3D Visual Simulation On Nanchang Hangkong University

CHENG Xiao Ning
Nanchang HangKong University
Institute of Information Engineering
Nanchang ,China
xiaoyal3031@163.com

SUN Ka
Nanchang HangKong University
Institute of Information Engineering
Nanchang ,China
Sunka1982@163.com

ZHANG Xiao Feng
Nanchang HangKong University
Institute of Information Engineering
Nanchang ,China
xfzhang1130@163.com

Abstract—**This paper combined with computer graphics and related spatial information sciences technologies, made use of the software Vega Prime, On the basis of three-dimensional modeling of Nanchang HangKong University campus, built a campus three-dimensional visual simulation software, which can achieve the campus landscape, zoom, rotation, scaling, flight roaming and static and dynamic simulation capabilities, such as the fountain, lake, pedestrians, vehicles, etc. The use of this technology has great importance on school enrollment, employment, education, alumni relations, showing the school strength and other aspects.**

Keywords-digital campus, 3D simulation, spatial data, 3d visualization

I. INTRODUCTION

Three dimension visual simulation built a virtual scene which reflect the reality environment, display and management the object of the reality, support a user to inquires and browsing, flight roaming and navigation path and other related operations, so as to deepen user's understanding of the real scene, in using computer graphics and geographic information system, surveying and mapping science, related spatial information sciences technologies. At present, 3d visualization simulation research is booming[1]: The United States of California University of North Carolina and Berkeley, has a world-class 3D visual simulation laboratory, and lead the development of the technology; Tsinghua University, Zhejiang University, Wuhan University, Beihang University and other universities has also made many important achievements in 3D visual simulation, and the development of the relevant system, Such as virtual palace, real-time roaming system of virtual building environment, VGEGIS, DVENET distributed virtual environment, etc.

At present, our school is established for the 60th anniversary celebration preparatory work, and the construction of the new campus is our school achieved one of many great achievements. In order to the broad masses of staff and students and people from all walks of life outside the visual display of our school appearance, it is necessary to built a campus three-dimensional visual simulation software which is based on 3 d visual modeling of Nanchang HangKong University campus. It is convenient to provide software support for enrollment and employment, education, alumni contact, expand the visibility of the school. This paper research on the secondary development of the software of Vega Prime, using software of Visual Studio C++ 2003, based on the three-dimensional modeling of Nanchang HangKong University campus, built a campus three-dimensional visual simulation software, which can simulate the campus of Nanchang HangKong University visually.

II. DEVELOPMENT MODE AND PROCESS

There are two kinds of development pattern of the simulation software [2]. One is the bottom for developing, which use programming interface of bottom 3d graphics such as OpenGL, Direct3D etc, encapsulated correspondingly, construct point, line, surface, body and curved surface etc, so as to support the expression and construct of the three-dimensional model at the process of simulation; The other one is secondary development, this way is development of the professional requirements on the basis of the visual frame or platform (such as Open Performer, Open GVS, Open Scene Graph, etc.)Provided by commercial companies and open source institutions. There are own features: it is high flexibility, low cost, but cost more energy and time in implementing and maintenance of the bottom visual and have a long cycle of development for the first one; the second one focus on realization of specific function with the existing visualization platform, but it cost higher to buy commercial platform module.

This paper uses the second one, using the software of Vega Prime provided by the company of Multigen-Paradigm of USA. This software using the object-oriented technology provides real-time visual function, with the practical c + + characteristics of the generic, container, design pattern; At the same time, it provides a complete development library function, with the good cross-platform-ability; the software implementation of the integrity of the underlying function package, each Vega Prime is an integrated management and operation feature sets; In addition, it also provides a plug-in (plug in) architecture, which can integrates dynamic terrain, physics engine, ion system and other related three-dimensional module into together, so as to speed up the software development[3].There are two kinds of secondary development on basis of the software of Vega Prime[4]:the first is compiling a small amount of code through the Win32 console application, calling the .acf file in Lynx Prime environment of the Vega Prime. News communication and graphic interface of the application generated by the first one don't need extra intervention, but its disadvantages is that human-computer interaction interface must be command line, which is not intuitive and less information; the second

is calling the dynamic link library API function provided by Vega Prime through development tools of VC++, C#, Java, etc. Although the code and the frame are relatively complex, the developed program which have interface of software and input/output and its function is perfect. This paper uses the second one.

Campus 3 d visualization simulation design and development consist of the following several steps:

(1)This paper establish the campus of the 3 d visualization model with the software of Multigen Creator, 3dmax,etc, generating the final data of OpenFlight format.

(2)This paper set the configuration of scene and 3d model, including the space position of 3d model, orientation, scaling and other related parameters;

(3)This paper set the line (Pipeline), the Window (Window), the Channel (Channel), the Observer (Observer) and environment (Env), sports mode (Motion), navigation path (PathNavigator), and other key parameter in software of Vega Prime;

(4)This paper develop software interface and input/output interface Using Visual Studio C++ 2003, calling header files and dynamic link library in the software of Vega Prime, and complete the relevant function, and finally build a 3 d visualization simulation system. The development process of system is shown in Fig. 1.

III. Design of Three Dimensional Simulation Software

A. Function Design

According to the practical demand of the three dimensional simulation of campus, the system adopts the thought of the object-oriented design, achieving following function as shown:

(1) Browsing: campus 3 d visualization simulation support the mode of flight in the scene, including free flight, steering, lift, speed control, etc, at the same time to play the region of interest repeatly.

(2) Inquires: any node in the scene of the campus of 3 d visualization simulation can be inquired such as: fountain, lake, pedestrians, vehicles, etc. Attribute information can be shown through the text, data, image and multimedia.

(3) Positioning: the region in campus be interested marked which can be switched directly to by clicking.

(4) Measurement: the distance, area, etc can be measured in the system.

(5) Modeling: the model of the campus of the 3 d visualization can be modeled on basis of the existing surveying and mapping, video and other material, including building model and road model, the feature model, the surface model, etc.

(6) Real-time display: a real-time display campus scene of the 3 d visualization environment be provided, including: refresh view, a variety of view shows, projection display, scale display, full screen display, rotate view, translation view, flight roaming, category shows, conditions shows, illumination rendering, etc.

B. Design of the Software Structure

This paper using Visual Studio C++ 2003 software, based on the development way of Vega Prime application of MFC. Development process mainly contains five steps: contains initialization, definition, configuration, frame cycle, closing[5], including all steps of key function is as follows: The function of vp: : initialize (__argc, __argv) is called to complete initialization of bottom library function and validation of the serial number, registration code; the function of define(const char *configFile) is called to complete the loading and analytic of application configuration file (ACF);the function of vpKernel::configure() is called to complete the configuration of the system and classes, including configuration services and service manager, cache space of frame data in the multithread, calling configuration function of initialization module, etc; the function of beginFrame() and endFrame () is called in the timer to complete the cycle of frame; the function of unconfigure() and shutdown() is called when the system is exiting to recover the configuration information. The window of view is set to system's father window so as to complete 3 d scene managed by Vega Prime in MFC view. In addition, the function of message accepting of mouse, keyboard, etc, is set up. All the configuration information above is set in the header file and cpp file of class of view in the software. It is necessary to define related parameters in the document class to achieve reading and preservation of some related information. Each function is mapped in the menus and toolbars so as to operate directly. Pictured for campus roaming are shown in Fig. 2.

IV. Realization of Three Dimensional Simulation

A. Three Dimensional Simulation of Static Scene

Static scene is composed of static object, which's space position has nothing to with the change of time, therefore the space position of the static scene is not change with changing of time. It is necessary to change the position of the observer for viewing the object at different point in the scene when static scene is simulated. There are two ways in changing the location of the observer: the first one is binding the selected movement model for the observer by calling member function setStrategy (Strategy * Strategy) of the observer class so as to control the position of the observer through the input device; the second way is fixing the location of the observer on a moving object by calling the function of setLookFrom (const vpPositionable *pos) so as to view scene through the changing of location of the moving object. Although the two ways of the changing of the observer's location is different, the final purpose is controlling the observer through the input device. Its essence is changing the position of the observer in static scene so as to read and draw the region of the view scene to complete the function of amplification, narrow, rotation, translation and roaming, etc. The realization of roaming is through motion mode which can be dynamically located by motion template [6]. Abstract motion mode is defined by vpMotion in VegaPrime. Motion model can be applied in the observer,

or object. Seven motion model are defined by the abstract base class of vpMotion in Vega Prime: vpMotionDrive, vpMotionUFO, vpMotionWalk, vpMotionWrap, etc. 3 d simulation of static scene include environmental effects change, such as sun, the moon and the sky box, clouds, wind and other related scene.

B. Three Dimensional Simulation of Dynamic Scene

Dynamic scene is that the space position or motion state changes when the time goes. The space position in the scene either is regular such as fountains, the airplane propeller or irregular such as car, pedestrians, etc. The active object is controlled and managed by technology of DOF. It is necessary to obtain DOF node and then control the related parameters of activities in the process of simulation. The object of motion path fixed is added navigation path (PathNavigator) characteristics which these object roaming along. For example, the school bus in simulation is added navigation path characteristics as its operation route is fixed and repeat.

As the active object may occur collision between each other in the movement, this paper use collision detection mechanism to vivid display the collision of the process and the effect after the collision. Vega Prime offers a variety of collision detection algorithm for vector data, such as Z method, HAT method, ZPR method, TRIPOD method, LOS method, BUMP method, XYZPR method, VOLUME method, etc. The function of collision detection is completed between object through the method above and corresponding auxiliary parameter configuration. The model of school bus is added collision detection function to avoid the collision with buildings and terrain in its operation process in the design of system.

C. Realization of the Function of Choice

It is usually to use mouse to choose some surface features which is checked in the interactive process [7]. Mouse selected process involves the conversion the coordinate function means that the screen coordinate is conversed to world coordinate in the scene and then get the mouse and window scene node by calling the corresponding collision detection class to complete the selection of object in the scene. The properties of the space objects are saved by external database in the system. It is necessary to map the searched objected Id in the external database in order to view the properties of space objects.

V. SUMMARY

This paper complete the three dimensional scene simulation of Nanchang HangKong University campus, construct the virtual campus environment through comprehensive utilization of computer graphics and the three dimensional visualization technology. The user can see the campus landscape vividly in the screen, and query, measuring, roaming and flight browse, etc. This system provides teachers, the alumni, the students, parents and social people a new technological platform which intuitively display the panorama of campus. The system is the part of campus informationization construction and is important to foreign publicity, recruit students, show the school strength. As the geographic information is weak in Jiangxi porvince and software industrial park is planned and constructed in our school, it is promising to simulate three dimensional campus.

Next, UAV, the wireless control, 3g video, GPS and other related module will be added in the system so as to realize the control of the UAV in the computer, and the function of transmission to computer of real-time image.

REFERENCES

[1] Gao Ronghua, Yin Baocai, Kong Dehui. Virtual Olympic venues roaming system based on Creator and Vega Prime. Journal of Beijing Polytechnic University, 2009, 35(5):715-720

[2] Sun Congbo, Tang Yonggang, Ning Jianguo. Design of the virtual aircraft carrier roaming based on Creator and Vega Prime. Computer simulation, 2007, 24(1):222-229

[3] Wang Mingyin, Wei Qun, Xu En. Research of key technology of big scene virtual reality based on Creator and Vega Prime. Journal of system simulation, 2009, 21(1):117-120

[4] Wang Yadong, Yuan Xulong, Zhang Yuwen. Research of trajectory visual simulation of ultra-high speed torpedo. Computer measurement and control, 2011, 19(4):887-889

[5] Liu Shuxia, Fan Xiongfei, Meng Yan. Research of Vega Prime program frame based on MFC. Academic conference proceedings of system simulation technology and its application, 2009, 418-421

[6] Xu Xiaodong. Research of UAV visual simulation system based on VEGA PRIME. Computer knowledge and technology, 2008, (4):760-762

[7] Xiao Yanbin, Liu Danghui, Wang Mingjun. Space launch training simulation visual control method based on VEGA PRIME. New technology and new process, 2011,(9):27-29
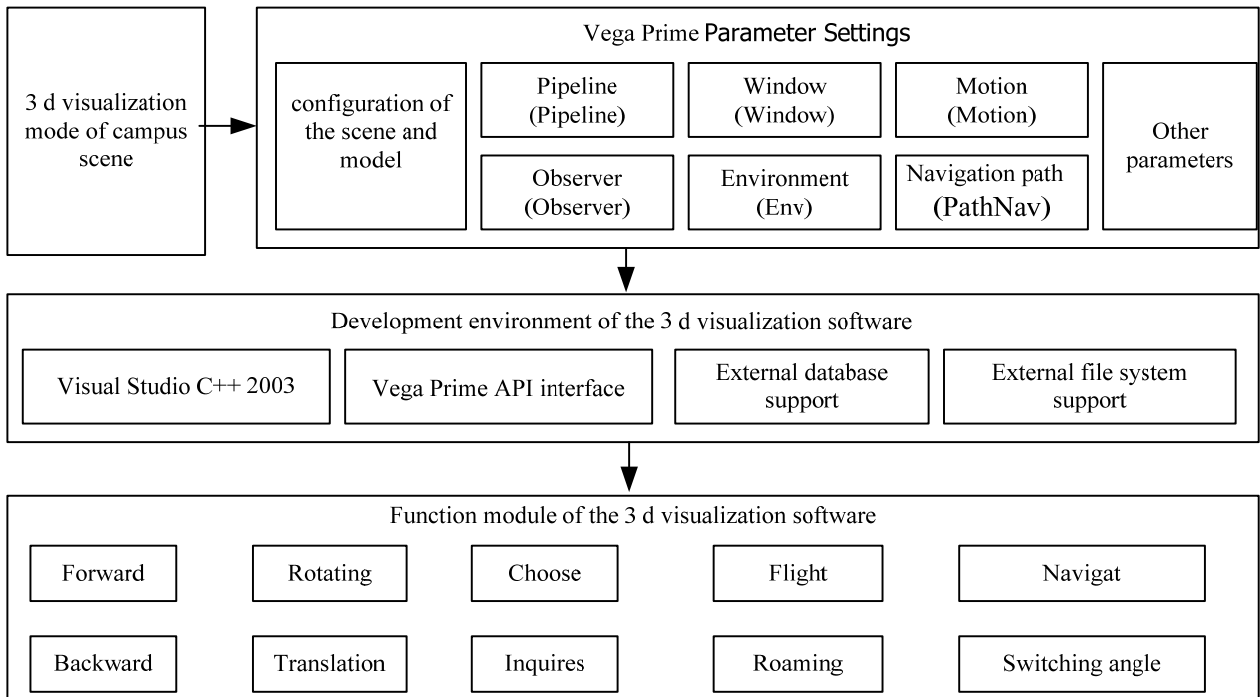
Vega Prime Parameter Settings

3 d visualization mode of campus scene	

configuration of the scene and model

Pipeline (Pipeline)	Window (Window)	Motion (Motion)	Other parameters
Observer (Observer)	Environment (Env)	Navigation path (PathNav)	

Development environment of the 3 d visualization software

Visual Studio C++ 2003	Vega Prime API interface	External database support	External file system support

Function module of the 3 d visualization software

Forward	Rotating	Choose	Flight	Navigat
Backward	Translation	Inquires	Roaming	Switching angle

Figure 1.   Development process of the Campus 3 d visualization simulation

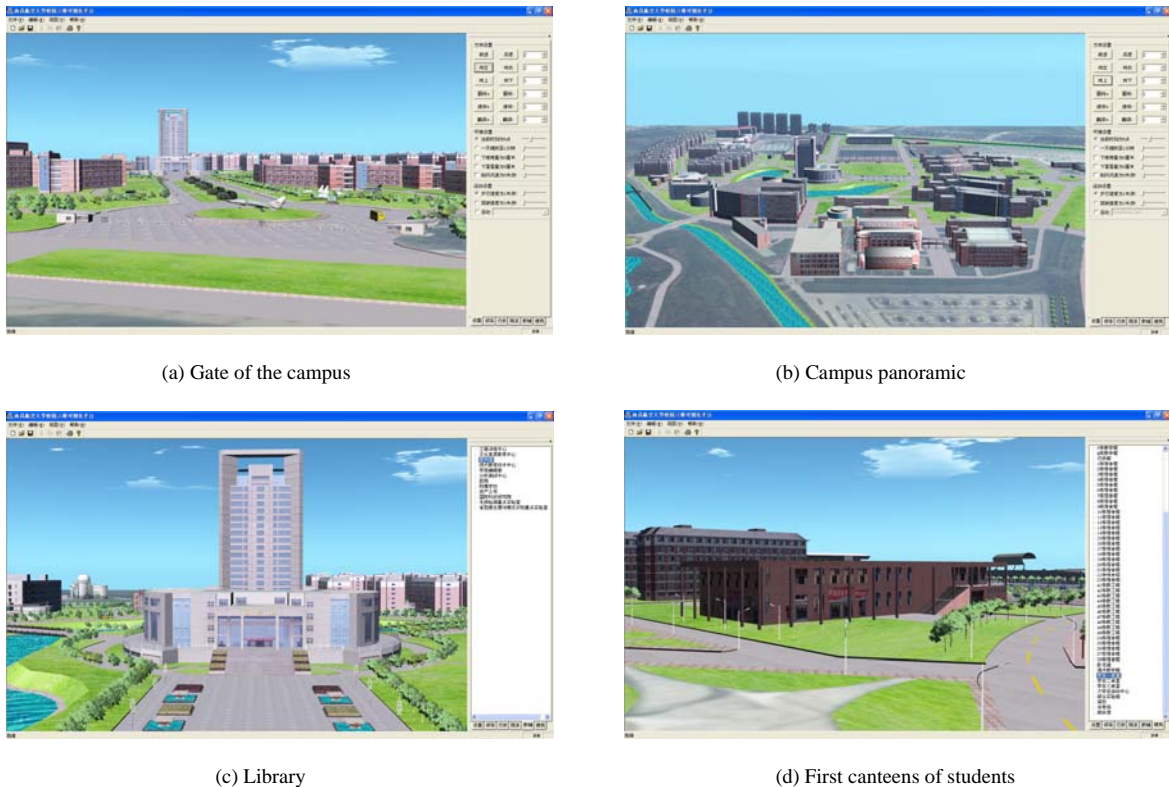(a) Gate of the campus

(b) Campus panoramic

(c) Library

(d) First canteens of students

Figure 2.   Landscape of Campus roaming