Realization of Hydrological Forecast Monitoring System Based on GPRS and Websocket

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Abstract: According to the characteristics of hydrological forecasting and the problems of data transmission, a hydrological forecasting monitoring system based on GPRS wireless communication technology and Websocket technology is proposed. Firstly, the system uses MSP430 MCU as the controller to constitute the farmland terminal, which can collect and process farmland information. Then, the MCU controls GPRS module to transmit data to the server of monitoring center through GPRS network and Internet. Users can query all kinds of information in real time and remotely through the Internet. This system focuses on the remote transmission of data and the use and sharing of farmland information. Experiments show that the system runs stably and can collect, transmit and display the environmental data of farmland in real time.

Hydrological forecast information is an important data source and parameter for agricultural expert system analysis and decision-making. Real-time and fast information collection is an important basis for promoting precision agriculture and agricultural modernization management. Accurate and real-time agricultural data can better help people carry out production and planting activities, and can carry out early warning and control of various pests and diseases. Therefore, the hydrological forecasting monitoring system is of great practical significance. It can effectively reduce human consumption and impact on hydrological forecasting, at the same time, real-time access to hydrological forecasting information, help agricultural scientists and technicians to clearly grasp the status of farmland and make appropriate control measures.

Most of the existing hydrological forecasting and monitoring systems are aimed at the plain greenhouse environment. However, in the face of more complex hydrological forecasting, such as mountains and hills, how to transmit the collected data quickly and how to maximize the sharing and use of farmland information is an important issue [2]. GPRS (General Packet Radio Service) is a mobile communication technology of packet switching. It has the advantages of permanent on-line, fast transmission, flow-based charging and low cost. And GPRS covers a wide range of areas, almost all mobile phones can use GPRS where they can talk, so it is very suitable for field communication in remote farmland. It is based on the above advantages that GPRS is chosen as the key technology of system wireless communication.

1. System Design

The hydrological forecasting and monitoring system is divided into three layers: data acquisition and transmission, data receiving and storage, data use and sharing. The system structure is shown in Figure 1. Firstly, the data acquisition terminal arranged in the monitoring farmland mainly collects, processes and packages farmland information such as temperature, humidity, illumination, etc. Then GPRS module transmits the data package to the server of the monitoring center through GPRS network and Internet. Finally, the use and sharing of hydrological forecast data is realized with B/S architecture. Users can access the server through the Internet, real-time query, browse various environmental information data and download the required Excel forms. The server of the monitoring center is mainly composed of Websocket server and database server. In order to facilitate management, the two servers are placed on the same host.

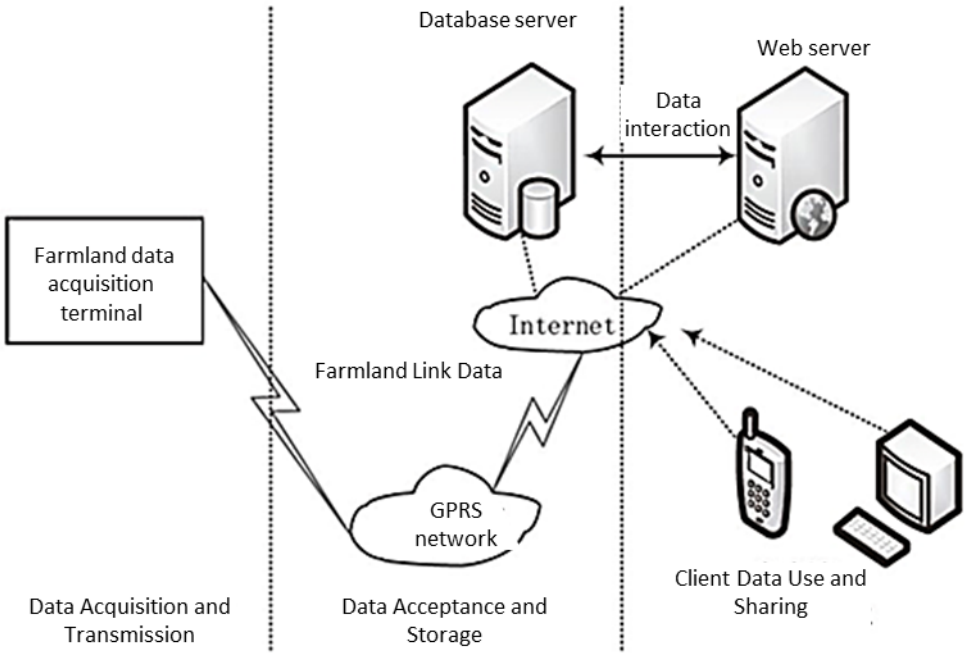

Fig. 1 Systematic Structure Diagram

2. Realization of System

2.1. Data Acquisition and Transmission

The farmland data acquisition terminal includes sensor acquisition module, controller module, GPRS communication module and power module [4]. Figure 2 shows the structure of farmland data acquisition terminal, which can realize the collection, processing and remote transmission of farmland information data. Sensor module includes all kinds of sensors needed by the system, which is responsible for collecting all kinds of information and data. The system uses MSP430 MCU as the control module. The MCU will control the sensor to collect farmland data, and then send data through GPRS module. GPRS module is embedded with TCP/IP protocol. MSP430 MCU sets up GPRS module through AT instruction, and the two modules are connected through serial port. GPRS module obtains IP address and port number of PC in monitoring center, and can transmit data packets to server remotely through GPRS network.

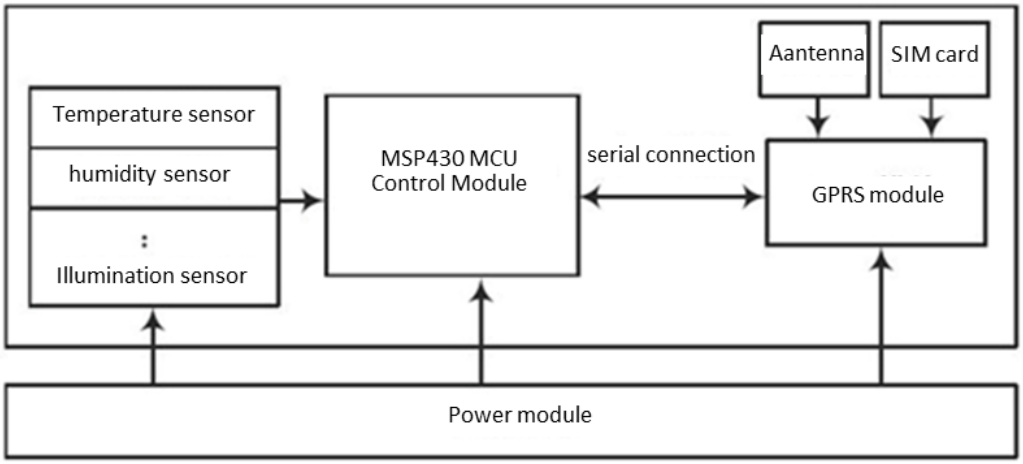

Fig. 2 Structure diagram of hydrological acquisition terminal

2.2. Data Acceptance and Storage

As the monitoring center server PC is located in the laboratory, i.e. LAN, without static IP, so the

Peanut Shell software with dynamic domain name resolution function is used, and the Peanut Shell of Intranet Edition has Intranet Mapping function, so the server does not need to map a local port to the Internet. Users can access the server of the monitoring center by accessing the domain name bound by peanut shell.

The server of monitoring center adopts streaming Socket, which is aimed at connection-oriented TCP protocol [5]. Socket includes IP address and port, which is used to communicate between two programs in the network. First, the monitoring center's host opportunity creates a socket responsible for listening, which is responsible for listening on the specified local port. The GPRS module has acquired the dynamic domain name and the specified port number of the host computer, and created the Socket to connect the host computer of the monitoring center. After receiving the connection request of the farmland terminal, the host computer generates a new Socket to establish the connection communication with the GPRS module, and then the data packet is received and stored in the server buffer. After the data transmission is completed, the Socket connecting the two modules is closed. The original monitor Socket continues to listen, waiting for the next connection request. The received data packets are parsed in a custom frame format and stored in the MS SQL Server 2005 database through ADO.NET according to the fields. The upper computer receives data as shown in Figure 3.

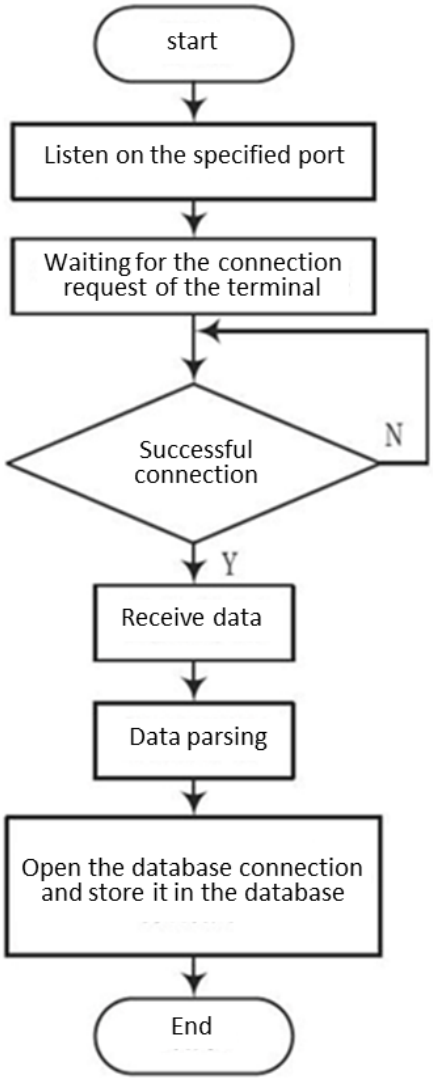

Figure 3 Upper computer receives data

2.3. Data Use and Sharing

The system adopts C and ASP.NET to implement the browser and server (Browser/Server, B/S) architecture, and the Websocket server is released by MS-IIS (Microsoft Internet Information Server,

MS-IIS) technology. The database adopts MS SQL Server 2005, which has good security and accuracy and high data processing efficiency. In the database, several tables such as farmland information data table, administrator information table, user information table and alarm information are designed. The system mainly develops Websocket website in Visual Studio 2010 with C# language.

According to the functions, the environmental monitoring website is divided into two parts: the front-end function module and the back-end administrator module. After the user logs in on the front page, he can send a request to the Websocket server on the network through the browser. The Websocket server responds to the request of the browser and returns the user's operation home page to the browser. The user can inquire and browse the real-time data and historical data by inputting the data inquiry parameters, and can draw the dynamic curve of the information of each node. It is more convenient to use and analyze data by finding and exporting Excel data tables. In order to facilitate administrators to maintain the server and ensure the security of data, the website also set up a background management module, administrators can enter the background management module from the front page, to manage the information of administrators and registered users. The system can also set different levels of authority for users.

3. System Testing and Result

When accessing from the external network, enter the dynamic domain name bound by peanut shell in the address bar, and visit the hydrological forecast monitoring website of the system. After successful registration and login, it enters the data curve page of the monitoring platform and realizes real-time and remote query of data. Figure 4 shows historical data query pages and data curve pages respectively. The results show that during the test period, the whole system can basically run steadily, and the collected data are more accurate and reliable.

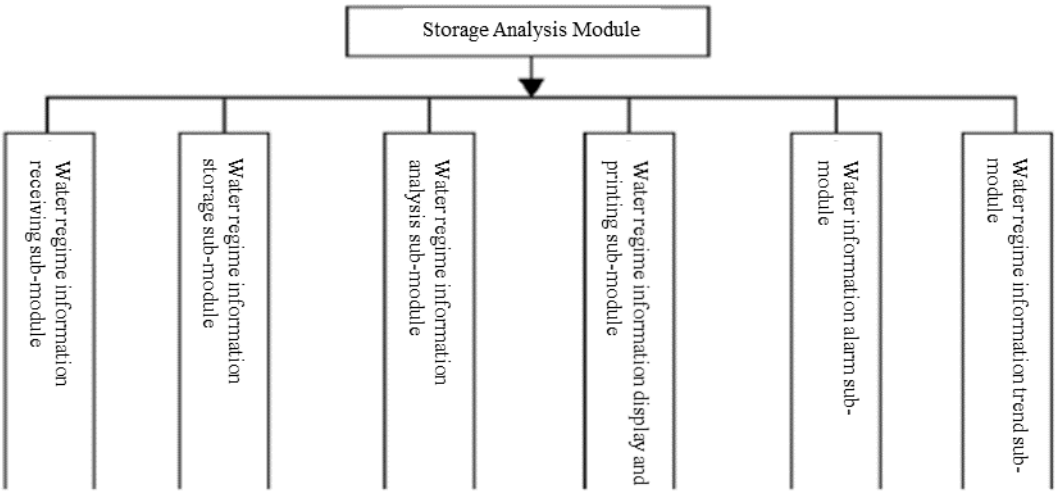

Figure 4 Functional Framework of Storage Analysis Module

Websocket website has also been tested in many ways, such as including database links, buttons, report refresh and other functions of the website function test, the results show that the basic realization of the web page function; website performance test mainly includes the user load and page response speed that the website can withstand at run time. Testers visit websites under campus network, Unicom Network and telecommunication network respectively. The test shows that the response speed of pages is faster and basically meets the needs of users. The browser compatibility test shows that the websites can run normally and steadily from IE, cheetah, 360, Sogou and other browsers.

4. Conclusion

Through the investigation and Research on the status quo of hydrological forecasting monitoring

at home and abroad, wireless data transmission mode and Websocket information publishing technology, a hydrological forecasting monitoring system based on GPRS wireless data transmission and Websocket information publishing is built, which can realize real-time data acquisition, transmission and distribution. Although the system is universal, there are also unstable factors. For example, bad weather will not only interfere with the real-time and accuracy of information collected by sensor nodes, but also affect the remote transmission of farmland data. The shortcomings and shortcomings of the system will be continuously improved in the future research, so that it has good practicability and better versatility.

References

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