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INFORMATION MONITORING SYSTEM OF COASTAL WATER RESOURCES BASED ON GIS

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Abstract: Through analyzing the technical characteristics of GIS technology and the demand of coastal water resources monitoring and management for GIS technology, the development and application status of GIS technology in coastal water resources monitoring and management in our country are sorted out. Collect and process basic data, real-time monitoring data and other relevant data, improve the operating procedures of system software, simplify the operating process, and improve the quality of system operation. Practice has proved that the monitoring system based on GIS has good effect in practical application, and can meet the research requirements.

Keywords: GIS; watershed; coastal water resources; information monitoring;

0 Introduction

GIS is an information system based on attribute data and spatial data, which collects, stores, analyzes and reproduces spatial information. GIS is to model and store geospatial information in a computer, query and analyze geospatial information, and describe, simulate and forecast the object of study. GIS can carry out spatial analysis and obtain and use information more comprehensively, intuitively and dynamically than traditional information systems[1]. Due to the uneven distribution of coastal water resources in time and space, the ability of human beings to influence coastal water resources is increasing, and the ability to understand the law of coastal water resources is increasingly limited. GIS has been widely used in many research and application fields, and has been developed rapidly in the comprehensive development and utilization of coastal water resources because of its unique multidisciplinary features and spatial data processing functions[2]. In this paper, the application of GIS technology in coastal water resources monitoring and management in our country is summarized, and the prospect of GIS technology in coastal water resources monitoring and management is forecasted.

1 Design of river basin coastal water resources information monitoring system

1.1 hardware configuration of basin coastal water resources information monitoring system

GIS development with Flex Builder as the front-end development tools, based on rest services, the development of rich network applications. The development system needs to access spatial data through rest and integrate remote object invocations with the business system. The frequency of a single database server and a single WebGIS server exceeds 2.7, memory exceeds 4G, and hard disk exceeds soog[3]. Research and development site configuration CPU frequency 2.0 +, 2G memory, 250g hard disk. The ESRI ArcGIS Server 9.3 software will be deployed to GIS Server 9.3, map data will be published to map service, monitoring data will be tested, classified, calculated, evaluated, alarm analysis and evaluation will be saved in the business application database[4]. The hardware of the hardware configuration module of watershed coastal water

resources information monitoring system is mainly wireless transceiver chip. The specific parameters are shown in Table 1.

Table 1 equipment related parameter settings

Name	Parameter
Model	nRF2401
Bluetooth specifications	BluetoothV4.0
Supply voltage	2.0-3.6V
Support v4.0 Bluetooth protocol stack	ATT，GATT，SMP，L2CAP，GAP
Working currents	≤10mA
Dormant current	＜5uA
Temperature range	-40℃~+80℃
Wireless transmission range	0-250m
Transmission power	Maximum adjustable 4dB
Sensitivity	-93dBm＜0.1%BER
Frequency range	2.4GHz-2.480GHz
External interface	IO，UART，SPI，USB2.0，PWM，ADC
Module size	16.6mm×12.2mm×1.8mm

The hardware consists of nRF2401 chip produced by Nordic company of Norway, including transmitting power amplifier, low noise receiving amplifier, crystal oscillator, mixer, demodulator and other circuits. Its biggest characteristic is fast transmission speed, strong anti-interference, and can minimize packet loss, ensure the complete transmission of data and information[5]. The system takes the processing module as the core, which is mainly responsible for the data processing and analysis, and according to the known information to locate the space that can be monitored, carry out disaster prediction, and try to avoid the occurrence of disasters[6]. Microcontroller is the main hardware of processing module. As a typical embedded MCU, MCU is composed of manipulator, controller, memory, input and output devices, which is similar to MCU. Siemens MSP453G785 MCU is selected as the ultra- low power device. The specific parameters are shown in Table 2.

Table 2 related parameter setting of single chip microcomputer

Name	Index
Working voltage	5V
Working current	1.5mA
Data storage	64*8
Interface	SPI
I/O	12
A/Dconverter	9
ROM	520bit
RAM	32bit

MSP453G785 MCU is added to the monitoring system of watershed coastal water resources information based on GIS, and 1nRF2401 chip is used as heterodyne receiver. The converted

digital signal is collected by the receiver module, amplified by the low-noise receiver amplifier, and then converted into IF digital signal by the MIXFR system, and then modulated into the next module[7]. The design and technical performance of the monitoring system and its terminal based on GIS are of great significance to realize the real-time monitoring and management system of coastal water resources[8]. Figure 1 shows the water quality monitoring system.

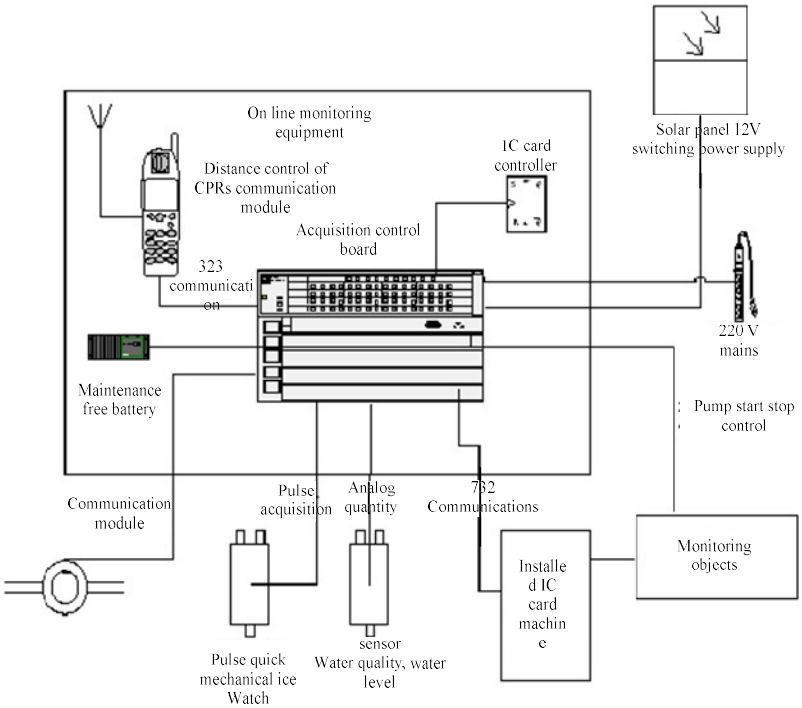

Fig. 1 configuration structure of coastal water resources information monitoring system based on GIS

GIS -based monitoring system for watershed coastal water resources can be used for power supply, such as real-time online, automatic metering, query, hybrid, low power consumption and so on[9]. The coastal water resources information monitoring system based on GIS is modular, which is only used as the integrated collection, control and communication equipment of communication RTU, or as the collection and communication mode[10]. According to the requirements of each monitoring point, flexible combination of module configuration is adopted to achieve low-cost integrated collection and management.

1.2 Software process optimization of coastal water resources information monitoring system in River Basin

Further optimize the functional flow of the software of the basin coastal water resources information monitoring system, and the system mainly realizes the collection and control of parameters such as sewage outlet water intake (supply), basin coastal water resources, basin coastal water resources water level, basin coastal water resources water quality and basin coastal water resources water quantity[11]. In order to better describe and standardize the monitoring and

management system of watershed coastal water resources, the functions of the software sub-module of the watershed coastal water resources information monitoring system are firstly optimized. As shown in Figure 2, the functions of the software sub-module of the watershed coastal water resources information monitoring system are planned:

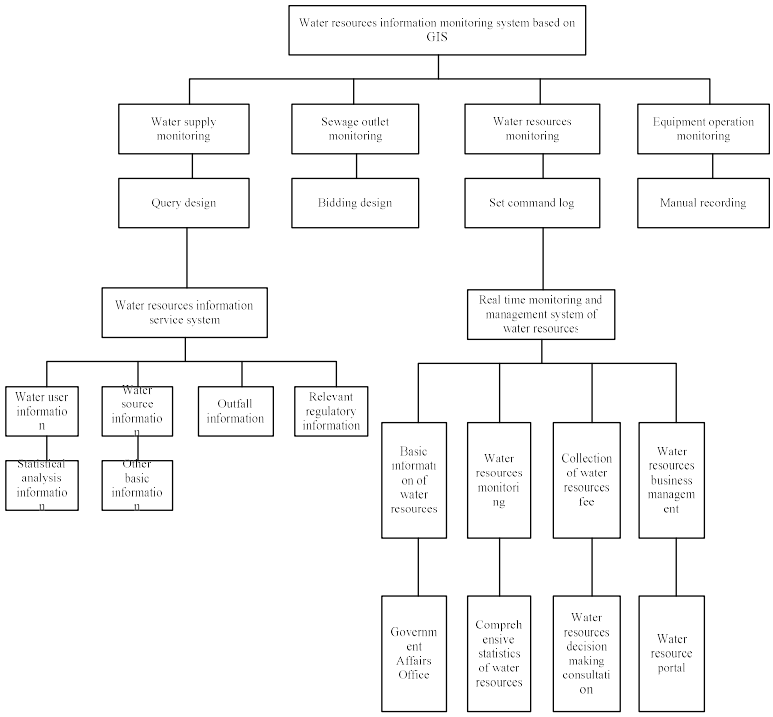

Fig. 2 function planning of coastal water resources information monitoring system software sub module

Data collection and processing in the software of coastal water resources information monitoring system is an important part of coastal water resources monitoring. The data processing services are classified, calculated, evaluated and counted, and the interpretation results are stored in the corresponding tables of the database. However, it is quite different in interpreting information and displaying interpretation results[12]. There are great differences in coding methods, data evaluation and calculation standards, monitoring and early warning rules and so on. Therefore, in the monitoring system, the data processing is very complex. ESRI sdespace design engine is used to store system spatial data, mainly in Microsoft SQL Server database. Create different attribute data databases in SQL Server database based on different topics[13]. The location of electronic map is represented by information containing spatial attributes. Water conservancy information service system provides professional map selection and topographic map query and analysis. On this basis, the basic principle of coastal water resources information monitoring based on GIS is presented, as shown in Figure 3:

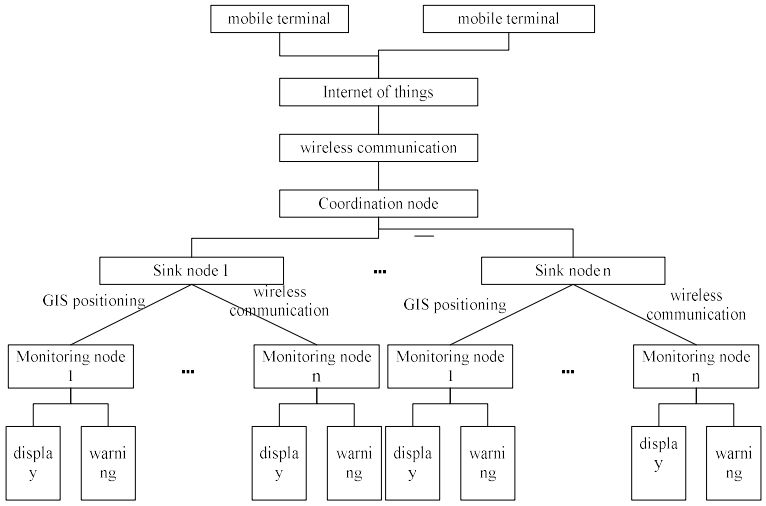

Fig. 3 principle of coastal water resources information monitoring based on GIS

The specific steps to further optimize the system flow include:

Step 1: management of coastal water resources information monitoring points, including addition and deletion.

Step 2: refresh the interface in the form of list according to the predetermined frequency to display the latest monitoring results. Contains current monitoring values, site status, and warning information.

Step 3: GIS display: display the current monitoring results on the map according to the preset frequency. On the basis of real-time monitoring data, station status and alarm information, the alarm information and results are analyzed by using point, rectangle, rectangle, rectangle and other forms.

Step 4: query and monitor any combination of historical data according to geographical location, time interval, site type and other attributes.

Step 5: statistical analysis of water quantity, water quality and water level changes at any time and place in the form of tables or GIS, and draw curves according to historical period, actual situation and plan, and form a report.

Step 6: based on the statistics of the basic data and monitoring data of coastal water resources in the administrative region, this paper analyzes the changes of water supply system, water quality and regional social and economic conditions, and illustrates the data processing method of coastal water resources monitoring through Figure 4.

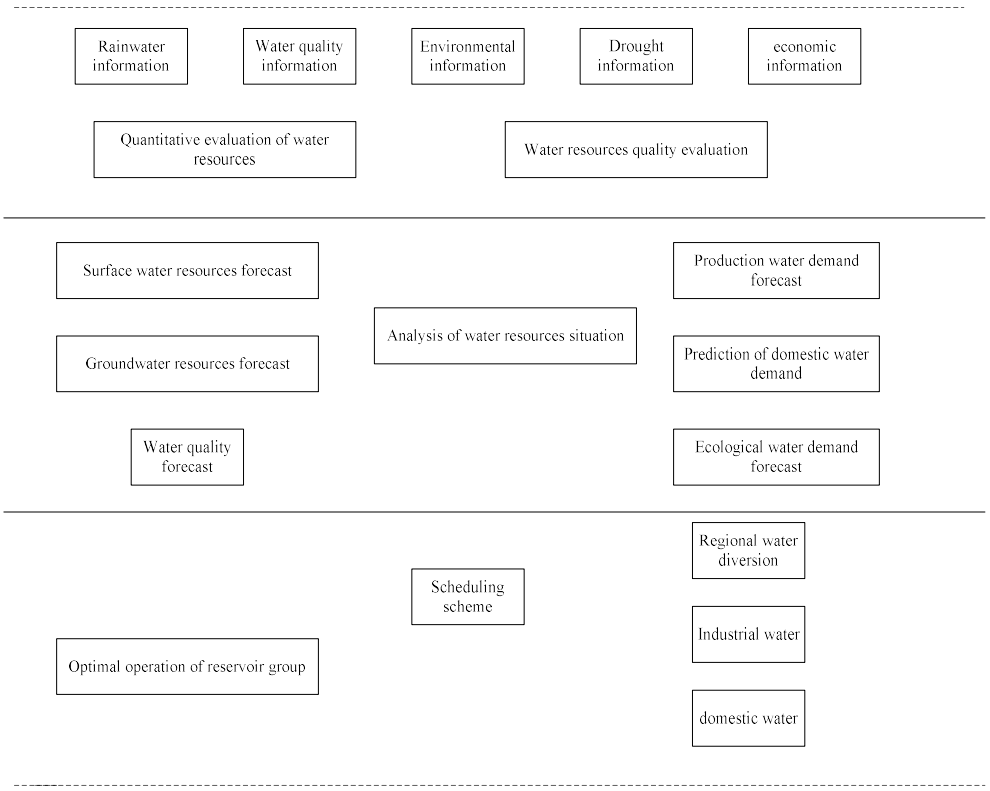

Fig. 4 data processing method of coastal water resources monitoring

According to the data communication protocol, the remote testing machine collects the real-time water intake flow, cumulative meter flow and other data for network transmission. The data are transmitted by all levels of network, and finally reach the hydropower resource center system[14]. The communication server receives the data according to the data transmission protocol of the central system, analyzes the data, forms the format, and sends it to the business system. The storage space is stored in the database. The system adopts a two-layer LAN structure, which integrates all kinds of basic information, monitoring information and management information together to realize high-speed processing and exchange of solid data. The mainstream LAN is designed according to the actual situation of the current network. For data processing, the overall requirements of data sharing and exchange platform are: the platform is relatively independent of business system, the system has data organization, data communication, data file processing, data transmission, data conversion and other functions.

1.3 Realization of coastal water resources information monitoring in River Basin

In order to realize the monitoring and control of coastal water resources information in river basins, taking "taking, supplying, using and discharging" as the main objects of coastal water resources monitoring and management in river basins, the decision-making coordination ability of water administrative departments at all levels is enhanced by monitoring the coastal water resources information of point, line and area. The system obtains the following objects:

Water source monitoring: including surface water and groundwater.

Monitoring the coastal water resources and environment of the river basin: including monitoring the water quantity and water quality of the water intake of the key river basins;

Water quality monitoring at the entrance of water conservation area: including the provincial, municipal and county-level control section information of water conservation area entrance, mainly used for surface water and water supply at the entrance of water conservation area.

The monitoring center mainly includes information interpretation, data processing and business application system. The different parts of these functions are as follows:

Measuring instrument: hardware equipment used to monitor and collect information, such as electromagnetic flowmeter, water quality analyzer, level meter and watt hour meter.

RF transmitter: process the data collected by measuring equipment into data information.

Information processing services: the discovery, classification, calculation and evaluation of monitoring information, early warning analysis and analysis and evaluation are saved in the commercial database

Basin coastal water resources information monitoring system is based on SCADA equipment management to optimize the configuration of functions. On the basis of GIS platform, with geographic map and thematic map as carrier, the visual display of coastal water resources management system in space is realized. On this basis, a data model combining topological structure, spatial analysis and network analysis is established. It is connected to GIS equipment interface through inter station coding[15]. Generate various charts and reports, and can respond to real-time information, such as on-site alarm. Furthermore, the monitoring steps of watershed coastal water resources information based on GIS are optimized, as shown in Figure 5:

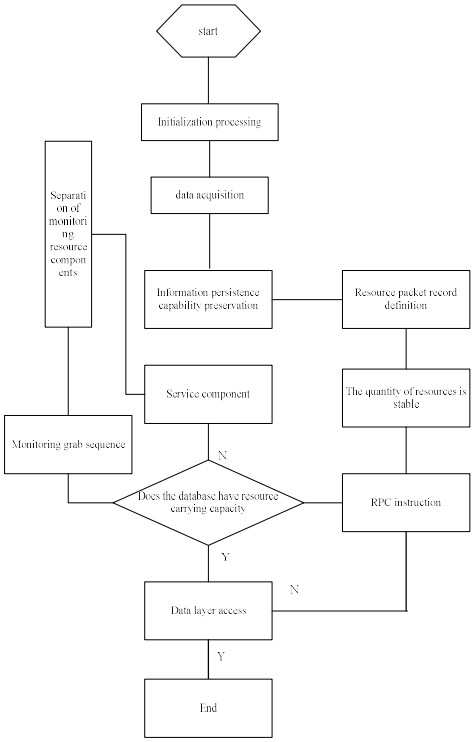

Fig. 5 monitoring steps of basin coastal water resources information based on GIS

According to figure 5, the system regularly monitors the coastal water resources information of the basin. If there are new coastal water resources data, they can be classified and stored. The information can be called through each function software database and compared with the preset

alarm value. The recorded hydrological data is divided into no alarm state, and the original real-time data is replaced by real-time data to display the new basin coastal water resources data; when the basin coastal water resources data exceeds the alarm value, the alarm state is displayed by switching the corresponding graphic data, and the real-time data is replaced by the new basin coastal water resources data. GIS technology can provide the basic station data reflecting the real-time information of river basin coastal water resources. It can receive, display and manage the data of river basin coastal water resources, and can carry out remote communication to realize the real-time and accurate monitoring of coastal water resources in the basin.

2 Analysis of experimental results

In order to ensure the feasibility of the system, its performance must be simulated after the system design is completed. Test environment: service enterprise operating system: Windows server2010; service enterprise hardware configuration requirements: more than 2G memory; hardware capacity greater than 150gb; ggda-25t5 server-side dedicated server; server database: Oracle10g; client browser: ie8.0; client hardware configuration: memory 0.98 g; hardware capacity: 80 GB; test recording tool: dev test tool. Determine whether they are in line with the customer's needs, especially some implied requirements. Software test includes hardware environment and software environment. The environment of system test is listed in Table 3:

Table 3 experimental parameter setting table

Parameter name	Numerical value
Host type	Client/Server Host &Client/Proxy/Server Host
Cloud platform type	Oracle Cloud platform
Database organization	Mysql
Experiment time	60min
Resource monitoring coefficient	0.75（transverse） 0.84（portrait）
Data fixed point interaction limit	83.66%
Monitoring information integrity limit	72.13%

According to the design requirements and actual needs, professional testers use white box test method to conduct comprehensive test and system test. The end user can complete the acceptance test in the actual operating environment. Test these methods by executing test commands in the program to ensure that each branch of the method can be executed correctly. Integration testing can only be done after unit testing is completed. Serious or major errors are suspended during the test phase, and the developer continues to execute unit tests. Using black box test method, the system is tested by professional testers. According to the requirement analysis report, testers write test cases and design them in tables. The boundary conditions and convenience of coastal water resources monitoring system are compared. On this basis, the monitoring information recognition effect and data processing effect of the system under complex interference environment are tested, and the test results are shown in Figure 6.

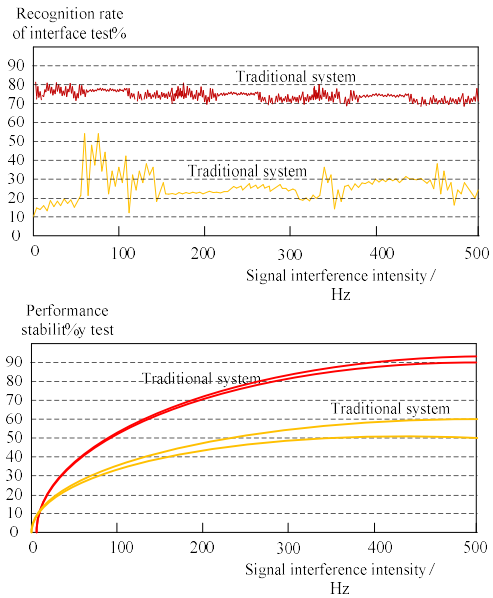

Fig. 6 comparison test results

The test results of Figure 6 include interface recognition function test and performance stability test. Based on the detection results, compared with the traditional monitoring system, the identification function of the monitoring interface of the proposed GIS based watershed coastal water resources information monitoring system is obviously better than the traditional method, and the stability of the system performance in complex environment is obviously optimized, which meets the requirements of the current system design.

3 Conclusion

According to the current situation of water shortage in China, the information management system of coastal water resources is established by combining GIS technology. The advanced technology and management means are used to improve the management level of coastal water resources and realize the scientific, information and modern research objectives, so as to realize the rational allocation and sustainable utilization of coastal water resources. Through coastal water resources data collection and transmission technology, computer network technology, database construction and query technology Based on GIS and multimedia technology, a coastal water resources information management system is constructed, which provides coastal water resources information services (real-time monitoring information services, basic information services) and business information management, and realizes business management modules such as coastal water resources information management, water intake information management, water use information management and coastal water resources charging management, which provides the basis for rational allocation of coastal water resources.

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