Modeling and Driving of Scene Simulation Nodes

Based on Vega

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Abstract. Instrument and switch nodes are constructed by using virtual simulation tool Multigen Creator, and the method of modeling is introduced in detail. Microsoft MFC is used to initialize configuration of scene simulation, realize of network communication with marine simulator server, receive real-time data, and drive the scene nodes. This technology can make the scene simulation more actual and interactive.

Introduction

Visual simulation is the combination of computer technology, graphics technology, optical technology, and other high-tech. Engine room scene is modeled on the engine room equipment by using the technology of visual simulation, and shown in front of us, to realize virtual simulation of Engine room environment. Engine room scene is mainly the virtual reproduction of the cabin environment. Students can not only be used in the engine room scene roaming, traversing the cabin, and also can be used for interactive operation and engine room virtual equipment. Realization of network communication of the visual simulation system and turbine simulator server, that obtains the simulation model real-time data, to realize real-time driving simulation system in virtual equipment as the engine room, can enhance the reality of visual system.

Development platform

Multigen Creator is a software package, specifically for real-time 3D model creating visual simulation, whose data format OpenFlight with high rendering efficiency and real-time interactive flexibility, and it has become the industry standard. Creator has a powerful polygon modeling, vector modeling, and a variety of professional options and plug-ins, efficient, optimized to generate real-time three-dimensional (RT3D) database, scientific visualization in real-time simulation field with a world leading position.

Multigen Vega is a 3D real-time simulation system[1].The combination of advanced analog functions and easy to use tool, for complex applications, can offer creation, edition and driving tool convenient. Vega can significantly improve the work efficiency, and greatly reduce the development time of source code. Vega also includes C language application program interface integrity, providing maximum software control and flexibility for software developers.

Driving process of visual system

In order to realize the real-time driving on controllable node in the simulation system, the design and development of the system can be divided into the following three steps [2]:

(1) According to the ship engine room equipment to obtain controllable node data, the equipment

instrument (e.g. tachometer, pressure gauge, thermometer, voltage meter, etc.) with the DOF node classification, and the indicator light (such as state of the lamp, the fault lamp etc.), knob and key with the Switch node classification.

(2) The establishment of controllable node model. In the engine room equipment instrument as an example, instrument module of Creator is applied to set up the dial model, and establishes DOF model in the center of the dial pointer; The model of Switch node on the indicating lamp and a knob, establishes a good Switch nodes of every node state model, such as light and extinguish the opening and closing state.

(3) The establishment of a Vega application based MFC. The application of the socket in the MFC network communication with simulator server obtains real-time data acquisition of engine room equipment, and then transfers to the cabin belonging to the visual system, to drive virtual device model. The realization process is shown in figure 1.
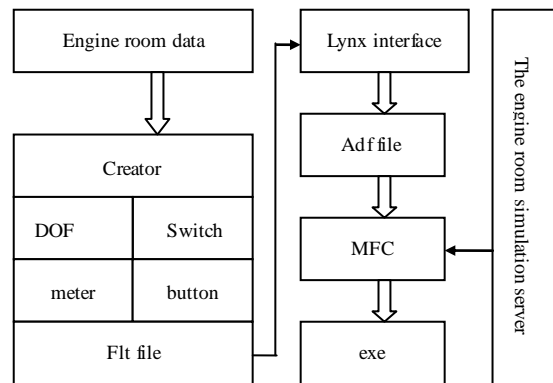
Fig. 1 scene simulation driven flow

Creation of scene node model

Meter node model

The two part of instrument model includs pointer and fixed panel. The dashboard is created by the Creator instrument panel module, which provides a disk scale and rectangular scale [3]. Disk scale can be used to create marine diesel engine tachometer, oil pressure gauge, pressure gauge, compressed air pressure gauge, and rectangular scale is used to create the accelerator, the car clock; The pointer in dial created by the DOF technology node, that can control node according to the degree of freedom range set in a local coordinate system rotation or movement.

Creation of a disk scale

First the dimensions, background, scale and layout of regional digital ID are defined; secondly, digital and other signs are added to scale panel; and then dial radian, to highlight the scale of special area on the panel; finally the design good disk scale is put into the model library of the specified location. The main setting disk scale is provided in the instrument panel module disk scale window, to open the window by selecting "Instruments/Dial Gauge" menu command. Disk scale settings window is shown in figure 2.
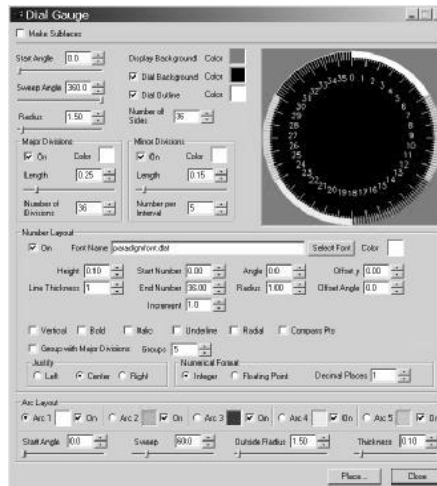
Fig. 2 disc scale settings window

Creation of a disk scale pointer model

To create the dial pointer using DOF technology, the following steps are needed: (1) the establishment of pointer models in the model database; (2) create an DOF node, that must be based on group (Group) the parent node or the same level, by opening the toolbox and selecting DOF tools to create; (3) need to set the pointer model freedom placed in the DOF node, and make it become a child of the DOF; (4) the creation of local coordinates using the "Local-DOF/Position DOF" menu command, by selecting "Local-DOF/Position DOF" menu command, that will be the re positioning, the pop-up dialog box shown in Figure 3, the plane will be local coordinate positioning in the pointer model the outer normal direction, toward the dial Z axis. (5) set the DOF property to [4], and then use the "Local-DOF/Set DOF Limits" menu commands, for freedom is arranged in the pop-up dialog box shown in Figure 4, the pointer is set around the Z axis, the choice of Yaw (Z), the input rotation range, limit swing around the Z axis angle.
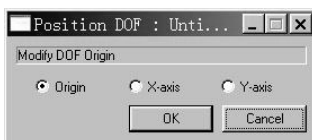

Fig. 3 the Local-DOF/Position DOF dialog box

Fig. 4 degrees of freedom setting dialog box

Switch node

The state indicating lamp, a switch button (such as host astern running indicating lamp, fault indicator, start and stop buttons), usually have two or more states. We can build a node state indicating lamp or a switch button, by placing it under the Switch node, selectively control procedures [5]. In the marine diesel engine of a fault indicator for example, creating a Switch node in Creator, which can be named as lamp_fail_01, model of sub node indicator light and bright two

states established in this node, respectively on two object nodes under the lights with marked red, and not shine with the dark mark. By double clicking the Switch node, the property settings dialog box is opened, set the attributes, the node display does not light in the state of Mask index in Mask, index 1 state and 2 state display lights state, as shown in figure 5.
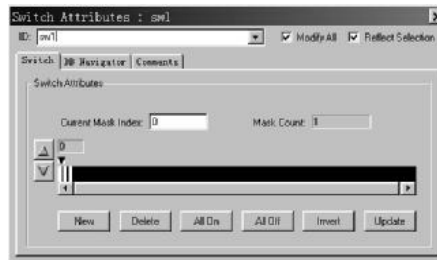

Fig. 5 Switch node properties settings dialog box

Model node driven

Communication between visual system and engine room simulator server

To realize the communication between visual system and engine room simulator, client socket [6] must be constructed in the OnInitDialog client program, the main code as follows:

m_pSocket = new CClientSocket(this)；m_pSocket -> Create( );

m_pSocket -> Connect("192. 0. 0. 10"，600);

A server socket calls the Listen to listen for a connection request, receiving a connection request to call Accept.

Adding a CSocket class CClientSocket class to implement the communication with the turbine simulator based on server, adding the OnReceive function in the CClientSocket class responsible for receiving data, in the dialog class function ProcessPendingReceive processes data received, the main code as follows:

char buffer [BUFFER- SIZE]；m-pSocket -> Receive(buffer，BUFFER- SIZE，0);

buffer[nReceived] = 0；

Nodes Driven of scene simulation system

The preparation of MFC Vega [7] applications that need first call FLT file in the Vega visual graphic interface -Lynx, to complete the initialization phase of a number of parameters setting, and generate the ADF file; then makes use of the AppWizard function interface design. zsVegaView classes that derive from CView, should also add member function runVega specifically for zsVegaView, open the Vega thread, and complete the Vega program configuration.

void zsVegaView::runVega(void)

{vegaThread= afxBeginThread(runVegaApp, this);win = vgGetWin(0); chan = vgGetChan(0);

obs = vgGetObserv(0); scene = vgGetScene(0);vgProp(win, VGWIN_WINBORDER, 0);}

In order to realize the driving of scene model, firstly the definition of global variables associated with each node model scene, real-time data and then by the communication program from the turbine simulator acquisition node model, is applied to the model variable. The main implementation code is as follows:

vgPart * part_pointer_01；pfSwitch * sw_lamp_01；

To complete the Vega function "the initialization; DEFINITIONS; system configuration" in thread function runVegaApp, the main code below [8]:

```
  UINT runVegaApp( LPVOID pParam )
{zsVegaView* pOwner = (zsVegaView*)pParam；
 vgInitWinSys( AfxGetInstanceHandle( )，pOwner->GetSafeHwnd( ));
 vgDefineSys( pOwner->getAdfName( ))；vgConfigSys( );
 part_pointer_01 = vgFindPart ( obj，"pointer_01"，NULL) ；
 sw_lamp_01= findSwitchlnObject ( obj，"lamp_01");
 while ( pOwner->getContinueRunning( ) )
{ vgSyncFrame ();vgFrame ();
   active_rotate ( part_pointer_01，0，m_pointer01);
   pfSwitchVal ( sw_lamp_01，flag_1amp_01);  }
   vgSyncFrame(); return 0; }
```

Summary

The visual simulation system of ship engine room is the use of computer virtual reproduction of marine engine room environment and marine equipment, authenticity, interactive virtual scene, the cabin visual system as client program, the realization of communication and marine simulator model server service model, real-time access to data server generated, used to drive the visual scene simulation cabin model in the system of ship engine room, to reproduce the real easy, no real ship experience students understanding of marine engine room. At present, the engine room scene simulation system can be used as a supplement of the marine simulator, for students majoring in marine engineering and Seamen's learning and training.

References

[1] XU Jian-feng, WENG Yue-zong. Applied Research on Harbor Scene Simulation Development Tool[J]. NAVIGATION OF CH INA,2008:31(3):256～260.

[2] Liang Yongen, Zou Yong, Ding Fong Yee. Application of Creator/ Vega in ship navigation scene simulation system[J]. The application of science and technology, 2005, 32 (4): 37 ~ 39

[3] Wang Cheng, Li Lijun, Zhou Junqing. Vega real time 3D visual simulation technology[M]. Wuhan: Huazhong University of Science and Technology press, 2005

[4] Dong Bo, Ma Liyuan, Luo Jing. Vega application program design based on MFC[J]. The information of computer, 2006:22 (2-1): 264 ~ 265

[5] Xiong Zhennan, Zhou Shibo. The shipping environment visual simulation[J]. Journal of Shanghai Maritime Univeristy, 2009:30 (1): 6 ~ 9

[6] HUANG Hui-ying，DUAN Xiao-ming. Design and Realized of Scene Simulation System of Ship Motion[J]. Computer simulation, 2012:29 (1): 369 ~ 373

[7] Luo Lu-feng, Zou Xiang-jun, Liu Tian-hu. The large data model of virtual landscape Journal of optimization and roaming[J]. Journal of System Simulation, 2009:21 (6): 1654 ~ 1657

[8]Zhang Jing, Yang Mai-shun. Research and Implementation of Scene Simulation Application System Based on Vega[J]. MICROELECTRONICS & COMPUTER, 2008:25 (2): 93 ~ 96