Development of 3-Dimensional Geographic Information Software Tools on Web
(1999, Ministry of Information and Telecommunication)

Abstract
The aim of this project was to develop a web-based 3-Dimensional GIS software. I researched a GIS software model that could run on Internet. With a large amount of geographic data, I developed compression and transmission techniques through a network environment in a client-server model. This system oriented a powerful client and thin server so that the server played a role of a simple data provider and data compressor. The client conducted data decompressing, user interaction processing, 3D modeling and visualization, terrain mesh analysis, and flight simulation.

Project Overview

With the progressive development of the Internet, the need for software running on Internet browsers is steadily increasing. It means the expansion of on-line services and convenience for general users. Internet-based GIS, a system, which provides people with spatial information, has been undergoing steady improvements.

This project was an innovative study to implement geographic information processing in a client/server model. Since the common data type has been 2-Dimensional, 3-Dimensional geographic information processing hasn’t been realized. In addition to developing widely used GIS functionalities, we tested an Internet-based communication model. For faster communication via the Internet, we implemented a compression-transmission-decompression model with terrain data processing. This framework was constructed in a Java™ environment using Java™ RMI (Remote Method Invocation). We also developed terrain analysis operators that could give information such as terrain clipping, contour line extraction, collision analysis, and profile analysis.

Research Achievements

Figure 1 shows the main screen of the software. The target area was Seoul, the capital of Korea. The figure shows the whole area of the city in the index map; the satellite image is mapped onto the 3D terrain data. User’s operation and processing terrain data from the system point of view are shown in Figure 2. By the figure, we had 3 main operations on 3D terrain data.

- **Selective Grid Data Loading**
  The whole size of terrain data is the number of grid points of the target area. Since the area of Seoul is approximately 35*30 Km and the sample data is of 10m-resolution, the number of points is thus about 3.5*3M. We give the selection from the index map. The initial data from a file were on the place where the user selects in the index map window.

- **Progressive Transmission Via Internet**
The main idea is to re-sample grid data by the geometric features to show the characteristics of the terrain, and send them to the client one by one. Figure 3 shows the differences before/after re-sampling steps. As soon as the client gets the point, it builds a 3D mesh structure by incremental Delauney triangulation and updates the main scene as shown in Figure 4.

- Dynamic Viewing by Flight Simulation
  To demonstrate 3D GIS properties, I implemented flight simulation effects to the system. To determine the path during flight, a user could select input points in a planar map, and give height and viewing angle from the horizontal plane. Then the system determined a continuous path by spline interpolation technique. This functionality was handled by a control box for the camera to stop, play, go forward/backward.

- ORACLE® Database for Geographic Objects
  Geometric building-type objects were dealt with in one of the geographic features depending on the utilization from society. We constructed a set of database tables representing each feature so that the user could select the feature that he wanted to carry on. The system connected to the database using JDBC (Java Database Connectivity), and loaded buildings when the target area was selected.

**Publications**

