

A Real-time 3D GIS Development Methodology for Web-based Environment

Sanghun Song, Myunghee Jo

Abstract

Advances in computer graphics hardware and algorithms, visualization, and interactive techniques for analysis offer the components for a highly integrated, efficient real time 3D Geographic Information System. We propose a novel method to adopt VRML(Virtual Reality Modeling Language) visualization of topography information and generate three dimensions city model from modeling method. we convert the DEM(Digital Elevation Model) format to VRML format to reduce the data size of the tomography information. Second we make 3D building model using 3D modeling method. The proposed algorithm demonstrates the effective results of a real time 3D Geographic Information System on web-based environment.

Key words: 3D GIS, 3D Modeling method, Real time, VR, Web

1. Introduction

The integration of virtual environment and GIS has been initiated. Since the mid 1990s, Virtual 3D GIS on World Wide Web(WWW) has been regarded as one of promising alternatives in the GIS field mainly due to cost-effectiveness and wide accessibility. In this newly emerging approach, VRML(Virtual Reality Modeling Language) shows several linked aspects with 3D GIS under Internet environment.

Internet and World Wide Web (WWW) have been widely applied in delivering, processing, and publishing geospatial data. Web-based GIS, which permits users to access, retrieve, display, and analyze geospatial data over the web, has got a wide variety of applications. Web-based GIS, which permits users to access, retrieve, display, and analyze geospatial data over the web, has got a wide variety of applications.

In the recent years, web-based 3D GIS for visualizing geospatial data have attracted many researchers. The operation uses the web as a delivery mechanism, deals with the transformation of multi-dimensional geospatial data, information, and knowledge into an effective 3D visual form. The 3D objects presented as 2D projections may lose

some of their properties and relations to other objects and may create difficulties to understand, analyze and evaluate the surrounding world in a critical for a certain activity moment.

An increasing number of applications already seek for tools to model, store, analyze and visualize 3D data in an efficient and effective way. Though until recently a 3D GIS would exhibit delayed responses to a user requested database query or a geographic location to the time that the result was displayed. 3D GIS have now become a reality due to pipeline 3D graphics and efficient terrain visualization algorithms and many GIS have become available on the web.

3D GIS but still would type in a coordinate or make a database query and then wait for display of the results. The 3D objects presented as 2D projections may lose some of their properties and relations to other objects and may create difficulties to understand, analyze and evaluate the surrounding world in a critical for a certain activity moment. An increasing number of applications already seek for tools to model, store, analyze and visualize 3D data in an efficient and effective way.

Because the world we live in is in three or more dimensions, focus has shifted towards the development of GIS in 3D. Though until recently a 3D GIS would exhibit delayed responses to a user requested database query or a geographic location to the time that the result was displayed. 3D GIS have now become a reality due to pipeline 3D graphics and efficient terrain visualization algorithms and many GIS have become available on the web.

33 Buho-ri, Hayang-up, Kyungsan-si, Kyungsan bukdo, 712-701, Korea
Doctor course of Dept. of Satellite Geoinformatics Engineering, Kyungil University
+82-53-857-7312,(Tel) +82-53-857-7313(Fax)
et7989@nate.com Http://geosat.kiu.ac.kr

But according to transition from 2D GIS from 3D GIS, the processing speed for 3D GIS becomes slow and the user's real time rendering request is growing. So in this study describes a real-time 3D GIS development using 3D Modeling Method. Convert the DEM format to VRML format to reduce the data size of the topography information. Make 3D building model using 3D modeling method. The proposed algorithm demonstrates the effective results of a real time 3D Geographic Information System on web-based environment.

2. System formation table

Figure 1 is to have shown to the method that proposed at this paper to an algorithm flow chart. First, acquire satellites and flights from generations of 3D topographical information process. Second, building and road information acquire from 3D modeling and texture mapping. Third, 3D topography data and 3D modeling data is integrated and adding object and texture extraction & mapping. Finally, proposed algorithm demonstrates the effective results of a real time 3D Geographic Information System on web-based environment.

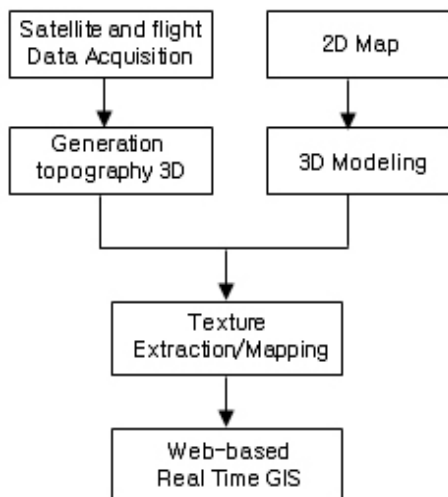


FIGURE1. System flow chart

2.1. Generation of 3D topography

In the past few years the number of applications that use the 3D information of topographical objects increased rapidly. Examples can be found in location based services, virtual reality tasks, visualization for city planning, etcetera. These applications require 3D

topographic input data. Acquiring 3D topographic information is even more complicated than 2D data.

A visualization of a topographical model is used in various fields to materialize a GIS, such as virtual reality simulation, virtual environments, computer game, etc. For a generation of topography information to gain the majority to decide on a speed of the efficient process three dimensions geography information system that utilized to be early with masses and performance at GIS large very play.

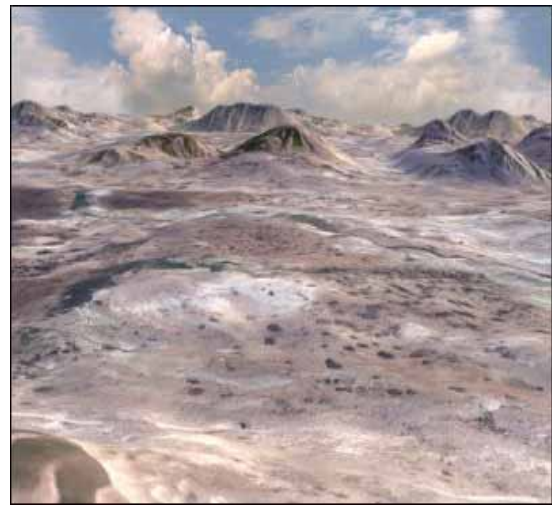


FIGURE2. Topography information

2.2. 3D urban modeling using 2D digital map

In 3D computer graphics, 3D modeling is the process of developing a mathematical, wire-frame representation of any three-dimensional object (either inanimate or living) via specialized software. It can be displayed as a two-dimensional image through a process called 3D rendering or used in a computer simulation of physical phenomena. The model can also be physically created using 3D Printing devices. Models may be created automatically or manually. The manual modeling process of preparing geometric data for 3D computer graphics is similar to plastic arts such as sculpting.

3D models represent a 3D object using a collection of points in 3D space, connected by various geometric entities such as triangles, lines, curved surfaces, etc. Being a collection of data (points and other information), 3D models can be created by hand, algorithmically (procedural modeling), or scanned. 3D models are widely used anywhere 3D graphics are used.

Actually, their use predates the widespread use of 3D graphics on personal computers. In other words, 3-

dimensional city model means a virtual model which is similar to the real world. This realization of this 3D city space model is a foundation to form a virtual space which is similar to the real world, and it can help a lot to plan various territory plans and it can help a lot to analyze space problem and to make a decision as well. Ever since our society came to form urban agglomerations, there has been a constant manifestation of interest in the study of urban environment.

So in this study describe digital map based a realistic 3D modeling. Digital map based virtual space on realistic digital contents generation way reality space of X, Y, Z axis direction coordinates value actual object alike data input. Also virtual space on location building and road information were acquired from modeling tool (3Ds-Max) using 3D modeling.

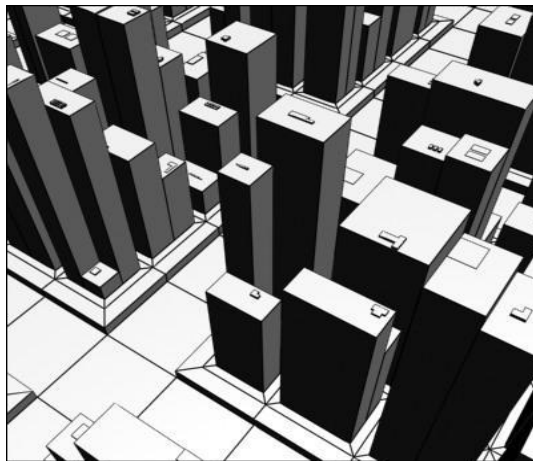


FIGURE3. 3D modeling data

2.3. Texture extraction and Mapping

Texture mapping onto 3D models has been the topic of recent research even though early work appeared in the late seventies. Texture mapping is a powerful technique for adding realism to a computer-generated scene. In its basic form, texture mapping lays an image (the texture) onto an object in a scene.

Texture mapping can therefore be used in a scene with only a modest increase in the complexity of the program that generates that scene, sometimes with little effect on scene generation time. The wide availability and high-performance of texture mapping makes it a desirable rendering technique for achieving a number of effects that are normally obtained with special purpose drawing hardware.

In this study using on the average modeling program

UV texture mapping method. 2D image from mapping work accomplish of 3D modeling data. So acquire texture extraction from 2D image and texture mapping work in 3D modeling data, actual object similar texture mapping work.

3. A real-time 3D GIS development methodology for web-based environment

The evolution of the World Wide Web based on the Internet was one of the most impressing developments in information technology during the past few years. Within a short period of time, standards for textual and 2D-image information exchange, to and from the viewer, have been established together with easy-to-use software tools to browse the information on different platforms. Recent developments like VRML or Java allow perform the rendering of 3D objects at the viewer workstation. With these tools software can be written which is closely coupled with the web and capable of running on many platforms without recompilation.

Building visual data models involves a set of data processing and display techniques that aid in providing reasonable interpretation and analysis of the complex relationships in large spatial data sets rapidly. 3D implementation in Web was hard by limit etc. of the internet speed past. But, current can show excellent quality and function simultaneously by fast development of internet environment and brilliant development of Web 3D solutions. Also, contents that have capacity that is less so much so that act enough in Web could be manufactured and graphic processing skill of various high quality was possible.

In this study describes real-time web based 3D GIS development using web3D characteristic. Generate data is simulation selected a camera button on a screen, and easily composed in mobile ways that searched to buildings and the place that a user wanted, and composed so as used a user 3D Viewer control button, and to be able to select various points of time. Also, did application so as added to the functional zoom-in or zoom-out and when 360 degrees function that gave, and to be able to any time, easily search information regarding a building.

Accomplishment can do high-quality virtual driving through detailed camera information, and a user did along the navigation paths which got from input from user through 3D navigation functions by the followings

as made virtual conspiracy driving possible.

4. Results

Figure 4 is 3D city information created through 3D modeling and texture Mapping.



FIGURE4. 3D city information

Figure 5 is information of web based real time 3D GIS. Modern VR systems provide modeling, simulation and 3D visualization on the simple or complex, scalable off-line or networked environment. Working with 3D objects in the Internet environment requires Internet browser or other suitable program for the visualization and navigation in the simulated model and an authoring tool-program for the creation of 3D worlds. So in this study describes real-time 3D GIS using web 3D.



FIGURE5. Information of web-based Real- time 3D GIS

5. Conclusions

In this study describes real time 3D Geographic Information System on web-based environment. Location or building information that take advantage of information that is created this and come with graphic processing skill of high quality and approach easily can. Also, anyone could receive GIS easily through various function implement.

References

- Sanghunn Song, Myunghee Jo. 2007. VRGIS Development Using 3D Modeling Method.” IEEK Summer Conference 2007, Vol.30 No.2. pp545-546.
- Cöltekin A. 2002. An Analysis of VRML-based 3D Interfaces for Online GIS: Current Limitations and Solutions. Surveying Science in Finland, Vol.20, No: 1-2, p.80-91
- Fabrice Neyret and Marie-Paule Cani, Pattern-Based Texturing Revisited, Proceedings of SIGGRAPH 99, 1999, ACM SIGGRAPH, Addison Wesley, Aug, pp. 235 - 242.
- P. V. Sander, J. Snyder et al., Texture Mapping Progressive Meshes, Computer Graphics, Proceedings of SIGGRAPH 2001
- Chen S. 1995. Quicktime VR – An image-based approach to virtual environment navigation. Computer Graphics SIGGRAPH Annual Conference, 6-11 August, Los Angeles, California, pp. 29-38.
- Batty M. 2000. The new geography of the third dimension, Environment and Planning B: Planning and Design 27: 483-484.
- Liggett R. & Jepson W., 1995: An integrated environment for urban simulation, Environment and Planning B: Planning and Design 22: 291-302.