Designing and Development of the Aerial Surveying Digital Data Management Information System Based on Two-tier C/S Structure Model

MA Deying¹, LAI Hongbin²
1. College of Civil Engineering and Architecture, Southwest Petroleum University, China, 610500
2. China Railway Eryuan Engineering Group CO., LTD, China, 610031
mdy0830@163.com

Abstract: It’s necessary for surveying and mapping departments to manage aerial surveying digital data. How to manage increasing data automatically has become an urgent problem to be settled. The framework designing of the aerial digital data management information system is deeply dissertated and discussed in this paper. Then the system based on two-tier C/S structured model, using the Borland's Delphi development tool, Microsoft’s SQL Server 2000 ultra-large databases and SuperMap Objects graphical components is established using parts of present data collecting from the aerial photographic surveying department. Compared with traditional systems, this aerial digital data management system has a good nature. It realize the automation management and operation easily.

Keywords: aerial surveying digital data, management information system, two-tier C/S structure mode, automation

1 Introduction

Railway Surveying and Mapping Data is the basis for railway designing. It provides topographic mapping and digital elevation models and other products for the following other works. These Data consists of a large number of images and files, such as air photographs, topographic maps and various engineering survey data¹². They are important components of spatial data.

At present, many surveying units still manage a large number of topographic maps and survey data by human resources. So there are many disadvantages in traditional artificial management, such as backward query methods, inconvenience on use, inefficiency, difficulty of preservation etc. Therefore, it has seriously hindered the production and management of surveying and mapping digitally and automatically and can’t adapt to the trend of survey result informatization.

With the rapid progress in computer technology, database and geographic information systems (GIS) techniques, some units have already developed the database management information system to meet their needs in recent years. Such as: The satellite remote-sensing database system of Heilongjiang Province’s meteorological Center, The urban control measurements management information system establishing by the Planning and Design Institute of Jiaozuo City and the Latitude mapping and geographic information companies of Jiaozuo City, The urban surveying management system establishing by East China Geological Institute and the Guangdong Nuclear Power Joint Venture Company, etc.

These systems have become the most important ways in managing, analyzing, collecting, processing, storing, updating and maintaining the cultural, geographic and spatial data.

In order to satisfy the needs of both surveying and mapping production and management and establishment of basic geographic information system, It’s necessary for surveying and mapping departments to explore the aerial survey digital data management system software to realize computer automation management (such as effective preservation, efficient query and retrieval) for the increasing aerial and topographic maps.

2 Designing of Aerial Survey Digital Data Management Information System
2.1 Designing objectives
On the basis of classifying and coding the existing data, we can establish the spatial database, the corresponding attribute database, graphics and image database and DEM for the main line’s data (lines, tunnels, stations, etc.) in information management office.
To promote the transmission of aerial digital data, we must make the system capable of unified querying, managing and sharing in spatial database and attribute database. They obtain exchange and manage data directly through database and network, no longer need paper-based materials.

2.2 The overall structure designing
According to the system designing objectives, this paper presented the system architecture mode based on Client/Server mode combined with the characteristics of railway aerial digital information and management department. The concrete model framework is shown in Fig. 1.

3 Development of Aerial Digital Data Management Information System Based on Two-tier C/S Structure Model
Based on existing data, using the Borland's Delphi development tool, Microsoft’s SQL Server 2000 ultra-large databases and SuperMap Objects graphical components, we designed and developed the aerial digital data management information system based on two-tier C/S structure model. The main work of the system exploitation includes: system client-side development and system server-side development.

3.1 System client-side development
System client-side layer is the layer used directly. It is the Platform for user to interact with management system. Users can send the client's request to server and receive feedback and error response from server.
In the system, the main modules of the client-side consist of database and user login module, data query module, graphics operation module, data management module and system maintenance module.
3.1.1 Database and user login module
Database and user login module can test and verify the different databases and users in the system, so
the system’s safety can be maintained and administrated.
During the designing of the system, the database login module links different types of databases by using different types of database engines in the Data Link Properties dialog box. Because the system is set up by the database of Microsoft SQL Server 2000, therefore, we should select Microsoft OLE DB Provider for SQL Server in the Data Link Properties dialog box to link the system database.

3.1.2 Data query module
Data query module in the Aerial survey digital data management information system can find out those topographic map data, image data, GPS data of ground control points, GPS coordinates, traverse coordinates and leveling measurements.

▲ Topographic map data query
Topographic map data query in the system can be divided into single record query model (see Fig. 2), and multiple records query model (Fig. 3). In the first model, it can be divided further into five query ways according to different properties: the name of topographic maps, the scale of topographic maps, the mapsheet of topographic maps, the drawing number of topographic maps, the lower left corner coordinate of topographic maps and so on.

![Fig. 2 Result of single record query](image)

![Fig. 3 Result of multiple records query](image)
Image data query can be divided into aerial photograph query and satellite image data query (Fig. 4). Similar to the previous one, they can be split into single image’s record query model and multiple image’s records query model. In established system, image data query is available to search our existing digital image data of information management office.

GPS data of ground control points query
Just as the previously mentioned queries, GPS data of ground control points query also can be divided into single record query model and multiple records query model. And the results of the query can be imported into Excel tables.

GPS coordinates query
GPS coordinates query includes three-dimensional coordinates (X, Y, Z) of GPS points query and the description of GPS station query. They can be separated into single record query model and multiple records query model too. Fig. 5 shows a result of multiple records query model of GPS coordinates query.

Traverse coordinates query
It is the same as the GPS coordinates query, traverse coordinates query includes traverse points (X, Y, Z) three-dimensional coordinates query and the description of traverse station query.

Leveling measurements query

Elevation and description of leveling station queries comprise the Leveling measurements query includes

3.1.3 Graphics operation module

In the system, graphics operation module has basic operations, such as zoom in, zoom out, pan, layers control, label, draw or change style of point, line and region, for various scale topographic maps, aerial photographs, satellite images and description of stations of GPS points, traverse points and leveling points. Fig. 6 shows a piece of 1:2000 topographic map of Shenzhen Metro Line 3 in the system.

Fig. 6 The interface of graphics operation

3.1.4 Data management module

Data management module contains 7 parts. They are data view, data input, data modification, data import, data export, data backup and data report.

Data View (Fig. 7) is used to browse attribute tables of server-side’s database, such as the results of topographic maps, control points and aerial survey data. Users can operate the system to add, delete, and edit the records of properties table through Data input and data modification, and also write the result to the properties table of server-side's database; Data import and data export: to import existing Excel or Word data files into appropriate database table with right format, or to export database table data into Excel spreadsheet or Word document. Backup: backup properties table at client-side; Report: this function is able to export and print properties tables of server-side according to set format.
3.1.5 System maintenance module
System maintenance module can make the system safe and stable, and backup databases spontaneously and regularly according to the server-side’s requirement to prevent data lost when the system failure occurred in the application server or database server.

3.2 System server-side development
In comparison with the client-side development, System server-side development can be designed and completed simply in the aerial digital data management information system based on two-tier C/S structure model.
The server-side is mainly used to store, manage and maintain the data related to the spatial database. It can be set up by means of some existing mature, stable database system (such as Oracle, Microsoft SQL Server, Informix, DB2, MS Access, etc.).
Taking into account that both attribute data and graphics data are involved in the system, and the Microsoft SQL Server database can not only store the attribute data, but also the graphics data by means of data stream of binary in the "Binary" field, So, we choose the Microsoft SQL Server 2000 database to manage two types data in the sever-side development.

4 Conclusion

With the development of computer skills and the desperate need of design departments, we have to develop the aerial digital data management information system quickly.
In this paper, an aerial digital data management information system was developed based on two-tier C/S structure model. The total structure of the system and exploration of two tiers (client and server sides) are described in detail to share.

References