Research on the Key Technology of "Multiple Measurements in One" Information Platform for Natural Resources

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Abstract. "Multiple measurements in one" is an important initiative of the natural resources department to deepen the reform of "management and service" and optimize the business environment, and the multi-measurement information platform system is a platform to promote multi-measurement merging and result-sharing. Based on Web technology, this paper uses Web application development technology and Web architecture to build a Web application architecture discusses the process model and database design method for "multiple measurements in one" business, and designs and analyzes the data flow and data table model. Based on Web technology and database, the paper researches key technologies such as modularization and architecture, develops and builds the business platform, and analyzes and summarizes the implementation of system functions and modules.

Keywords: multiple measurements in one · Web technologies · process patterns · database design · data flow · data table models

1 Introduction

Implement the deployment requirements of the CPC Central Committee and the State Council on deepening the reform of "streamline administration, delegate powers, and improve regulation and services" and optimizing the business environment, promote the transformation of government functions to reduce approval, strengthen supervision, and optimize services, and promote fair market competition. Through the reform of "multiple measurements in one", the integration of surveying and mapping business, the further optimization of the surveying and mapping process, the unification of standards, and the sharing of results are realized. The goal of measuring only once for the same subject, undertaking the same surveying and mapping matters by a surveying and mapping unit, and providing only once for the same surveying and mapping results is finally achieved. The overall goal of "one-time commission, joint surveying and mapping, and

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results sharing" [1–3]. Through continuous reform, improve the competitiveness of the surveying and mapping products production unit, for surveying and mapping unit itself relative to other pillar industries, has the characteristics of less investment, the quick effect [4, 5].

Internet technology and distributed systems have enabled cloud computing and storage capacity to grow geometrically, and the public's demand for information has become increasingly digital. Cloud computing can support large-scale high-performance computing, support shared resource pools, and data processing results [6]. At present, the country vigorously promotes the development of digital China, digital government, and digital economy. The information resources of smart city construction have spawned digital application scenarios in various industries and fields. At present, the design of the data interaction interface between the front-end and back-end database is not very extensive, and there is a lack of development and design process of data interaction between the database and Web front-end [7, 8]. Web service has the characteristics of a unified standard, independent platform, self-contained, and programmable [9, 10]. Web development includes both front-end and back-end components and the integration of Web technology and database systems is a good balance between data-centric and user-centric development goals, bringing both Web interactivity and the convenience of accessing database systems anytime and anywhere, greatly promoting the popularity of database systems and Web technology and the level of information technology in various industries. Based on database and Web technology, the multi-test integration information platform system is developed and deployed to the government cloud. It is a typical example of the above development scenario model. It can not only make the system run efficiently but also create a humanized network environment and provide users with convenient access paths.

2 System Construction Requirements and Objectives

The "multiple measurements in one" reform program require the integration of surveying and mapping matters, unified standards, the establishment of a unified surveying and mapping project management, data management, process management new mechanism. The essence of the multi-metric information platform system is to use digital means to manage the surveying and mapping projects and surveying and mapping results in engineering construction, creating a digital twin scene of engineering construction surveying and mapping project management. The core content of the system construction is the database of a multi-metric information platform system, the main task of the construction includes the construction of scientific and reasonable "multiple measurements in one" data framework, service framework, and operating environment, the necessary functions include data processing, data sharing, seamless interface with other systems, etc., which can fully grasp the different types of engineering construction It can provide a unified information service guarantee platform for administrative approval, business management, comprehensive supervision, auxiliary decision-making, social services, and other diversified application needs.

The core database of the "multiple measurements in one" information platform system is a data container and a platform for the comprehensive management, release,

and sharing of data related to surveying and mapping projects. The construction of the database should address the data application service needs at three levels.

Application service needs of various departments: to meet the needs of various departments for data of surveying and mapping project results, and to provide relevant surveying and mapping business function services for various application systems and users; Requirements for sharing results of surveying and mapping projects: establishing a directory of engineering construction surveying and mapping projects to meet the needs of various application systems and users for sharing results of surveying and mapping projects at different stages; Requirements for registration and remittance of mapping projects: according to the relevant regulations of the state on project registration and remittance of results, the project registration and remittance system is implemented for mapping projects, and the mapping units should register the mapping projects that meet the requirements and remit the mapping results.

3 Process Patterns and Database Design

3.1 "Multiple Measurements in One" Mapping Matters Management Mode

In the whole process of the engineering construction project from land application to real estate registration title certificate, each stage has different demands on the type and content of surveying and mapping results, which requires scientific division of surveying and mapping project categories based on the integration of surveying and mapping matters, unified data format standards, standardization and integration of the operation process of surveying and mapping results, and establishment of serial and parallel methods according to the needs of surveying and mapping results submission and business audit. "Land-> real estate registration" is the whole process of "multiple measurements in one" surveying and mapping matters management mode. The "multiple measurements in one" mapping matters throughout the process of "land - > real estate registration", the process of mapping matters in different stages of serial mode management, and mapping matters of business operations to implement parallel mode management.

3.2 Database Construction Objective and Design

The database should be constructed to achieve the following objectives: the "multiple measurements in one" database should have an incremental update mechanism at the element level, with each feature element having a unique identification code for differentiation and subsequent historical data retrieval through the combination of time node information. In terms of data storage, the current situation and historical data are managed in a unified manner, providing a guarantee for the historical preservation of multiple data. Based on a large relational database and spatial data engine, the spatial data model is used to establish a spatial geodatabase, which ultimately realizes the construction, storage, management, and maintenance of "multiple measurements in one" data.

Based on the framework model and data model of business data and spatial data, the conceptual model, logical model, and physical model of all data sets of the "multiple measurements in one" database were designed.

1) **Database content and relationships**

In view of the system construction demand of "multiple measurements in one", the data content involved in the approval business is mapped with the database data items around the database construction target. The data contained in the database is mainly divided into management data and spatial data. Management data includes user data, permission data, mapping results audit information data, mapping project information data, mapping project business process management data, etc. Spatial data mainly includes topographic maps, survey and boundary maps, as-built maps, cadastral maps, parcel maps, property mapping, and other mapping results data.

The relationship between the data databases is that the management database is a record of the project management process and behavior of "multiple measurements in one" surveying and mapping, and it is the information of the management process and the result of "precipitation". The spatial database stores all the mapping results in data for the management database, and all kinds of data take the spatial database as a unified spatial reference. The management database and spatial database together form a unified framework system for project management and results data management of "multi-survey in one".

2) **Data Flow**

The data (including management data and mapping data) in the whole "multiple measurements in one" information platform system come from users, and these data will eventually realize the interconnection with other business management systems. Other business management systems can access the exchange of data flow of the "multiple measurements in one" information platform system through the interface. The project mapping results rendezvous mechanism established by the "multiple measurements in one" one map subsystem will aggregate the mapping results data generated by each business into the spatial database. The background data management mechanism will realize storage management according to the dynamic changes in the management and mapping results databases. The schematic is shown in Fig. 1.

3) **Data Organization**

Data is the core of the application system, and a well-performing database platform will be able to ensure efficient data operations. The system also involves the construction of a GIS database, the database system adopts SQL Server, which supports the processing of a large amount of data.

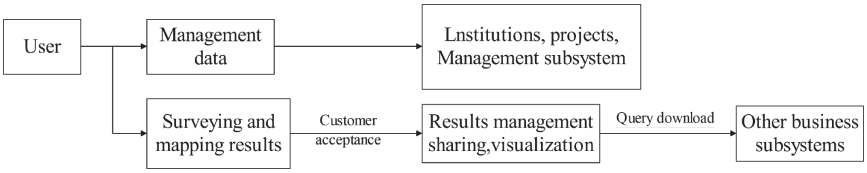

Fig. 1. Multiple measurements in one data flow

Table 1. Data table model

Data Table Classification	Portal datasheet	Business process datasheet	System datasheet	Project data sheet
Datasheet	Content table	Business table	User Table	Multi measurements in one project table
	Column table	Current Business Flow Table	Role Table	Survey and mapping unit information table
	Template table	Historical Business Flow Table	Organization Table	Mapping unit qualification table
	Log table	Process permissions table	User Roles Table	
		Process chart	User Organization Table	
		Job table	Menu Navigation Table	
			Menu navigation role permission table	

According to the database conceptual design method, the user requirements of "multiple measurements in one" obtained from the demand analysis are abstracted into the information structure, and the attributes and data relationships of government departments, mapping agencies, mapping projects, and other entities are designed according to the information structure. On this basis, the data table model is designed. As shown in Table 1.

4 System Technical Architecture Route

4.1 System Technology Route

The "multiple measurements in one" information platform system are deployed on the government cloud, divided into an application server and database server, where the application server is mapped to the Internet and users can access the "multiple measurements in one" information platform system through the Internet. The portal of the "multiple measurements in one" information platform system will use a CMS system for content management, based on the Microsoft.NET platform, SQL Server database development, using layered and modular design, separating information presentation

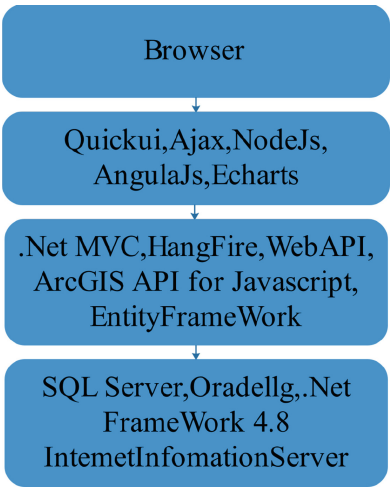

Fig. 2. Technical Architecture Diagram

and data storage, facilitating the change of front-end style, website information maintenance and website data security, centralized management of various information on the website, and through templates, this information through text lists, graphics, various links and other ways to publish to the website, the website's update and maintenance work is simplified to just entering text and uploading images.

The platform will be mainly based on B/S architecture and workflow engine, which will realize the management of qualification declaration information of surveying and mapping units and the management of results remittance of surveying and mapping units, support the flow of business processes by using EPS_Office workflow engine, manage the presentation of business forms by form designer, manage the operation rights of menus and forms by the authority management system, provide internal and external WebAPI interface center and services for users to call. Services for users to call; the system uses unified login authentication to ensure the consistency of logged-in users among subsystems; Hangfire is used for timed task scheduling management; ArcGIS API for Javascript will be used for the development of WebGIS a map function. The schematic is shown in Fig. 2. The main technologies are as follows:

Web server: IIS8;
Workflow engine: EPS_Office;
Browser: Google Chrome;
Development environment:.Net Framework 4.8,Visual Studio 2019, Visual Studio Code;
Development language: Net, JavaScript, Jquery, NodeJS.

4.2 System Technology Architecture

The technical architecture is divided into a foundation layer, data layer, support layer, application layer, and display layer. The system is deployed on the government affairs

cloud, and users access the system through the Internet. The application server is used to deploy the "multiple measurements in one" information platform system, the database server is used to assemble the database program, and data storage, and the application server can access the database server through the local area network. The schematic is shown in Fig. 3.

Foundation layer: The foundation layer provides software and hardware support and security for the operation of the "multiple measurements in one" information system. The server can provide sufficient computing and processing capacity; storage and backup facilities are safe, reliable, efficient, and sufficient capacity; security facilities provide the necessary security technology for the normal operation of the information system; the basic software part of the operating system should be stable and reliable, and the database has the ability and efficiency to manage large amounts of data.

Data layer: The data layer mainly includes business configuration data, file storage data, project data, and system data, where business configuration data are business flow records and permission configuration; file storage data are result data and other project information; project data are project information; other system data make users, roles, organizations, and other system management data.

Support layer: The project uses a workflow engine to support the flow of business processes, manages the presentation of business forms through a form designer, manages the operation rights of menus and forms through a permission management system; provides internal and external interface center services for users to call; the system uses unified login authentication to ensure the consistency of logged-in users among subsystems.

Application layer: The project application layer includes the surveying and mapping unit directory subsystem, my project subsystem, project management subsystem, result management, and sharing subsystem, "one map" management subsystem, surveying and mapping project registration and result remittance subsystem, platform management subsystem, and system interface.

Display layer: The portal of the "multiple measurements in one" information platform system is used as a display layer for construction units, mapping units, and approval units to access, which includes information of interest to each user, such as mapping unit directory information, project information, policies and regulations, and notices, etc.

5 System Implementation

5.1 System Functions

The functional design of the system includes portal, subsystem and interface design, subsystem including mapping unit directory subsystem, my project subsystem, project management subsystem, result management, and sharing subsystem, "one map" management subsystem, mapping project registration and result remittance subsystem, and platform management subsystem.

The portal provides an interface for users to interact with the system platform, and users can obtain important information from the portal, providing a secure, integrated, configurable, personalized, and on-demand work interface through a unified

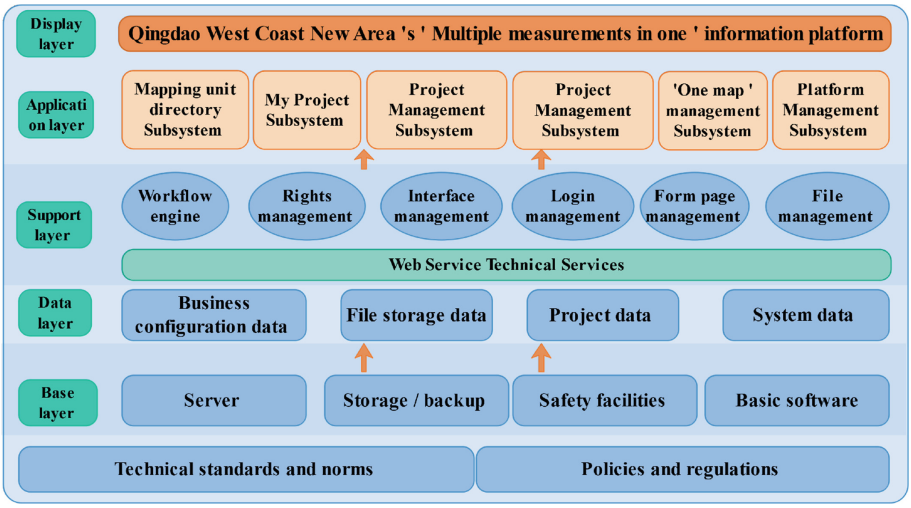

Fig. 3. Overall project architecture diagram

portal framework, including login module, content management and aggregation, personalization of the portal homepage display content and style, unified user, organization and authorization management, and unified application configuration management. Management, and unified application configuration management. Users can access each sub-module of the system through the portal to achieve what they need.

The system interface mainly realizes the functional integration and data interaction with external business systems, and correlates and interacts with other information systems.

5.2 System Applications

After the system is deployed in the government cloud, users can use it by accessing the portal. The system is based on the "Land- > Real Estate Registration" process axis, and the application workflow is shown in Fig. 4.

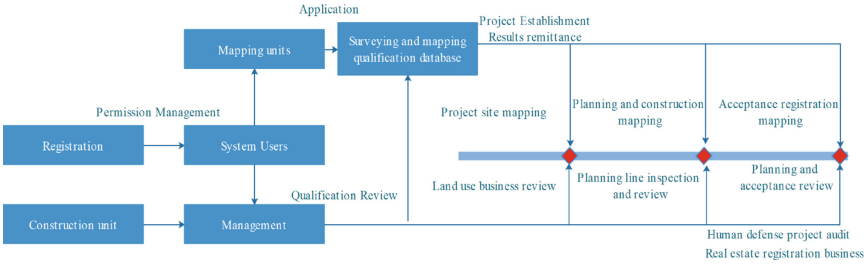

Fig. 4. System workflow chart

1. The project site's comprehensive mapping management process. Project establishment and base map application, map review out, mapping unit operation production and results remittance, land use review, real estate registration review, results archiving.
2. Comprehensive surveying and mapping management process for planning and construction. Project establishment and base map application, map review, mapping unit operation production and remittance of results, construction management and real estate registration review, archiving of results.
3. Acceptance registration comprehensive mapping management process. Project establishment and base map application, map review out of the library, mapping unit operation production and results remittance, construction management review, mapping unit operation production, results in remittance.

Users for system registration is a prerequisite for use, and the management review account is configured by the system. Users of surveying and mapping units need to apply to join the directory of surveying and mapping qualifications, in which the qualification conditions management to match the three types of comprehensive surveying and mapping matters in the map. Application and project establishment will initiate a workflow, and the workflow will end automatically after the results are remitted and audited. Users share the mapping results in the workflow to carry out subsequent mapping.

As the business continues, the mapping results are accumulated and the system is managed through the "One Map" management subsystem for big data calculation. The matching of the project management workflow and process axis of surveying and mapping ensures the connection of surveying and mapping projects at all stages of engineering construction and achieves the purpose of simplification and sharing. The system is deployed in the government affairs cloud, and the storage, computing, and network resources can guarantee the operation of the system well.

6 Conclusion

1. Engineering construction "multiple measurements in one" reform is the key to scientific integration of surveying and mapping matters according to the actual needs of the business, to ensure that under the premise of streamlining matters and simplifying the process, the results can be shared and meet the needs of the approval business.
2. Engineering construction project management "land - > real estate registration" process axis model construction is the basis of the system core function design. According to the matching of the process axis and workflow, the intersection node of the flow of results and the business process of surveying and mapping projects is accurately set. Comprehensive combing and analysis of data entities contained in the system, precise information abstraction and extraction, elimination of redundant data structures according to the database conceptual design and logical design methods, and construction of platform system data model ensure the management of big data calculation and improve the system operation efficiency.
3. The system is deployed on the government affairs cloud, and users access the system through the Internet. The application server is used to deploy the "multiple measurements in one" information platform system, the database server is used to assemble

the database program, and data storage, and the application server can access the database server through the local area network. To promote the innovative development of digital transformation of urban wisdom, make full use of government cloud resources to realize digital application scenarios for people's services, realize the project management and remittance of surveying and mapping results from offline processing to online processing, and maximize the expansion to enhance the breadth, depth, and market integration of open government data.

4. Standardize the data format of spatial data results remittance, standardize the submitted data of mapping results, enable users to effectively manage data, and improve the extensiveness of data sharing. The platform establishes a unified data standard, which is conducive to making full use of the engineering construction "multi-survey" mapping results to update the existing basic mapping data. Using ArcGIS API for Javascript to develop WebGIS one map function improves the efficiency of spatial data management and visualization, and saves the cost of developing separate GIS client applications.

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