THE DESIGN AND IMPLEMENTATION OF SAR REFERENCE IMAGE INFORMATION INSURANCE SYSTEM BASED ON ARCSDE

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ABSTRACT:

This paper aims at the characteristics of the data source, the requirements of the database establishing, studies the theory of spatial database, ComGIS and some relative key technique, discusses the pattern of database establishing, the organizing and storing mode of the data. Then the logical and physical model of SAR reference image database is proposed. The prototype of the information insurance system is designed and implemented finally. Oracle and ArcSDE is used to build the SAR reference image information insurance system. C/S pattern is adopted. The design of database is based on ArcSDE technology, and the development of the system is based on VC and ArcEngine. The final system achieves the requirements. It provides efficient concurrency accessing mechanism, fine security mechanism and flexible index mechanism. It can build quick index, manage spatial data and property data integrity in a transparent way, achieving data updating and sharing. SAR reference image information insurance system satisfies the needs of data import and update, data browse, spatial query and analysis. Data in the system can also output to be the given format to support for load preparation. Ultimately, a certain target region is taken for example and it shows that the design scheme is practicable and has some instructional meaning.

1. INTRODUNCTION

With the development of remote sensing and photogrammetry, spatial data with abundant information can be obtained easily. Data increases geometrically as a result of the improvement of sensors. Synthetic Aperture Radar (SAR), a kind of imaging radar, is an active illumination system using microwave. Its appearance makes up the limitations in difficult situations by optical sensors. So SAR is widely used in the projects of water conservancy, agriculture, oceanography, geology, environmental monitoring etc. Particularly, SAR can provide unique images representing the electrical and geometrical properties of a surface in daylight or at night in nearly all weather conditions without national boundaries limitations, and with high resolution; it can penetrate through certain veils, disguises and blindages. So it is used widely and successfully in military to support for missile guidance.

In recent years, many scholars are researching on SAR image processing and reference images preparation. As the data increases, more and more information is accumulated，whereas it cannot be managed efficiently. Although there are some commercial DBMS for images, such as TarraServer(Li J. et al, 2005), but there is not a ready-made system or model that can satisfy the requirements of data organization and management of target regions for SAR reference images. Therefore, to establish a database for reference image preparation and missile guidance is absolutely necessary.

After analyzing the characteristics of the data source, the logical and physical model of the database is proposed in this paper. Then the prototype of SAR reference image information insurance system based on GIS is implemented. The data can be visited and managed by asynchronous buffering, spatial index, and distributed management. The system is benefit for data management and updating. It can serve as the data source guarantee for battling, and can also provides decision making support for headquarters, which makes the information insurance develop towards systematic, automatic and intelligent, and plays an important role in our national defense.

2. DATA ORGANIZATION AND DATABASE ESTABLISHING

Database is the core of the information insurance system, which including multi-source data with large quantity. High security requirement for the data is recommended because it is used in military. How to build a database to organize these data reasonablely and efficiently will directly influence the capability of the system.

2.1 Spatial Database Establishing

Most softwares do well in vector data management. However, raster data is managed and shared by file-based system for years. With the growth of the database in size and number of users, file-based management shows the shortages in data security, concurrency access and spatial index. As DBMS capability has evolved into more powerful technology that could support complex data objects, larger queries, and stronger transactional support, using DBMS for data management has become much more practical. Considering Oracle is open completely that can be run on nearly all platforms, it has the ability of parellel processing and is scalable with high security(Wen H., 2005), so it is used to be as the database management system. ArcSDE, the GIS gateway to DBMS(ESRI, 2004), can be seemed as a continuous spatial data model. It can fuse spatial data into all commercial DBMS, and provide effective services for spatial and non-spatial data. Accordingly, the information insurance system of SAR reference images uses Oracle and ArcSDE to build it. The design of database is based on ArcSDE technology, and the development of the database is based on VC and ArcEngine. Data is organized based on GeoDatabase, thus the

spatial data is unified to save in the object oriented and relational database.

2.2 Data Organization

SAR orthographics, the main data of the system, and some other auxiliary data such as vector data, DEM and the parameters of SAR reference images are the data source of the database.The model of SAR reference image database is defined based on the logical structure and the GeoDatabase model, which can be seen from figure 1. It is divided into some sub-database, like DOM, DEM, DLG and the database of property. Raster data is organized by raster catalogs. Othographics of each region is treated as a sub-database of DOM, and each image is stored as a dataset. DLG is composed of different scales, and is stored by geographical features. Each geographical feature is made up of point, line and polygon. The hiberarchy of the database is clear, and it is easily to update data and is used to organize and manage massive data.

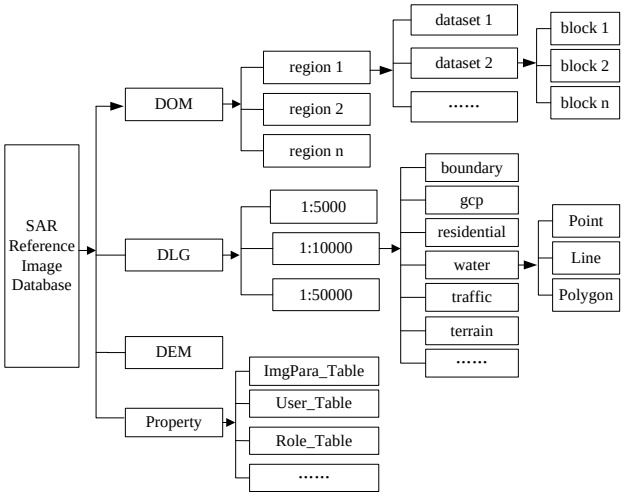

Figure 1 Logical Structure of SAR Reference Image Database

3. DESIGN AND IMPLEMENTATION FOR SAR REFERENCE IMAGE INFORMATION INSURANCE SYSTEM

3.1 Objective of the System

The objective of the system is to build a database using GIS, network and database technology to manage data of experimental regions with military value. The key task is to organize, store, manage, query, and analyze the data, which will support for decision making.

3.2 System Framework

C/S pattern is used in the system, and three- tier structure is adopted, that is the data tier, where Oracle is used to store multi-source data, the logical tier, where ArcSDE is used to connect the user and the database, and finally the application on the client developed by ArcEngine. By using this mode, the access to the system can be controlled and the data can be backup and restored to keep the consistency and integrality.

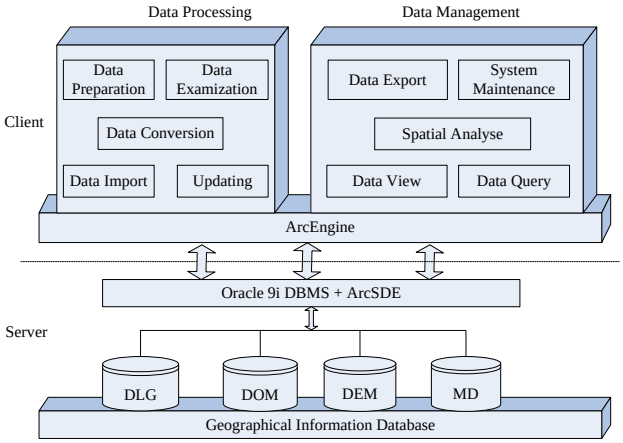

Figure 2 System Framework

3.3 Function Modules of the System

Reference images, the fundamental data of the system, are geocoded orthographics with geographical coordinates after processing with original images. They can be organized and managed with other relative data by SAR reference image database. Meanwhile, the flight path and the optimal route can be planned by spatial analysis, which can make the exact spy and strike come true. Based on data management, decision making and data processing, this system is designed for 6 function modules like data import and updating, data view, query and index, spatial analysis and system maintenance. See figure 3.

3.4 Implementation of the system

When user login the system, the username and corresponding password is checked. Users of different levers are granted with distinct privileges by administrators, with which they can access and manipulate the data in the database. Figure 4 shows the interface of the system.

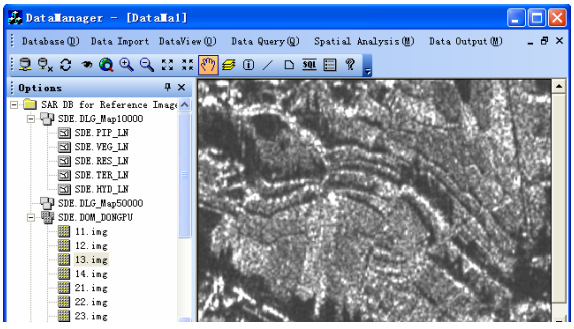

Figure 4 the interface of the system

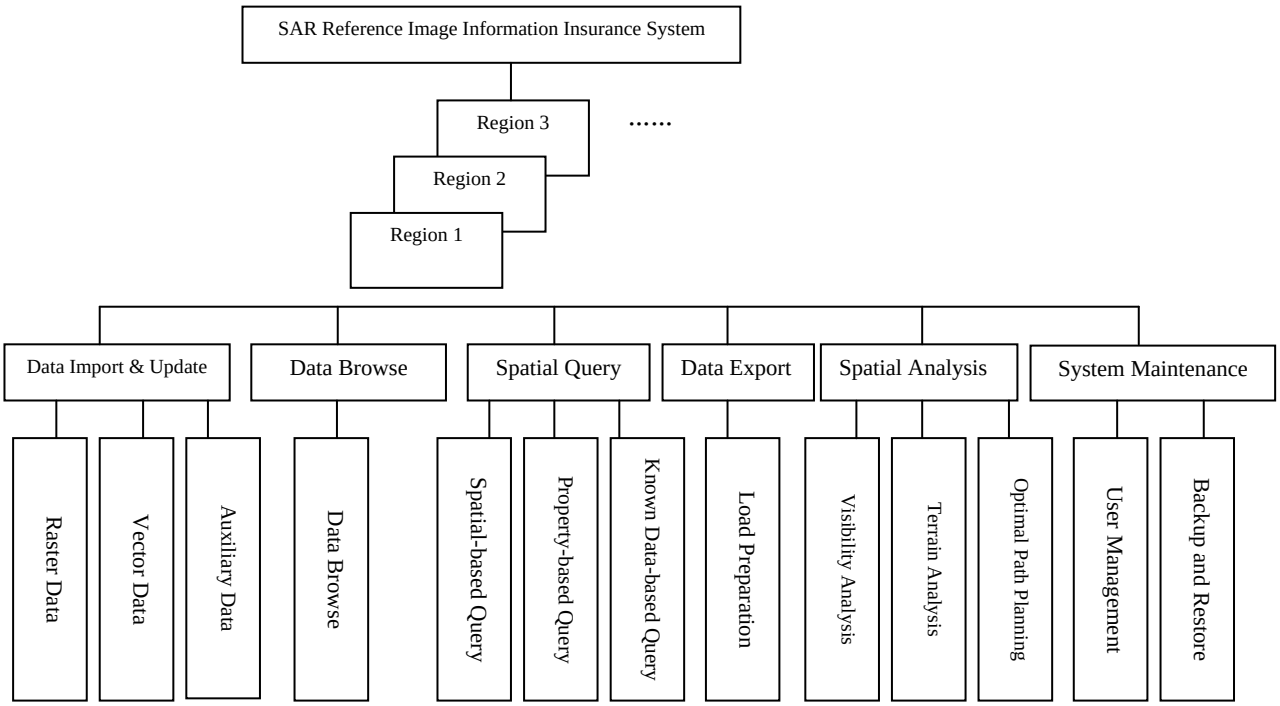

Figure 3 Function Modules of the System

4. KEY TECHNOLOGY

4.1 ArcSDE

ArcSDE, the spatial data engine by ESRI, is a kind of middle-ware. Users can store, manage and obtain spatial data using the interfaces provided by ArcSDE.

4.2 ArcEngine

ArcEngine is composed of a group of key packages of ArcObjects. It provides integrated embedded GIS COM library. The objects of ArcEngine have nothing to do with the platforms, so it can be called by various programming interface. Applications developed by ArcEngine can be independent from ArcGIS, which can reduce the expenses and make develop easily and efficiently(Chen D.Y. et al, 2006).

4.3 Database Technology

DBMS is used to improve the capability of the system: the transaction mechanism helps the researchers to restore the data from misoperations; the index mechanism can obtain required data quickly and efficiently; the security mechanism keeps the reliability of the data, which satisfies the demands of the information insurance system.

5. CONCLUSION

Mainstream spatial database model is used in this paper, and SAR images are brought into the database of SAR reference images. A target region is taken for example to study on the establishing and integrated management of the database. The final database management achieves the requirements. It provides efficient concurrency accessing mechanism, fine security mechanism and flexible index mechanism. It can build quick index, manage vector and raster data integrity in a transparent way, achieving data updating and sharing. It satisfies system demands of data import and update, data browse, spatial query and analysis, and can query and output the spatial data quickly and conveniencely. The design scheme is practicable and has some instructional meaning.

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