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Design and Realization of Agricultural Land Quality Data Management Information System after Land Improvement

Hui Kong[1, 2, 3, 4]

[1]*Shaanxi Provincial Land Engineering Construction Group Co., Ltd., Xi'an 710075, China*

[2]*Institute of Land Engineering and Technology, Shaanxi Provincial Land Engineering Construction Group Co., Ltd., Xi'an 710021, China*

[3]*Key Laboratory of Degraded and Unused Land Consolidation Engineering, the Ministry of Land and Resources, Xi'an 710021, China*

[4]*Shaanxi Provincial Land Consolidation Engineering Technology Research Center, Xi'an 710021, China*

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Abstract: Based on the land reclamation of land after the premise of quality data and ecological environmental monitoring data and the data management and application direction, based on JavaScript, Java Web technology and ArcGIS for Server technology, the WebGIS system design, the MVC development mode, B/S (browser/Server) multi-tier architecture model design to achieve the collection of maps, data management, data query, data statistical analysis and system integrated management and so on five big modules for the integration of agricultural land quality after land reclamation and ecological environment on-line monitoring system design.

1. Introduction

In terms of the monitoring of cultivated land quality and ecological environment in the current land improvement project, no monitoring system and normal monitoring has been formed. In order to meet the acceptance needs of the project, some specific soil indicators of agricultural land in the project area have been tested as a model.Due to the short construction cycle of engineering projects, most of them are 3-5 years, and the least of them is 1 year. The number of sampling and monitoring is 2-3 times, and the least of them is 1 time, and some projects even do not have it.However, in the planning and design of land improvement engineering projects, the return period of investment is 8-10 years, or even more than 15 years. Therefore, compared with the period of about 10 years of land engineering projects, the amount of monitoring data is very little, so how to ensure that the quality of agricultural land and ecological environment will not deteriorate after the improvement.Therefore, it is necessary to use advanced technical means and methods to monitor the quality of agricultural land and ecological environment for a long time.

Farmland quality after land reclamation and ecological environment on-line monitoring system is the area of farmland, laboratories and field observation of soil index data, the environment index data as well as the growth of the crops in the collection and online observation, to manage the data

and display at the same time, through the real-time data obtained provide objective basis for decision making, at the same time, the online monitoring environment deployment, also can better to different space, region of the observatory, experimental base of test to grasp, better improve the work efficiency of scientific research personnel, also can better aid decision making.

2. System basic configuration

The construction of land data management information system is a process of applying software engineering theory to land management informatization.The construction of land management information system needs to carry out system requirement analysis, system design, software coding, integration and testing, operation and maintenance on the basis of system requirements.Farmland quality after land reclamation and ecological environment construction of the on-line monitoring system is under the online test system hardware complete research and development, based on the Internet network, using simple, the SpringMVC framework, combining real-time transmission data structures, database, developed a B/S model of data management and display system, can make the staff to find the monitoring data in real time, borrow the front-end visualization technology, the data in diverse format display, friendly interface, strong interactivity.

The design of this system is based on ArcGIS10.2 based software platform to build, in open source PostgreSQL database management platform, SOA architecture system, through the ArcGIS for Server related standard land price data, based on ArcGIS API for JavaScript's client technology in development, build a set map browsing based on B/S mode data query, data management, data query, statistical analysis and comprehensive management system function module in the integration of data management information system,It effectively provides help for the monitoring and management of agricultural land quality data after land renovation, and also better serves the management and full use of scientific research data.

Table 1 The system software and hardware configuration

Type	Specify
The hardware system	Intel Core I3 processor (dual core 3.70GHz), 8 gb of ram
The operating system	Windows7 flagship version 64bit
Development platform	Myeclipse, Webstorm, Dreamweaver
The database	MySQL5.5
The Web server	Struts2, Hibernate3.5, Spring4.0, Tomcat8
The GIS server	Map world online API service
The client	EChart, Jquery, AJAX, Know the weather API
The UI	Photoshop and query easyui plug-ins

3. System design principles

3.1 Practical principle

This principle is the prerequisite factor for the system operation effect.Online monitoring system is user-oriented, friendly interface, simple operation to meet different levels of different needs of users, improve the mechanism of constant update, is the system's operation effect is closer to meet the needs of users.

3.2 Principle of progressiveness

In the design and development process of the system, we fully consider the existing and running system conditions, adopt advanced and mature enterprise GIS platform, innovate the open source database platform, the current mainstream system architecture and development framework, and the latest software system development technology and development tools.

3.3 Efficiency principle

The development of the system is based on the practicality of the premise, is the problem of work efficiency, the system is from the database data storage and management and system server processing efficiency to make a targeted design, in order to meet and realize the system in a large number of data under the efficient operation of the system efficiency.

3.4 Normative principles

The design and implementation of the system comply with the relevant international and domestic development standards, from the design architecture of the system, the design of the database, the design of the functional modules, the style of the code and the design of the interface style are carried out in accordance with the existing standards.

3.5 Stability principle

System stability is a crucial link, is also the system can maintain the long-term operation of the key point, the system after the completion of the design and implementation, also through a large number of data repeated testing, debugging, to ensure the stable operation of the system.

3.6 Reliability principle

The relevant technology software used in the system design needs to have a certain recovery, backup and fault tolerance mechanism, so as to prevent the loss or damage of important information of data when some uncontrollable problems cause the system to crash.

3.7 Safety principle

System security starts from two aspects. One is the security of the system itself, that is, the handling of the crash mechanism in the operation of the system, so as to prevent the influence and damage of external unsafe factors on the system.On the other side is the security mechanism of user operation, that is, the influence of the user's role management and the security of operation permission on the system.

3.8 Principle of openness

This system USES the "map of heaven and earth" GIS map service platform, the open source MySQL database platform and related development technologies, which can be well combined and integrated into this system, so that the system can be combined with more new technical elements in the later maintenance and upgrade.

3.9 Principle of extensibility

The extensibility of the system is convenient for system upgrade and maintenance in the future, providing convenience for data processing, and various development interfaces are also convenient for extending new system functions in the later stage.

4. Overall system design

In farmland quality after land reclamation and ecological environment online monitoring method research as a starting point, build online monitoring method in data acquisition and monitoring equipment to collect the data stored as the foundation, through to the data display, data extraction and query and analyze the data of the reorganization of on-line monitoring database, build and service platform based on SOA architecture system and network builds a system platform is applied to the management.

This system by on-line monitoring based on the soil and surrounding environment index data of starting point, through technology based on JavaScript, Java programming language, for SpringMVC framework of the Web server, online map API, using B/S multilayer architecture and WebGIS technology for system design, build a set of monitoring station management, data management, data query, monitoring data display and statistics and analysis system of integrated management, and other functions as one of the online monitoring application system, to provide users with the real-time on-line monitoring data query and management function,At the same time, it also provides a convenient and efficient platform for relevant business personnel to effectively manage and dynamically monitor data.

The online monitoring system based on open service-oriented architecture (SOA) is a multi-functional application system based on Web technology, GIS spatial technology and B/S architecture. It is composed of data layer, logic layer (business layer) and application layer.It is mainly based on the data layer and the core, relying on the network platform and the basic support of various services, through the management and display of data to effectively monitor data and analyze data.

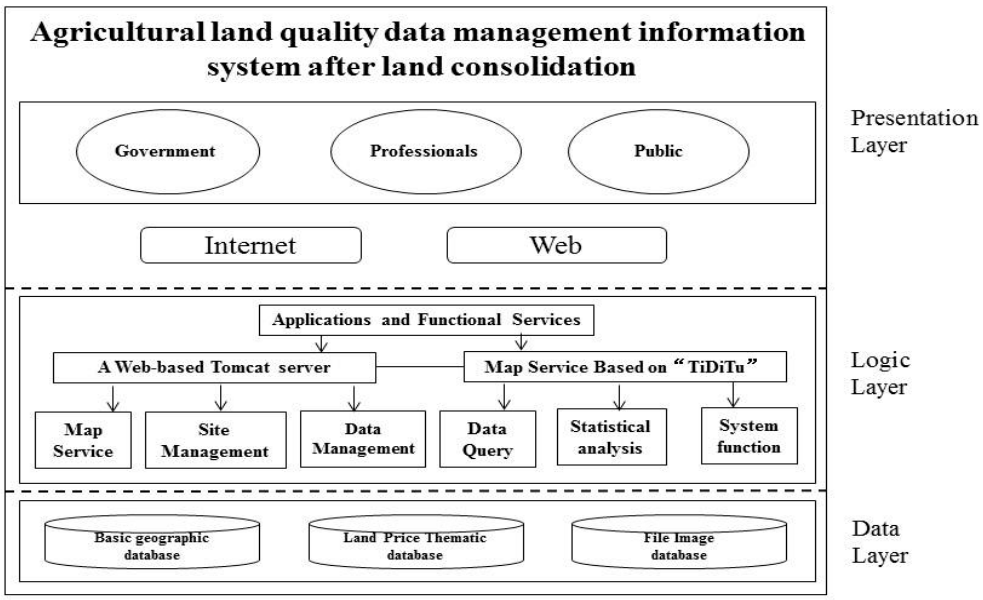

Figure. 1 Overall system design

5. Functional module design

System function module is an important part of the online monitoring system, the system analysis and design according to the requirements of the early stage of the target, and the corresponding function requirements, system design for five functional modules, respectively is the map browsing module, data query module, data management module, statistics and analysis module, integrated management module, etc.According to the analysis and design of data flow in the previous chapter, the system function modules are divided into two modules: application module and management module.Application module is the sum of all modules providing services for the whole user, including map browsing (including basic operation of map and basic measurement function) and statistical analysis (including analysis and statistics of solid data according to relevant model algorithm).System management module is used to realize the management of the entire system, including data query, data management and integrated management (including user information, password change, authority management, etc.).System function modules are introduced as follows.

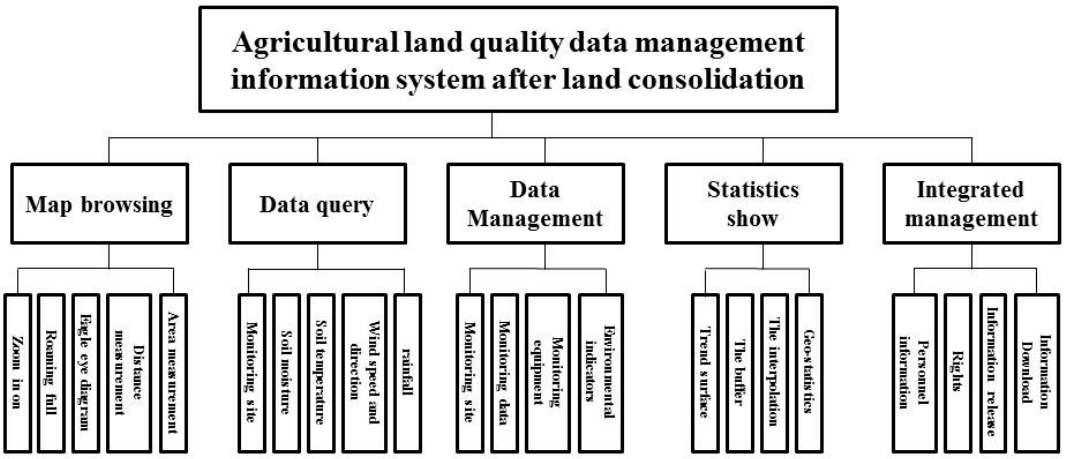

Figure. 2 System function module chart

5.1 Design of map browsing function

Browse function module is based on WebGIS map service the basic operation, the basis of this system is called reproduction "map world" as the background map, including the amplification, narrow, roaming, hawkeye map, map, the previous perspective, a perspective after browsing capabilities, including distance measurement, the area of measurement, map printing, etc.The following is a brief introduction to these features:

(1) Zoom in: zoom in the map with free multiples, which can be operated by mouse pulley, or double click the map to multiply.

(2) Zoom out: zoom out the map with free multiples, and operate the mouse pulley.

(3) Roaming: you can click on the map and drag to browse the whole map.

(4) Eagle eye: it refers to the position of the map displayed in the picture box in the whole map from the perspective of overlooking.

(5) Full map: restore the expanded or reduced map to the original full map mode.

(6) The former perspective: the previous state is displayed according to the current map state.

(7) The latter perspective: the latter state is displayed according to the current map state.

(8) Distance measurement: click two points on the map to calculate the distance between two

points.

(9) Area measurement: the area of the area can be calculated by drawing rectangles, circles and polygons.

(10) Map printing: print out the map in the current display state of the browser window and output it in the general picture format.

In addition to the basic operation functions of map browsing commonly seen in these GIS application systems, the background map can also switch the display state of the map according to the four modes of moderate mode, image mode, rendering mode and 3d mode, so as to browse the map from different angles.

5.2 Design of data management function

Data management module is mainly aimed at monitoring collection database integrated management, also is the important core part of the system, the concrete function is the basis of the database for geographic data, the monitoring data, other file image data to data acquisition and display on the front end through the logic layer in the table of data management, implementation of data browsing, data add, edit, delete data, data query and data export several basic functions, in the face of these functions do brief introduction:

(1) Data browsing: browse the data through the data management table, including the right scroll bar and the bottom page button toolbox.

(2) Data addition: enter new data records according to the corresponding fields in the database.

(3) Data editing: modify the content of existing data and update the database at the same time.

(4) Data deletion: delete unwanted data records by clicking or checking.

(5) Data query: query the records in the data table through the query box at the top of the table.

(6) Data export: export the data in the data table in excel format.

5.3 Design of data query function

Map data query is a traditional business methods of GIS system, including spatial data query and attribute query two kinds, at the same time, based on the method of difference and can be divided into position through a graphical query through and attribute query spatial location, this system is mainly aimed at monitoring station data, the monitoring data, sample data and basic geographic data through the query function to realize the query of spatial data and attribute data query.In addition to the query of attribute data in the data management module, the query of attribute data can also be realized through spatial graph data or corresponding single or multiple points of interest. The specific query method is as follows:

(1) Single entity query: click on a single entity to display the property data searched and returned from the database through the pop-up box.

(2) Rectangular query: draw rectangular box query, can query multiple or a single data record.

(3) Oval query: draw an oval to query multiple or single data records.

(4) Polygon query: draw polygons to query multiple or single data records.

(5) Keyword query: search the unique keywords such as ID and name of the attribute data to query the attribute data and highlight the graph data.

5.4 Statistical analysis function design

The function module of spatial analysis and statistics mainly carries out numerical statistics on the monitoring point data and sample point data, including the total number, variance, mean value, and the maximum and minimum values of land price, etc. In addition, according to some spatial

analysis methods and models of GIS, the existing data are analyzed and displayed in the form of some ICONS.At the same time, the data dynamic trend monitoring chart and comparison chart are also formed by the comparison of data at different time points and different monitoring stations. Among them, the functional module for analysis and statistics is GP (geographic preprocessing and model) service released by ArcGIS for Server, which is operated by establishing geographical model.

5.5 Design of integrated management functions

The integrated management module is mainly aimed at the security of the system. The ultimate operator of the system is a person, so it is particularly important to manage the operator and the authority of the operator. This module mainly includes the personnel management, the authority management related information download, etc. The relevant introduction is as follows:

(1) Personnel management: manage the personnel who log in the system, including registration, personal information query and editing, and personal password security protection.

(2) Permission management: permission management starts from the functional modules of the system. Some people have the permission to read and write, while some only have the permission to read or write, which is also determined according to the actual business requirements.

(3) Relevant data download: download information about monitoring data, background information, data reports, etc.

6. Conclusion

Based on WebGIS design principles applied to agricultural land quality after land reclamation and ecological environment, on-line monitoring of GIS information system aims to by combining the forefront of the GIS technology and new types of Web technology data for the agricultural land quality change before and after the land reclamation and the surrounding ecological environment monitoring data collected by the implementation of systematic management, to promote the development of scientific research work and help.The system adopts the method of JavaScript technology as the core technology for design and development of the whole system, this paper designed the system based on B/S structure, using the latest WebGIS technology and principle, to implement a platform before and after the renovation of farmland management and sharing data related indicators, through the analysis of the relevant GIS, the user can clear knowledge of the data acquisition and monitoring dynamic change, also can be in the accumulation of data provide the basis for project land, convenient and better in the future to serve the project decision-making and scientific research.

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