3D VISUALIZATION OF THE FLYING OBJECT MOVEMENT

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This article contains information about the proposal software for 3D visualization of the movement of an object flying in the virtual space based on real geographical data, which was developed based on OpenSource in order to view the movement of data obtained from the FDR recording.

Key words: 3D, OpenSource, FlightGear, FDR

1 INTRODUCTION

The issue of monitoring and management of flying and no flying objects movement is considerably comprehensive and exacting. At the Department Of Aviation Technical Studies of the Faculty of Aeronautics TU Košice is currently working on a land control workstation to manage any object in the virtual space, which could visualize the movement of an object flying in the virtual space based on real geographical data, which have been processed using GIS systems. One of the main priorities was to ensure that the entire solution was based on OpenSource, namely that it is not encumbered by any proprietary license. After the initial research we obtain the first real results.

2 MAPS PREPARATION

One of the main requirements for the characteristics of the design was the possibility to 3D display the location of object on the virtual map of the terrain. After thorough tested various types of geographical data we used available vector map (VMAP), which is distributed in the format of MIL-V-89039. A lot of GIS programs know this format. We was also used GLOBE database, which uses the WGS84 reference system as the basis for the creation of digital elevation model (DEM), which will serve as a reference base for subsequent 3D visualization of the country. Using maps of both formats was necessary because they have different content. This means that the Vmap contains information about the location of forests, water, populated parts, etc., But unfortunately it doesn’t contain information about the altitude, which is necessary to create a 3D model of land. By contrast, the GLOBE database contains such information, even the whole country elevation model of land accuracy of a one vertical point on the 30 second latitude and longitude, but it has no information about the land. It was therefore necessary to use both resources and combine their to joint maps and modify it so that it became a suitable resource for creating a 3D model of country and it can be used in the subsequent visualization. High-quality digital model could be the basis for entry into the next phase of the design 3D visualization of the country to support spatial orientation and visualization.

3 REALIZATION OF 3D VISUALIZATION

All 3D visualization of country was created by using the OpenSceneGraph libraries. OpenSceneGraph is standard in the area of 3D visualization now. It uses techniques based on OpenGL. To achieve realism object movement in this country were used OpenSource project called FlightGear. FlightGear is a free OpenSource multiplatform flight simulator developed since 1997 by group of many developers around the world. Availability of source and the excellent modular structure allows them to modify system to improve his performance.

FlightGear uses own simulation kernel module named SimGear, which is used, as a research tool, by many academic and scientific institutions. They are engaged it in research and management of simulators and simulations of movement. FlightGear is actually a virtual cockpit based on the simulation kernel, which uses the defined characteristics of the flight dynamics models FDM (Flight Dynamics Models). FDM describes the dynamic properties of aircraft.
4 BOARD INSTRUMENTS REALIZATION

For the disclosure of basic information about the state of controlled object for the operating personnel, which manages this object, is necessary to display them, the information in an intelligible form. All information are displayed in graphical form so they are easy readable and identifiable. As primary board instruments were elected: Horizontal Situation Indicator, Attitude Indicator, Airspeed Indicator, Altimeter and Vertical Velocity Indicator.

Figure 1 Basic board instruments views

Those basic equipments are sufficient for obtaining basic information about actual flying object. Through simple structure of the panels configuration we can define optional on-board instruments, which are connected to the system's variables defined by simulation core (SimGear).

5 ENVIRONMENT COMMUNICATION

During development of control workstation we considered with the possibility of communication between a visualization kernel and his system environment to connect system to other devices. For this need we developed the program, named communicate, to ensuring data exchange between FlightGear kernel and his environment. This program allowed to link control workstation with any devices that is capable of communicating via a computer network though a TCP or UDP. Thanks to the wide possibilities for using a network communication system in networks we also can connect it to other similar systems in the world and thus redouble its efficiency further.

6 PRACTICAL RESULTS

One of the first practical uses of created software was the possibility to visualize the flight of real object in the virtual model of land and visualization it’s path of movement by using data from the FDR (Flight Data Recorder), called black box. FDR is a flight recorder for recording specific parameters and characteristics of an aircraft whose purpose is to provide data for the analysis of any aviation accident. It is also used as a source of data for the study and analysis of controversial issues concerning flight safety, materials damage, jet engines performance, etc.

To increase the survey on the situation in the monitoring area we can use video view of monitoring area through the fair monitoring camera system, which delivers the image of the environment.

Figure 2 FDR data flight and video preview

After analyzing the available records from the FDR we can create a script to show object flight or object movement on the ground for any others means. Similarly, if we use network communication, we can show the movement of real objects in the real world and at the same time we can control the movement of the object directly by controlling data exchange between the objects.

Our implementation of a solution to view flight flying object based on data from FDR record is one of the few solutions that are entirely built on OpenSource software and displays the flight based on real data. Currently, we found information about only one solution, which can to view data from the FDR record of Boeing 737 aircraft. It is created as a proprietary extension of the MS Flight Simulator. Unfortunately other available solutions are the corporate secrets subjects.
7 CONCLUSION

Based on data from the FDR was possible to verify the functionality of the entire visualization subsystem and display the movement of the monitored object in the three-dimensional environment based on real maps. In the development stage will be supplemented in the future the possibility of creating different analysis on the basis of the data.

Currently, these functions are being developed, also with other simulation tools which are in the development. We want to simulate flight object with creating non-standard situations, whether different disorders or different external effects.

Also we want to fully exploit the simulation kernel SimGear and connect our system with other air traffic control systems (ATC) such as the Albatross Display, in the future. Albatross Display is an open source Air Traffic Controller environment to provide the controller with precise visualization of airspace. Albatross Display is the result of SkySoft-ATM operational expertise in ATC. Best of breed new features ensure improved safety, ease of use and productivity. It is Open Source system for professionals.

BIBLIOGRAPHY


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