

Design and Development of Land Resources Information System of Zibo area Based on Client/Server

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SUMMARY

Land resources information system has been developed to assess the land quality, to manage agricultural resource and to analysis the land use in Zibo area, China. Through analysis present situation of the development of the land resources, land resources information system based on MapObjects is designed this paper. Key technologies such as total database system structure, data organization and functionality designation are studied. This paper presents Client/Server structure about the two –level data integration and management mode, namely the combination of Oracle database and MapObjects spatial data files. Land resources information system with component is established in VB programming environment that MapObjects component is full used. On the basis of these, Land resources information system of Zibo area (LISZ) is designed and developed well by virtue of geographical information system and remote sensing technology. So it realized visualization in managing information about land resources. In the end, the system gives a good example to show the successful application and provides scientific supports for creating international LIS.

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I. INTRODUCTION

Land resources have become a global research hotspot. How to use land resources is an important topic for the future socio-economic sustainable development. Now there is no standard land resources information system in China. Recently years, with the improvement of science technology, many materials about land resource information appear. But there is no uniform system standard to implement. Therefore, it is necessary for assess the land productivity and the land use to create a better land resources information system.

Arc/Info GIS software has strong the second development function. Especially, MapObjects, the second development ActiveX component of Arc/Info, can complete majority function of Arc/Info GIS, including land information capturing, storing, querying, analyzing and displaying. So area special GIS has been constructed and developed in Visual Basic or Visual C++ environment by virtue of MapObjects component [1].

On the basis of these, in order to effectively monitor the changes of land resources of Zibo area and achieve the changes of land use this paper sets up land resources information system based on MapObjects component in Visual Basic environment and remote sensing technology. The whole system framework is designed by Client/Server structure. The system is composed of basic information database, land change monitor, spatial data management, data analysis and data decision support system etc.

II. DATABASE DESIGN

A. Data Model

The data model of this database adopts entity-object model [2]. The entities of the model have spatial information and thematic land information. The data model is shown as Fig.1. In this design, spatial information is a father class, including four child classes, namely point data, line data, polygon data and complicated data respectively.

While every child class is composed of some values. In addition to spatial information, thematic land information also is a father class, including seven child classes, namely land resources management, land assessment, land use plan, land use monitor, land protection, urban land management and land rehabilitation etc.

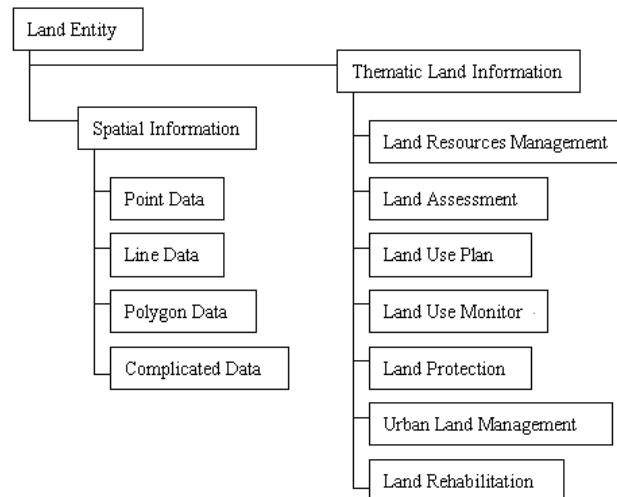


Fig.1 Land data model

B. System Structure and Framework

Land resources information system of Zibo area (LISZ) is composed of hardware, software and land information database. The lowest layer of Land resources information system of Zibo area (LISZ) mainly includes three child databases, namely attribute database, remote sensing database and Geo-database. In this layer, different database stores different data. Attribute data is stored in basic information database and remote sensing database is composed of ETM+ imageries, TM imageries, SPOT imageries and other imageries. Geo-database provides local climate information, soil resources information, soil erosion information, land resources information. At the same time, Geo-database stores soil spatial distribution information and attribute data management. The system structure and framework chart is shown as Fig.2.

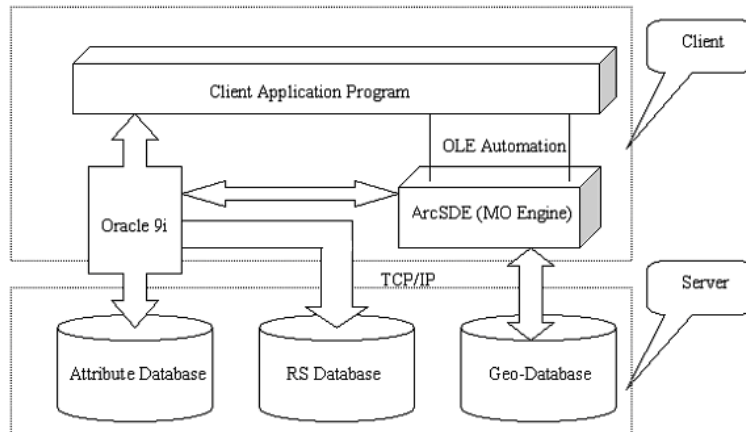


Fig.2 System structure and framework

The middle layer of LISZ is important part of the whole system structure and framework. This system depends on ArcSDE spatial data engine and Oracle 9i data engine to improve the rate of data transmission. At this layer, many tasks such as the data consistency and integrality checkup, data storage, backup and encrypt will done simultaneously.

The top layer of this system, client application program, provides land resources data administrative function: data update, layer management, statistics, assessment and map export etc. The platform of data access interface services the internal and external users with service response protocols.

III. SYSTEM DEVELOPMENT

A. Development of LISZ

In LISZ, the application system is developed with MapObjects, which is provided by Arc/Info software. Judged by the systemic requirement and extendable ability in the future, besides, Visual Basic 6.0 is used as the program platform to develop basic module. During the design and development process, the two –level data integration and management mode — the combination of Oracle database and MapObjects data is adopted. It is shown as Fig.3.

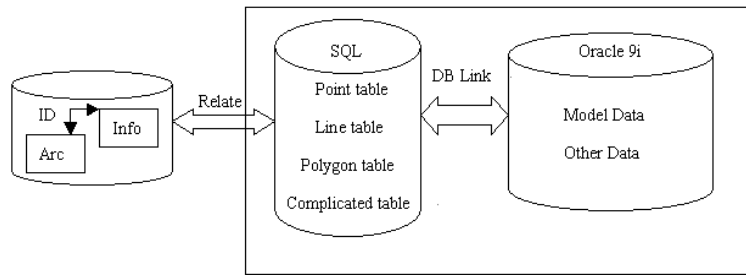


Fig.3 Oracle database and MapObjects data

After constructing Oracle database, Acquiring information from database is needed. So how to select these techniques, namely, ODBC, ADO, SDO, ArcSDE, for acquiring useful data is the key step. We will take advantage of ArcSDE technique because of adopting Oracle basic database and MapObjects component. This technique has two significant advantages [3]. Firstly, ArcSDE can visit data and structure in database and also visit Oracle database by dynamic binds. Secondly, ArcSDE provides us a familiar and advanced spatial data interface, so it is convenient for us to write the programs. Parts of codes are shown as follows.

```
//define ADO connecting database
```

```
Dim Rs As New MapObjects.DataConnection
```

```
With Rs
```

```
.Server="SDE81;"& server
```

```
.Database="instance=esri_sde; database="&database1
```

```
.User=boyyao
```

```
.Password=igisrs
```

```
If .Connect Then
```

```
... ..
```

```
End If
```

```
End With
```

Oracle basic database makes it easier to visit land resources data. But many table files are visited many times in VB programming environment. This not only wastes times, but also makes data error for modifying data. Therefore, this paper introduces MapObjects attribute data management function [4]. For example:

```
_Geodataset () // MapObject binding spatial data function
```

Based on this function, MapObjects spatial data files are created and visiting data frequency is decreased. This system improves database security and layers displaying efficiency by MapObjects component.

B. Example

LISZ is mainly used at Zibo area (Fig.4), Shandong province, China. Zibo area is located between latitude $35^{\circ}56' N$ and $37^{\circ}18' N$ and longitude $117^{\circ}32' E$ and $118^{\circ}31' E$.

This area includes 5 boroughs and 3 counties. The total area is approximately 5938 km^2 . The climate is characterized as subtropical humid monsoon zone. The average temperature is $12.3 \sim 13.1$. The annual precipitation is between $400 \sim 800 \text{ mm}$. With the improvement of agriculture, land resources become main problem in Zibo area [5]. So it is necessary to design land resources information system in order to analyze agriculture of this area.

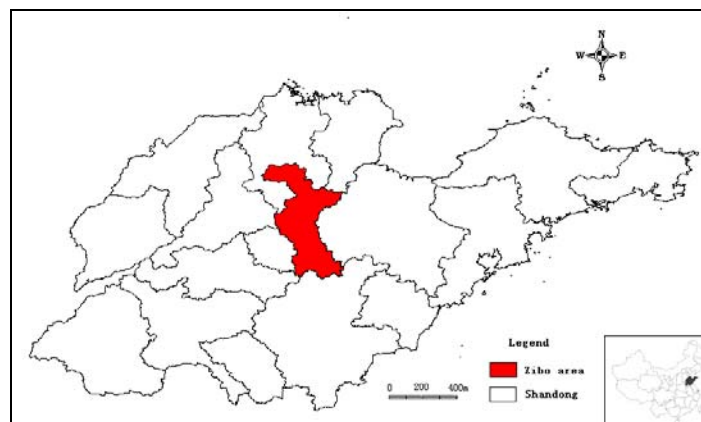


Fig.4 Zibo area

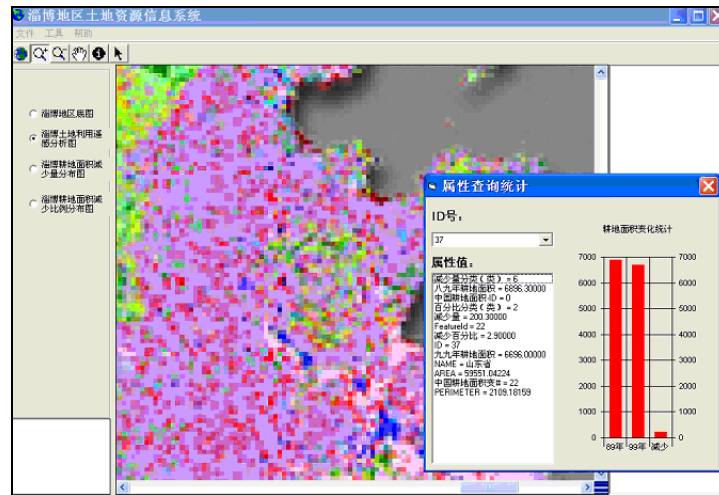


Fig.5 One of user interface

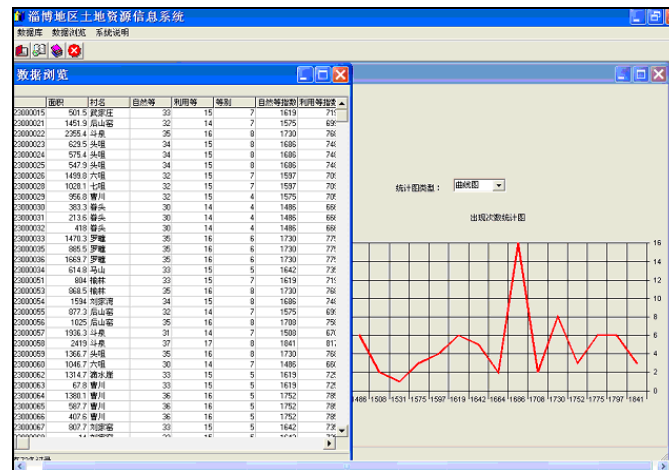


Fig.6 Analysis interface

Fig.5 shows an example of user interface in LISZ. User can complete the data import, transfer, modification, analysis, query, statistics and mapping conveniently.

For example, user can query and analyze all kinds of land use and assessment in the database making full use of Oracle. Fig.6 shows a picture of analysis interface.

IV. CONCLUSION

(1) LISZ is a land quality management information system based on MapObjects component, which improves system strong function and lays a solid foundation for assessing land quality and land use.

(2) LISZ is an application-oriented system designed based on the client/server. the two-level data integration and management mode — the combination of Oracle database and MapObjects spatial data extends fields of the thematic data. With the feasible three-layer systemic, the established and running LISZ are flexible for different users.

(3) LISZ is an important part of LIS (Land Information System) and provides scientific supports for creating international LIS [6].

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