

MANAGING 3D GIS DATA FOR SIMULATING URBAN EARTHQUAKE DISASTERS

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Introduction

It is estimated that 80% of all data contains geographical or spatial information. Conducting simulation of urban earthquake disasters needs both data of GIS and city infrastructure. GIS data provide basic image of a city, from static information such as a map to dynamic data from remote sensing. More data of buildings and other structures in detail are needed in simulating urban earthquake disasters. As the number of buildings and structures in a city is huge, to collect all the data and to analyze them are usually difficult and impractical. This study develops a web-based platform to manage the 3D GIS data, makes structural feature connections and implements a 3D data viewer.

Managing GIS data and structural features using web technology

Since the simulation is going to use both normal GIS data and structural data with integrated applications, an open web-based framework is preferred. This study refers the Open GIS framework from Open GIS Consortium, Inc. ^[1] (OGC) to build a GIS database. Feature IDs are used to connect GIS data with structural data. Figure 1 shows a web-based platform for simulating urban earthquake disasters and presenting results. GIS data and structural data are managed at the server side, which can be accessed by applications and/or viewers both at the server side and the client side. Concrete technologies of implementing the platform are also marked in this figure.

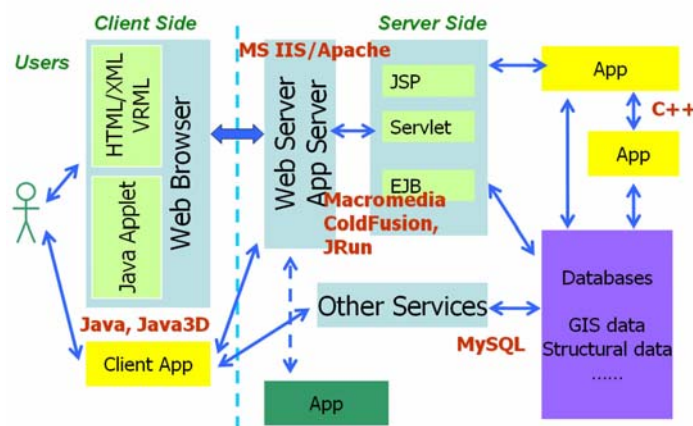


Figure 1 Web-based platform

This study uses real city GIS information of Bunkyo-ku, Tokyo. The GIS data available are in both 2D and 3D. 2D data include layers of buildings, roads and railways. Profile of buildings in polygon, height of buildings and ground level are given in the 3D part. The original GIS data are in Arc/GIS shapefile format and have been transferred into a DataBase Management System (DBMS, in this platform, MySQL is used) using SQL. Consequent accessing to the GIS information uses either Java DataBase Connectivity (JDBC) or Open DataBase Connectivity (ODBC) for Java and C/C++, respectively. Figure 2 shows a block of the city with 2D layout. 3D information of each building can be accessed from the Internet by a web browser (text browsing as a test in Figure 3), a client side application or an applet in a browser (Figure 4). Urban earthquake disaster simulation needs more data from structures. In addition to using a

Keyword: GIS, Open GIS, Urban disaster simulation, Web technology, Java 3D

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connecting feature ID in GIS database, the 3D GIS information of buildings (the base polygon and the height) can also be utilized in generating structural data of huge number of buildings for conducting simulation.



Figure 2 City GIS data

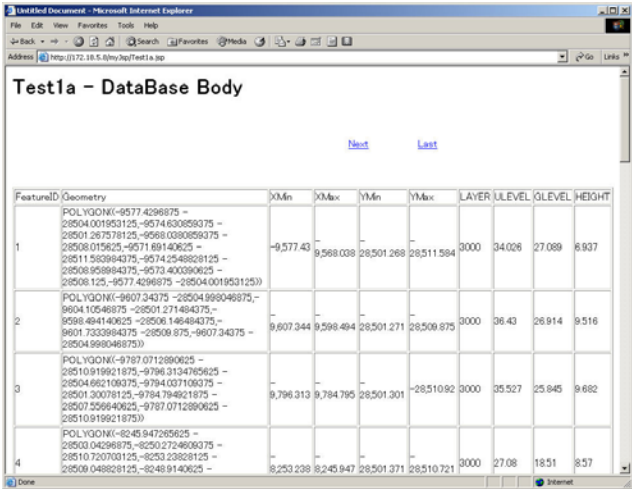


Figure 3 Accessing GIS database using a web browser

Implementing a data viewer using Java 3D

Java 3D^[2] is a 3D graphical Application Programming interface (API) using scene graph. This study implemented a data viewer using Java 3D for both 3D GIS data and other results from the simulation that can be visualized. 3D GIS data are retrieved using JDBC via the Internet. Figure 4 gives two examples of browsing a block of the city using this viewer. Buildings are colored according to their heights. Since the viewer is implemented with a programming language, more optimum on navigating large amount of graphical objects can be applied with less difficulty than that of using a script language, such as Virtual Reality Modeling Language (VRML).

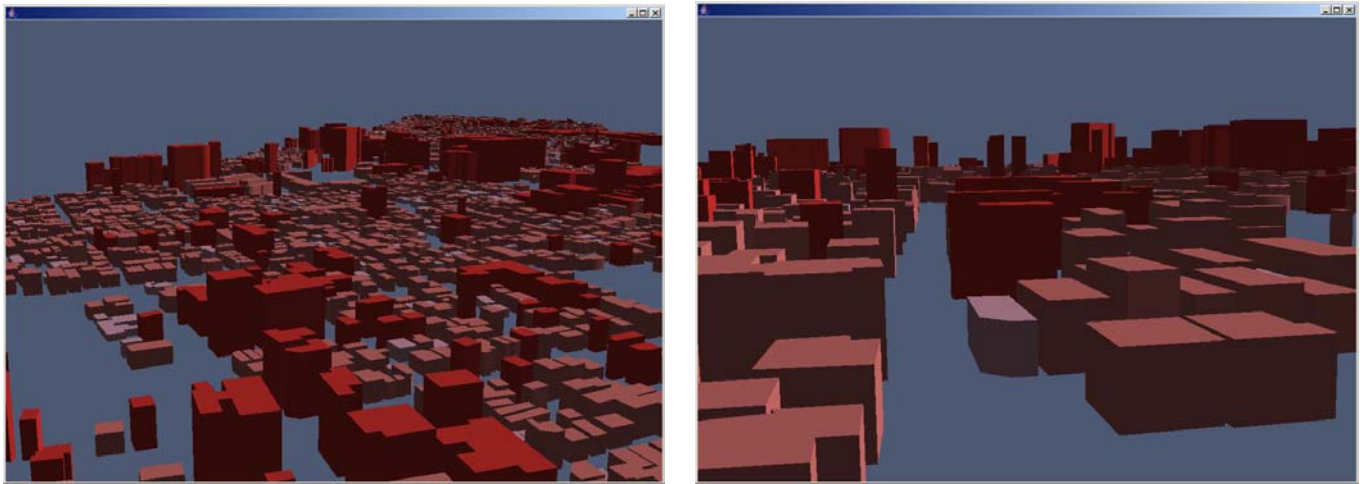


Figure 4 A Java3D viewer for browsing GIS database

Conclusions

Aimed to simulate urban earthquake disasters, this study developed a web-based platform to manage 3D GIS data with feature connectors to structural data referring to Open GIS framework. A viewer was implemented using Java3D for both GIS data and simulation results. Implementing with real city GIS data, the platform is proven to be a useful tool to integrate simulations with GIS data sources in an easy way.

Reference

1. Open GIS Consortium, Inc. (OGC). <http://www.opengis.org/>
2. D. Selman. Java 3D Programming, Manning Publications Co., 2002.