wave are projected onto a screen with divided projectors. The transverse wave and longitudinal wave are separately projected by two groups of projectors. At this moment, beholders should wear special glasses which is made up of two layers of membrane. The two layers of glasses could filtrate transverse waves and longitudinal waves respectively[3][4]. Because the structure of both glasses are contrary, they could receive a set of transverse wave and a set of longitudinal wave respectively. That is to say, people's eyes could respectively receive a set of transverse wave and a set of longitudinal wave. So, two groups of projector suit both eyes of a person respectively. In this way, beholders could see distinct virtual geographical environment in the screen[5][6].

In this virtual environment, we adopt the Creator of Multigen corporation to construct the model of campus. The scenes are rendered by Vega presented by Multigen corporation. Finally, steering wheel and remote controlling pole are used as interactive equipments to simulate roaming of driving vehicles or overlook the whole campus from the sky by air. The established virtual environment are presented as follows: Fig. 1, Fig. 2, Fig. 3, Fig. 4.

Fig. 1 Comprehensive administration building

Fig. 2 Students' dormitory building on the second phase

Fig. 3 Cafeteria and rest house in the living areas

Fig. 4 Flank greenbelt of electric engineering department on the second phase

3. A Few Key Techniques

3.1 Texture Patching Pictures

Digital camera will be used to collect surface texture pictures to show actual scenes. RGB or RGBA format graphics file are recommended in Vega. When exporting texture files, attention should be focused on length and width of these graphics. The pixel of length and width of the graphics texture files should be limited within power of two. The strict limitation guarantees the normal display of patching picture texture. As for large area of lawn and roof, multi-surface patching picture should be adopted. Mipmap bilinear and Mipmap trilinear should be adopted as the ways of filtration so as to avoid twinkle of graphics texture effectively[7].

3.2 Processing of Trees

As for trees along the roads, it is a difficult technique problem to display them quickly and effectively while the speed of roaming is not decreased. This problem is settled effectively with the adoption of Billboard and interactive patching pictures. In addition, large quantities of trees could be produced by applying the Instance technique provided by Creator. Trees of the same kind could share the same texture and memory is used only once, which greatly economizes resources of the system and speed up displaying on the screen[8].

3.3 Combination of Building Units

If the number of building is small (which means the number of files which need to be combined is small)，we could produce the final document by applying the methods of duplicating and paste with one of the files as dominance. Meanwhile, we could integrate the

actual scenes by copying other building models into the present documents in the way of paste, placing them in the proper position and adjusting the levels of documents in the catalogue frame work. If single building units at different stages are processed, it is not proper to apply the above stated methods, while single document is dominant. In this way, single building units are introduced with the method of External Reference so that graphics texture files of building models and independence of three-dimension model file could be maintained and the actual scenes could be integrated[9].

3.4 Roaming of Sight

To make the users interact with the virtual environment naturally and simultaneously, we could manipulate Joystick like steering wheel to roam in the campus. We could realize this aim with the application of C++ procedure and dynamic model which is based on Vega.

On the basis of analysis of Vega structure and operational principle, we could upgrade the immersed sense of roaming system by applying DirectInput and controlling poll of force feedback. Users could sense that they are immersed in roaming by controlling the automobiles in the virtual scenes with steering wheel manipulated. There are ten BULL type trigger buttons on the input equipment which separately symbolize “Forward” “Backward” “Turn on” “Turn off”. The other two buttons are used to simulate steering wheel and accelerator. (As shown in Fig.5 and Fig. 6).

Fig. 5 virtual roaming environment

Fig. 6 steering wheel

3.5 Accomplishment of Collision Test

The phenomenon of perforation should be avoided in virtual environment. Tools for collision joints are not directly provided in Creator, while perforation could be solved by collision test.

Collision test could be carried out among entities in the virtual scene where collisions probably happen, which is main characteristic of video rendering software. It could be described

as evaluation of intersection point in mathematics. In collision test and intersection test, vector which is composed of certain number of directed line segments will be considered. There are generally seven methods to define vector entity. These methods confine the position of the entities and determine the minimum test results. They are as follows: Z, HAT, Tripod, LOS, BUMP, XYZPR, Volume. Each method has its own applicatory field. For example: the method of "Z" is fit to be used in calculation of elevation. The method of "LOS" is fit to be used in tests of eyesight direction. If collisions happen, collision responses will be made according to the information which is stored in gathered intersection test results[10].

To carry out collision test, we intercalate anti-collision for every building by applying C++ procedure in Vega environment, that is to set up a category which prevents perforation. Effect of mountain climbing could be achieved by applying the method of "Z" to calculate the collision between dynamic objects and ground. The method of "Bump" could be applied to calculate collision between dynamic objects and buildings and trees in the virtual scene.

4. Conclusion

Through the above study as follow the conclusion can be summarized. The Texture Mapping Technology make the 3D model roaming more smoother, which can make the observers' eyes more comfy. The Construction Technologies of many trees models make the data volume worse, which make the computer run faster. The 3D digitization of Zhengzhou University campus provides a new thought to construct 3D virtual large scene model which has bigger data volume in the future.

5. Future Work

It is not the best choice to apply Multigen Creator to building modeling in large-area real scene. Its superiority lies in modeling of geometric objects. While the best way is to patch picture by modeling with AutoCAD or 3DSMAX software and then switch them into Creator to revise. In addition, authenticity, applicability and interest could be promoted by further improvement of dynamic modeling to support coordinated roaming of individuals.

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