Early warning expert decision system of water resource management based on Cloud Computing

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Abstract: In order to solve various problems caused by the lack of timely warning in water resources management, based on the current water resources informatization, an early warning expert decision-making system for water resources management based on cloud computing architecture is proposed. The system collects real-time data through the Internet of things interface layer, uses Web GIS to display geographic information and Ajax (asynchronous Javascript + XML) asynchronous interactive processing mode to speed up the response speed. Finally, an early-warning expert decision system for water resource management based on the cloud computing architecture is realized, which can monitor both the command center and the mobile terminal at the same time.

Keyword: Cloud computing; water resources management early warning; expert decision system; Internet of things; Web GIS; Ajax asynchronous interactive processing mode

1. Introduction

Water resources are the infrastructure and basic industry of national economy and social development. Water resources informatization can comprehensively improve the efficiency and efficiency of water resources construction. Water resources expert decision system can provide support for real-time query, evaluation and prediction of water resources data, optimization management and scheduling, statistical analysis and decision-making, water resources e-government, etc. It will lay a solid foundation for water resources planning and management to be informationized, networked and intelligent [1]. At present, some River Basin Organizations and regional departments have established relevant systems, such as the decision support system of water resources management in the lower Yellow River, the decision support system of water resources management in Handan, etc. Cloud computing is regarded as the third it wave of information technology. It is an important part of China's strategic emerging industries, and has become the focus of attention of the whole society. Cloud computing is the product of the integration and development of distributed computing, parallel computing, network storage, virtualization and so on. Based on the cloud computing architecture, this paper designs an expert decision-making system for water resources early warning. The system collects information resources related to water resources, stores, analyzes, manages and real-time detects these information resources, and finally forms a decision support software system.
2. System model
The system software is divided into four levels, which are IOT data interface layer, cloud computing platform layer, business application representation system and user decision support system. The data interface layer of the Internet of things is responsible for obtaining real-time information and data resources through remote communication of field sensors. These real-time data include:

① Water information, including water level, flow and flow rate of river, reservoir and groundwater; ② rainfall information, including rainfall size and distribution; ③ engineering information, including drainage pump station, sluice station, irrigation pump station, valve, etc., which should have certain timeliness; ④ water intake and supply information, including urban water supply, rural water supply monitoring, including water consumption, water fee, etc. Cloud computing platform layer includes GIS system and various database systems. GIS provides geographic support for the whole information system, and all engineering information is published on the map. The database system is mainly used for the storage of all kinds of information data, which is convenient for the data access of the upper layer. At the same time, the cloud computing platform layer provides data exchange, transmission, and sharing [2].

The business application layer adopts B / S framework, which is mainly responsible for: 1) geospatial publishing query and retrieval of information resources; 2) remote monitoring system of water resources engineering such as pump station and gate station; 3) irrigation forecast and control; 4) flood control and drought relief command system includes portal website, water dispatching model, flood forecast model, flood control material dispatching, etc. The user layer mainly studies and analyzes the information resources, data and background information provided by the system, establishes the decision-making model by means of simulation and intelligent simulation, and analyzes, compares and judges through the human-computer interaction function, so as to provide necessary support for correct decision-making.

3. Key technologies of system construction
The key technologies involved in this system include: cloud computing technology, AJAX interaction technology, Web GIS technology and expert decision model. Distributed storage, cloud computing system uses distributed storage data, using redundant storage to ensure the reliability of data. This system uses Google's GFS (Google File System) file system, which can run on common hardware and provide high-performance services for a large number of users [3].

Data management
This system adopts Google's BT (BigTable) data management technology, which is different from the traditional relational database. It processes all data as objects and forms a huge table for distributed storage of large-scale structured data. Virtualization technology isolates the software application from the underlying hardware, which can divide a single resource into multiple virtual resource splitting modes, or integrate multiple resources into a virtual resource aggregation mode.

3.1 Ajax interaction technology
Due to the increase of information transmission, when the server processes the request, using the traditional web application synchronous interaction mode, only when the final response is transmitted to the request, the whole page will refresh the results of processing, the browser user must wait, so that the user's experience becomes inconsistent. This paper uses Ajax (Asynchronous JavaScript + XML) to deal with the problem. It combines JavaScript and XML technology, uses the SMLHttpRequest object to send the request and get the response from the server, figure 1 shows the asynchronous interaction technology.
Ajax can use JavaScript to update the final page without reloading the entire page. Therefore, in the process of reading data, the user is not facing a white screen, the update is instantaneous, which is a sense of continuity for the user, and the response speed of the interface has been significantly improved, thus improving the user experience.

3.2 Web GIS technology
Web GIS technology provides a new application platform for geographic information and GIS services. Through Web GIS, spatial data can be distributed and published on the Internet. Users only need to use the general web The browser can browse and query spatial data, which has the characteristics of wide range of access, good scalability, large-scale cost reduction and simpler system operation.

Expert system (ES) is a computer software system simulating human experts to solve domain problems. It has the characteristics of knowledge collection, knowledge acquisition and updating, and heuristic reasoning. It can provide training, experiment and simulation means for decision makers and managers [4].

The expert decision system of water resources early warning designed in this system provides real-time data of rainfall, meteorology, temperature, humidity, etc. through sensors, it uses the Internet of things technology to connect it to the cloud server and integrate with historical data, uses the basic principle and technology of the expert system, summarizes and collects a lot of experience and knowledge of water resources experts, and studies and analyzes the information resources provided by the system, data and background information, using simulation, intelligent simulation and other means to establish the decision-making model. This paper provides a model of intelligent irrigation decision system.

4. System display
The water and rain information query and analysis system shows that the system aims at the characteristics of water and rain data: there are many kinds of water and rain data, large amount of information, and spatial distribution. Generally, through the combination of graphics and related attribute data, map can be used as the information carrier to express their spatial attributes more completely.

The regional distribution map (bottom map) of a region can be displayed on the computer screen by using GIS technology. By selecting different information regions, the hydrological information of the area can be queried and analyzed, supplemented by dynamic editing, modification and query analysis. Using WebGIS to publish geographic information on the network, at any node of the network, users can browse the water and rain data on the WebGIS site, make thematic maps, carry out spatial query and retrieval and spatial analysis.
The expert decision system of water resources early warning is designed based on cloud computing architecture, which is divided into command center and mobile terminal. Therefore, through the central station and mobile terminal, the flood control work of each gate station can be commanded, dispatched and communicated at the same time, so as to master the water and rain data and dynamic parameters in real time, so as to provide real-time, reliable and stable basis for flood control safety analysis, data management and dispatching decision-making, so as to meet the requirements of water resources modernization.

5. Conclusions
The quality of water resources system is related to the national economy and people's livelihood, and the current situation of water resources management has not met the actual needs. The expert decision-making system of water resources early warning designed in this paper realizes the real-time monitoring of water and rain data, water and rain dynamic, flood and other parameters by using the cloud computing architecture, and makes reliable analysis and reasoning based on the knowledge base data of the expert system, so as to provide decision support for water resources units at all levels.

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