Design and Implementation of River Data Acquisition and Storage System Based on Cloud Platform

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Abstract. In view of the huge geospatial information data in the Yangtze River Basin, messy data storage and difficulty in searching, a cloud platform for river scientific research was established based on Browser/Server Architecture. The system design comprehensively considers and balances the advancement and maturity, enabling the system to mass-store and manage data from various units or departments, multiple types and multiple channels, and to provide advanced data management methods to ensure data security and data unified management, thus providing researchers with fast and reliable data information. The system realizes a set of standards, a map, a library and a platform for the whole basin, which is of great significance to the standardized management and application of data in the Yangtze River Basin.

1. Introduction
With the rapid development of computer technology and Internet technology, the world has entered the digital age. Technologies such as big data, Internet of Things, cloud computing, virtualization, and artificial intelligence have gradually matured and are being applied in various industries. Water conservancy informatization refers to the process of making full use of modern information technology, in-depth development and utilization of water conservancy information resources, modernization of collection, transportation, storage, processing and service of water conservancy information, and comprehensive improvement of the efficiency and effectiveness of water conservancy business activities[1]. Water conservancy informatization is of great significance for water regime monitoring, flood situation monitoring, water resources management, automated office, information service and other system construction[2]. The Yangtze River Basin is China’s largest watershed, which spans the three major economic zones of Southwest China, Central China, and East China. Its natural characteristics are closely related to its socio-economic characteristics. Due to the large area of the Yangtze River Basin, across the Qinghai-Tibet high-altitude zone, the southwestern tropical monsoon zone and the Central China subtropical monsoon zone[3-5], the hydrometeorological conditions are very complicated, and the relevant data are extremely large. In order to strengthen the standardized management of water resources information in the Yangtze River Basin, comprehensively improve the data management level of the river basin, and give full play to the comprehensive utilization of engineering research and scientific research, CRSRI (Changjiang River Scientific Research Institute of Changjiang Water Resources Commission) of River research institute have established a river research cloud platform based on the .Net technology platform, which improved the management and application level of water conservancy information.
2. **Overall System Design**

In order to achieve comprehensive supervision of all kinds of data in the Yangtze River Basin, it is necessary to sort and classify the data itself to achieve unified data standards, real-time data updates, and accurate keyword search. The system consists of five parts: disk array and storage management module, remote data transmission module, distributed data storage and management module, and data display module. The system design comprehensively considers and balances the advanced and mature aspects, enabling the system to mass-store and manage data from various units or departments, multiple types and multiple channels, and provide advanced data management methods to ensure data security and data unified management to provide researchers with fast and reliable data information.

3. **Hardware Design**

The hardware part of the system mainly includes: 2U rack-mounted integrated controller control system, Intel 64-bit high-performance processor, 10Gb/s network port, and disk array. The hardware system provides two copies of exactly the same hardware, and the standby hardware is always on standby to ensure that in case of system failure, redundant configuration components step in and assume the work of the failed parts, so as to keep the server running. The distributed storage architecture of river research cloud is shown in Figure 1.

![Diagram of distributed storage architecture of river research cloud](image)

**Figure 1.** Distributed storage architecture of river research cloud

4. **Software System Design**

The River Research Cloud Platform System focuses on providing detailed geospatial information services to researchers. The system uses a multi-layer implementation mechanism, namely the Browser/Server Architecture (B/S Architecture). In the B/S Architecture, each node is distributed on the network. These network nodes can be divided into browser end, server end and middleware, and the functional tasks of the system are completed through the links and interactions between them. The
three levels of division are logically divided. In practical applications, different physical divisions are performed according to the actual physical network[6].

The overall architecture of the system consists of front-end UI, presentation layer, application layer, data layer, and data interaction. The logical architecture diagram of the system is shown in Figure 2. In terms of external (horizontal) level, security assurance system, standard specification system and operation and maintenance system run through all levels of the platform to ensure that the internal (vertical) platforms conform to standards, safety and reliability, thus ensuring the system's operational quality. In terms of internal (vertical) level, each platform provides technical support from bottom to top, and finally provides a display platform for users to ensure the effective operation of the system.

The system platform is mainly composed of five modules: map data point, data entry, data search, data display and data application.

Figure 2. Logical architecture diagram of the system

4.1 Map data points
The main page of this module displays the map of the Yangtze River Basin. Users can zoom in and out on the map. The module provides satellite map, road condition map, traffic map and other layers. Data points can be edited along the river basin. You can click on the data points to view all the measured data in the corresponding location.

4.2 Data entry
This module mainly relies on users to input the latest watershed data, and can be used for single or batch data uploading. The uploaded data backstage will automatically detect and classify the types and upload them to disk array. The storage folder structure is: /Upload/data type/experiment type/time/file, and the information is saved to the database.

4.3 Data Search
Users can perform fuzzy or precise search under this module.
Fuzzy query: the users can input the corresponding conditions in the search input box and click the search and send the search parameters request to the backstage through methods of \textit{ui} and \textit{ajax}. Then the backstage gets the parameters to the database search and returns the results to the list.

Precise search: the users fill in the contents in the detailed search box and search it. Similarly, sending the search parameters request to the backstage through methods of \textit{ajax}. Then the backstage gets the parameters to the database search and returns the results to the list.

4.4 Data display

The function of this module is to display all picture and text video data stored on the platform. The page displays the data classified by the upper, middle and lower reaches of the Yangtze River. Click the corresponding data to display the backstage data to the data list through \textit{ajax}.

4.5 Data Application

At this stage, the module can draw three-dimensional topographic maps of before and after channel erosion and deposition, and its contrasted situation according to the .dat data, and extract the sections from the comparison results. In the future, new functions will be introduced to provide researchers with a convenient cloud-based office environment.

5. Conclusion

This paper proposes a solution of river big data management based on computer cloud platform. This system is designed for river geographic information data, and its focus is to sort and classify the data itself, so as to achieve unified data standards, real-time update of data and accurate search of keywords. The platform has basically completed the above functions and put into use, realizing the design objectives of a set of standards, a map, a database and a platform for the whole basin. In the future, we will continue to improve the platform and realize the goal of cloud office for scientific researchers as soon as possible.

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