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# Research on the Smart Information System of Weihe River Basin

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**Abstract.** To avoid the problems of imperfect function, single content, insufficient application of new technology and low management level in the Weihe River Basin (WRB) information system, a smart WRB information integration system is established. The application of intelligent water conservancy business is developed to serve for decision-making. Firstly, the master plan of building smart WRB information integration system is put forward. Secondly, several information technologies including the Beidou technology, big data, cloud computing, three-dimension technology are used to build the overall framework of smart WRB information integration system. Lastly, based on the smart WRB system, massive information integration, intelligent forecasting and warning, smart response is exploited. The results demonstrate that the smart WRB information integration system is able to integrate the massive information, share information resources and improve the ability of user's quick response while presenting the three-dimension visualization.

## 1. Introduction

Informatization of China has been developing rapidly under the national policy. In the development procedure of the construction industry information, the International Business Machines corporation (IBM) first put forward the concept of smart city and raised the curtain of the new generation of information technology application. The smart river basin is elicited by the smart city. According to the unique climatic conditions and terrain features of the basin, the intelligent plan to deal with the basin problem is formulated, the most strict water resource management system is implemented, the green, informationized and modernized watershed is promoted, and a new comprehensive management strategy of the basin is provided. As the lifeline of the water system in the development of Guanzhong area, WRB has a great effect on the development of the national economy and agriculture and plays an important role in social progress. Therefore, it is urgent to construct the smart WRB.

In the water conservancy industry, the research and application of modern management in developed countries started earlier. The application of information technology has been playing an important role in the construction and management and other aspects, and has obtained great benefits. In the United States, remote sensing technology is widely used in data acquisition. In addition, microwave, ultrashort wave, optical cable and satellite technology have also been applied to the greatest extent. Computer simulation technology is widely used in flood forecasting and dispatching of

water, which improves the comprehensive utilization level of the whole water resources system. In terms of decision support, the policy support and simulation system are established according to the characteristics of rivers. The automation and semi-automatic monitoring network of rivers in developed European countries has been basically improved. The acquisition of hydrology and meteorology is also basically automated. Although the smart basin started late in China, it developed rapidly. In view of the construction of smart river basin, many experts and scholars have carried out extensive research, gradually applying the concept of intelligent basin to practical application, and obtained some beneficial results [1-2]. Based on Hydro-EST, Jiang Rengui [3] developed water conservancy theme services, such as flood prevention and warning monitoring, reservoir migration visual simulation, sudden water pollution event simulation and the most strict water resource management. It possesses a complete theoretical and technical system, and the water conservancy information is used in practical projects. Yan Denghua et al. [4] put forward the crucial task of comprehensive watershed management, which clarified the overall needs of the system governance of the water problem in the changing environment and the general idea of the intelligent basin construction. It wrote the bright blueprint for the intelligent basin.

As a basic natural resource, the natural and social attributes of water resources indicate that the future direction of water resources development is the integrated management of water resources on level of basin. The smart WRB proposed in this paper is the framework of the traditional map by building a "smart basin" based on the information technology, such as Beidou technology, large data, cloud computing, and 3D technology. The smart WRB information integration system of WRB is constructed. It can realize the applications of massive information integration, intelligent forecasting and warning and smart response and so on. The ecological environment problems such as water shortage, water and soil erosion, water pollution aggravation and river silt will be solved, and the concept of green development is fully implemented. It is of great significance and practical value to the rational development of river basin water resources management and the mastery of the mechanism of water circulation in the basin. It provides basis for water resources management, development and utilization in WRB.

## 2. The Master Plan of the Smart WRB

### *2.1 Study area*

The WRB locates between 33.68ºN-37.39ºN latitude and 103.94ºW-110.03ºW longitude. The northern part of the WRB is the Loess Plateau, the south is Qinling Mountains. The total length of WRB is about 818 kilometers. The WRB passes through the central Shaanxi plain, moistening eight hundred square kilometers of land, and plays an irreplaceable role in the development of shaanxi province. The WRB is the lifeblood of the construction of the Silk Road Economic Belt and the development of the western region of China.

### *2.2 General idea*

The general idea which is "the construction of sky-ground-air integrated intelligent monitoring equipment-the construction of massive information integration and sharing center-the construction of the smart WRB Information Integration System-the theme service application of the smart WRB" is followed. It represents the process of collecting, transmitting, storing, processing and servicing in water informatization. Finally, the "live" map is put in the pocket, and manager can check the real-time dynamic of WRB at any time. The concept of green development is fully implemented. Our system can guarantee the transformation from traditional water conservancy to the smart water conservancy.

### *2.3 Overall framework*

The overall framework of the smart WRB is composed of a dynamic sensing layer, a data transmission layer, an application supporting layer, and an intelligent application layer, as shown in figure 1. The

dynamic sensing layer provides users for an entrance of service function and combines each relatively dispersed module into a unified whole. This layer accesses the intelligent application layer through the interface. For example, through the computer, mobile phone, sensor nodes, RF tags, QR codes, monitoring probes, drones and so on, the system automatically realizes the input and output of effective information such as water, geography and meteorological conditions. The data transmission layer provides data support and data transmission functions to the system. Using big data and cloud computing technology to build a data center, water business data can be analyzed and mined. The integration application of the WRB data is realized. The comprehensive integration system is constructed by applying support layer offers. Use 3S technology to integrate and process multi-source spatial data, and apply 3D visualization technology to enhance users' real-time perception, information sharing and intelligent analysis capabilities. The smart WRB information integration system is built by World Wild platform construction technology, which provide development and operation environment for application services. The intelligent application layer is combined with the data transmission layer and an application supporting layer to form a system application. Combining water conservancy business data, the smart WRB information integration system realized the theme service of water conservancy business. The method of combining theory and technology with actual business is adopted to provide users with various visual tools and information services by utilizing the advantages of multi-source data fusion and interdisciplinary research [5-6].

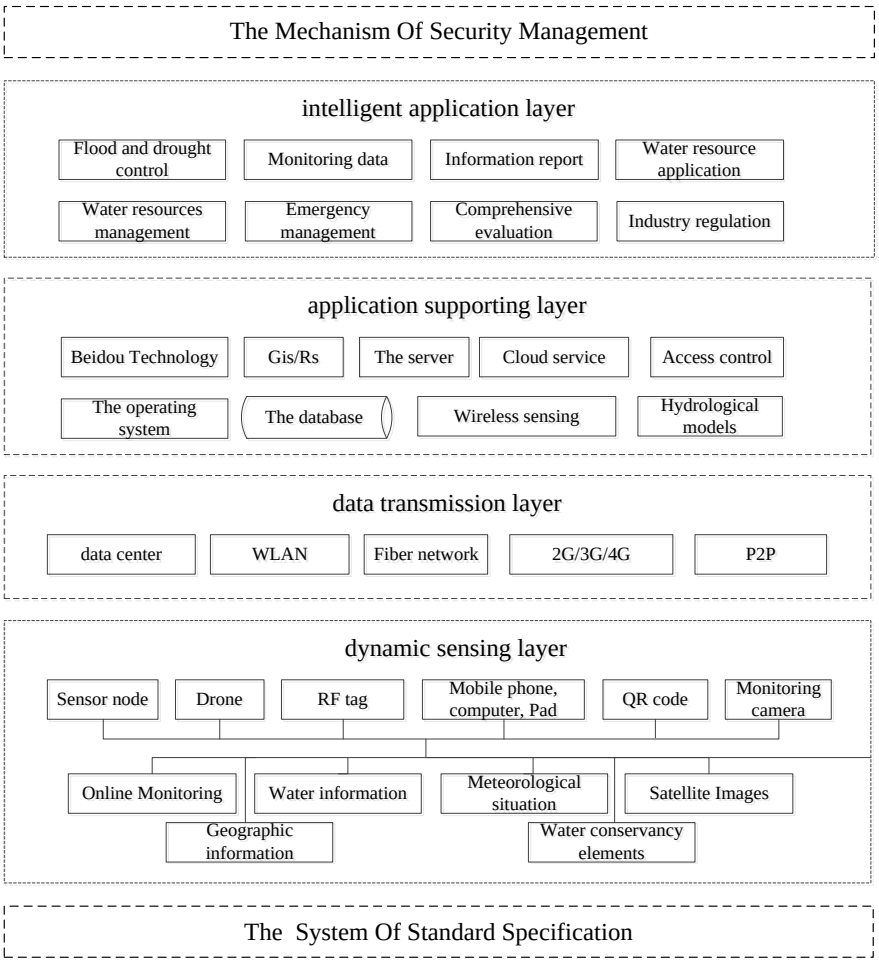


**Figure 1.** The overall framework of the smart WRB construction

## 3. An application example of the smart WRB

### *3.1 Massive information integration*

In the traditional WRB management, it is necessary to manually record a large amount of meteorological and hydrological data into the database or record the data through sensors, and data still need to manually proofread and modify. The traditional method of information processing is inefficient, and the processing results cannot be guaranteed to be accurate and efficient. Intelligent information processing based on the smart WRB has the following functions: identify misleading information, quickly eliminate error data, geometrically correct some images, extract effective information and shorten working hours. The problem of hydrological data in WRB management is solved by massive information integration, and the data of rainfall and runoff can be obtained in real time and automatically. The construction of the integrated system of the smart WRB enables the integration of information resources among between the water administrative departments at all levels of the WRB, the water management agencies and other functional departments, so that the data can be accurately and real-time transmitted to each other, and the sudden problems can be communicated and addressed in time.

### *3.2 Intelligent forecasting and warning*

The construction of "sky-ground-air" integrated intelligent monitoring equipment is mainly realized by automatic monitoring equipment such as Beidou technology, ground monitoring station, remote sensing technology and aerial image of drone. For example, according to the flood forecasting intelligence in the smart WRB information integration system, the relevant departments can notify the personnel to evacuate and prepare the flood control materials in advance. When the heavy rain arrives, the water level of the monitoring point approaches the warning water level line. The information is quickly reflected in the integrated information system of the smart WRB through the Beidou satellite navigation system. The decision makers immediately make flood prevention preparations to propose solutions, reduce emergency time and improve emergency efficiency. That non-engineering measures will minimize people's livelihood and economic losses.

### *3.3 Smart response*

Relying on the smart system, the sudden water events in the WRB are promptly dealt with, and it can provide functional support for water resources security. Building visualization environment by using spatial information technology can realize the main functions, such as monitoring, forecasting, warning, information reporting and decision-making, which are to satisfy the need for emergency management of water incidents. In intelligent services, forecasting is a difficult link in water management, and it is often difficult to accurately predict the results. The smart WRB information integration system can simulate and predict future water resources through a variety of hydrological models which are based on the latest statistical data. It can give more accurate range values and provide reliable guarantees for solution. On the smart System, users can quickly access the latest data and get the results of their analysis. Policymakers can adjust the decisions appropriately according to current policies or plans and make the superiors do the decisions. The construction of the system not only makes the communication between the level and the department convenient, but also renders the rapid transmission of information. The efficiency is improved in the water resource management decision.

## 4. The application value of the smart WRB

### *4.1 Improve the ability to quickly respond*

The security of the WRB is related to the overall situation of national economy and social stability. The project comprehensively improves the ability to quickly respond from the aspects of information

collection, transmission and application. In the information collection, through the construction of remote sensing, telemetry, and automatic acquisition systems, the traditional manual-based information collection methods are transformed to shorten the information collection duration.

### *4.2 Enhance the scientificity and accuracy of decision making*

Scientific decision-making is based on comprehensive and accurate information. Relying on the information superhighway, user can greatly increase the scope of data collection, reduce the probability of information errors, improve the efficiency and quality of data collection and provide comprehensive and accurate information for decision-making.

### *4.3 Achieve high sharing of information resources*

Due to the limitation of management system and technology, it is difficult to share information resources, which restricts the development of the work of the WRB. The implementation of the smart WRB not only enriches the types and quantity of information, but also improves the transmission speed of information. Moreover, the unified management, organization and the efficient sharing of information are realized through the construction of the data center, which avoids repeated development of information resources, saves the cost of investment and makes significant economic benefits.

### *4.4 Improve the quality and efficiency of administrative work*

The construction of e-government not only has accelerated the transmission and processing speed of internal information in various units, but also broke geographical restrictions. All units can widely access and utilize various information resources to improve management level and work efficiency.

### *4.5 Enhance social participation*

In recent years, problems such as the cutoff of the WRB and the deterioration of the ecological environment have been paid widely attention to domestic and abroad. With the implementation of the country's western development strategy, the governance and development of the WRB has attracted much attention. The construction of the smart WRB information integration system enables all sectors of society to participate and create a better future.

## 5. Conclusions

The smart WRB information integration system provides information services for the rational use of water resources, water and soil conservation, water conservancy construction and management of the WRB. The system provides various services and information for relevant water conservancy departments, and improve water resources monitoring and decision-making capability. It can form a work platform and a decision-making environment to grasp the overall situation of water resources development and utilization in the WRB timely and accurately. And manager will implement the management system of water resources better, to realize the optimization of allocation, efficient utilization and scientific governance.

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