Remote monitoring system design based on configuration software

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***Abstract*—Configuration software adopts configuration program mode, and has good secondary development function and portability. After analyzing configuration software of home and abroad, a set of remote monitoring system that monitors soil moisture is developed using KingView 6.55 in this paper. This system realizes online monitoring dynamic display of real-time data, historical data recording and inquiring, remote access. The system was tested in Haikou. The result shows that the monitoring system provides real-time and precise data, and has good scalability and stability. It meets all the demands of remote monitoring.**

Keywords- remote monitoring; configuration software; soil moisture

I. INTRODUCTION

Configuration software is also called configuration monitoring software. Many functions of the software are designed as function modules, and it supports various mainstream industrial control equipment and standard communication protocols, also provides distributed data management and network function. During the secondary development, it is only needed to call the corresponding function modules and complete system communication to design a monitoring and control system. If needed, the system can be developed in C++ or VB language. As a development platform, the software has the characteristics of agile configuration, short development cycle, low secondary development cost, strong commonality, etc. It is widely used in electric power, mining, transportation and other industries. At present, the mainstream configuration software abroad includes InTouch, IFix, WinCC and so on. Domestic configuration software contains KingView, PCAuto, Centurystar, etc[1].

Soil moisture content refers to how much water the soil contents. It is one of the main factors of soil fertility and the basic conditions of crop growth [2]. Mastering soil moisture accurately can not only give guidance to irrigation, but also is the important information of agricultural management department to allocate water resources. Because the previous measuring methods has the disadvantages of big workload, inaccuracy and so on , it makes soil moisture detection method develop more intelligently and remotely with the development of computer, network, communication and testing technology[3-4].

This system is developed based on the configuration software to monitor soil moisture content.

II. SYSTEM STRUCTURE

Overall system structure can be divided into three layers, which are data acquisition layer, network transmission layer and data processing and application layer. Function of data acquisition layer is to realize the data collection. Network transmission layer transmits collected data to the monitoring center wirelessly with GPRS module implement and Intranet/ internet. Data processing and application layer is the core of the remote monitoring system, which receives, analyses, processes, stores the data, and publishes website. The monitoring center consists of server and end users. Figure 1 is the system structure diagram. Data acquisition layer includes sensors and I/O module. Network transmission layer includes GPRS module and Ethernet switch. Data processing and application layer includes monitoring center and terminal clients.

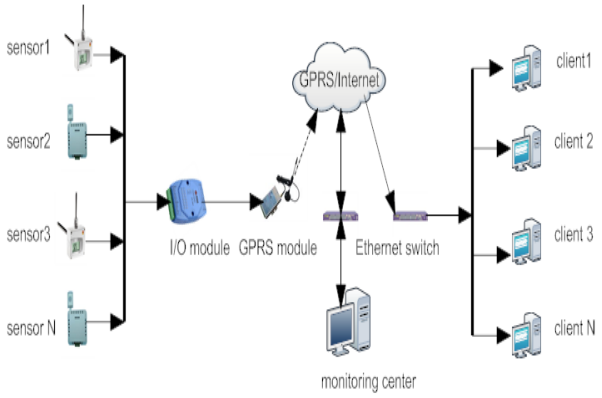

Figure 1 system structure diagram.

III. THE DESIGN OF SYSTEM HARDWARE

In order to realize the field data collection, transmission and processing, the system hardware includes sensors, distributed data acquisition I/O module and GPRS module. Every part of the system hardware performances their corresponding functions. The output of sensors is current, which rang is from 4 mA to 20mA. These sensors are connected to I\O module. I/O module collects all the data of the sensors and transmits the data to GPRS module through RS485. One I/O module has eight input ends and can connect eight sensors. The hardware is connected as Figure 2.

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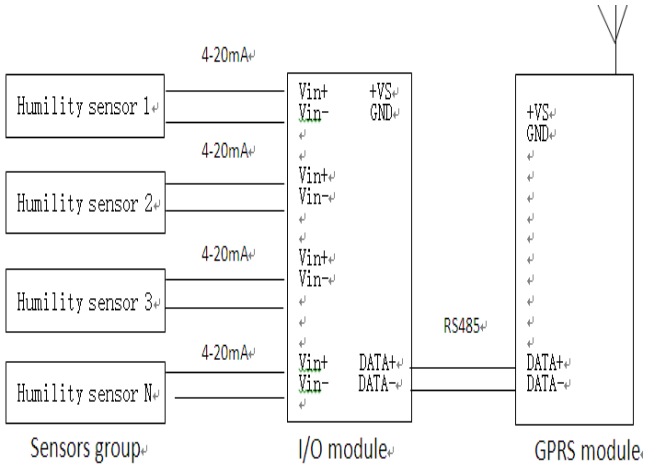

Figure 2 Hardware connection diagram

A. *Humility Sensor*

Because field data collecting circumstance is not good, in order to collect and monitor soil moisture accurately, the demands of power consumption, measurement range, and accuracy are high for sensors, and this system chooses the kind of humility sensors, which error is within 5% and working temperature is from -10 centigrade degree to 60 centigrade degree. Its output is analog output, and output current is from 4mA to 20mA. Supply voltage is from12 V to 24V.

B. *I/O module*

Distributed data acquisition I/O module adopts general industry standard communication protocol and Modbus protocol. Its eight inputs and output are analog. Eight inputs are connected to the sensors, and output is connected with the GPRS module through RS485.

C. *GPRS module*

GPRS module is the core module to connect the data acquisition equipment and remote control center. It transmits field data received from I/O module to the GPRS network. According to the monitoring center communication protocol, IP address and port mapping number and so on, the module parameters is set with serial debugging tools. The serial port communication protocol to set parameters is RS232. A SIM card is inserted in the GPRS module to communicate.

IV. THE DESIGN OF SYSTEM SOFTWARE

System monitoring software function is divided into several small parts, which are real-time data receiving, processing, analysis, display, historical data recording, querying, and remote monitoring and accessing. As for the real time data reception, remote monitoring and accessing, the system needs to be connected to Internet. But for real-time data analysis, processing, display, recording and querying, they can be finished on monitoring center server. All the system functions are realized in special server. I/O server finishes data acquisition. Historical data server realizes data storage. Remote online accessing uses Web server [5]. In this system all servers are concentrated on a big computer.

A. *Data receiving*

As for data receiving, monitoring center needs to define every sensor as an I/O type variable. Every GPRS module is look as a virtual device. Setting variable type and range is according to the sensor measurement range. I/O variable's two extreme values are equal to the sensor's two extreme values. In order to make I/O variable reflect the real-time data, it is needed to associate virtual device. According to different hardware definition, I/O variables choose corresponding registers and complete data receiving. When defining a variable, alarm events and recording data collection are defined as needed. But data recording is necessary if needing historical data.

B. *Real-time data processing , display and analysis*

Real-time data processing is one of the important functions of the monitoring center. The real time data is displayed in the form of digital signal in the interface, and can be analyzed by trend curve, temperature control curve and super x-y curve. User can know the tendency from the curve directly. The other way to show real-time data is dynamical number. The system monitors the real-time data all the time, if the collected data is different from the last time, the dynamical number in the monitoring interface changes too

C. *Historical data recording and querying*

The system records field data and stores it in the data server. The methods to analyze historical data are historical data report and history trend curve. User can call historical data within a year from data server in the form of historical data report according to actual need. Called information includes date, time and variable. The other way to call historical data is history trend curve. History trend curve is a more intuitive method to analyze historical data, including the following information of maximum, minimum, and alarm events and so on. The historical data recording and querying not only provides past soil moisture content, but also guides irrigation. Figure 3 is data report of Haikou monitoring site.

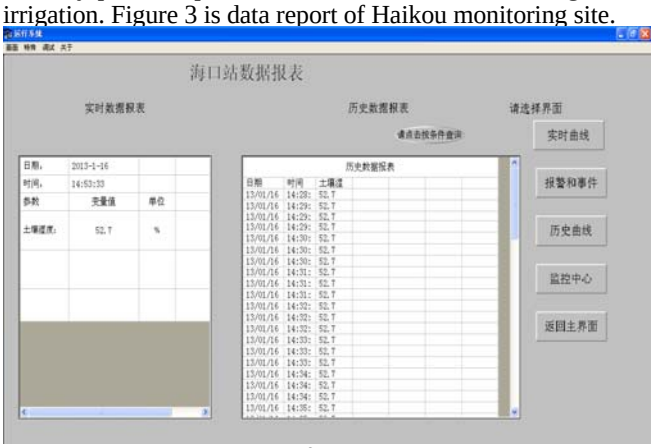

Figure 3 data report of Haikou monitoring site

D. *Database access*

The database is an important part of the system to store data. In order to improve the data sharing, the system's database can not only be allowed to access other database, but also allows other databases to access system's database. Also the system can use DDE (Dynamic Data Exchange) to visit other application software in the form of dialogue. Other applications can access system's database in the same time. Specific access method is showed as table 1.

System visit other database or application software		Other databases or application software visit system	
Database/ application software	Visit method	Database/ application software	Visit method
Oracle6	Start SQL*Net TSRNETINIT.EXE	OPC	Define related visual device and variables
Oracle7.2	Install Oracle Standard Client and run SQL-Net Easy	DDE	The same way as DDE visit the system
Sybase、MS SQL Server	Windows's user use SQLConnect() to connect	Active X	Use KvTcpipClientOcx.ocx
EXCEL	Define related DDE visual device and variables	EXCEL	Define device and I/O variables

Table 1 access between system database and other database or application software

E. *Remote access*

WEB publishing is based on ActiveX technology using B/S structure. Before WEB is published, it is needed to set data server and WEB server. WEB server is connected with data server. Data server is looked as remote server and WEB server is regard as client. I/O variables in WEB server are remote variables defined in the data server. In order to realize remote visit, it is needed to use system WEB tools for website releasing. Procedure as follow: firstly installed IIS (Internet information service) components, and then add the configuration king's common control manually, then configure the local area network firewall or router communications port. So requirement of monitoring center is finished. For remote user, his computer also need install IIS.

After WEB is published, user whose computer is connected with Internet inputs monitoring site published by WEB server and then login in the monitoring interface. Remote user can check all parameters with IE browser. In this system, inquiring the historical data is allowed to all users too. So data remote access is realized.

V. SYSTEM COMMUNICATION

System communication is important not only for data collecting, but also for remote access. There are three ways to realize system communication, which are domain name resolution, port mapping and open private network (APN). Domain name resolution and port mapping are easy and practical. APN is the safest, but the expense is very high. From the practical use and operating cost angle, this system chooses port mapping. It is needed to set port mapping on the school Ethernet switch. The mapping number in this system is 2021.

VI. SYSTEM RUNNING

After connecting system hardware correctly, it is time to run monitoring software on the server. Firstly, the system initiates GPRS module drive and KVcom, and then finds and connects the corresponding identification number of GPRS module through the mapping port. After building a successful connection, the system begins to accept data from GPRS module, and displays in the interface on the monitoring center. The process is as Figure 4.

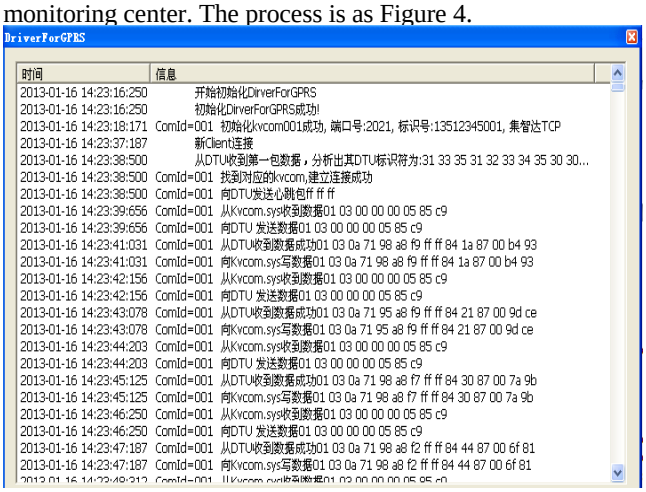

Figure 4 the system's initiation

After system operated and WEB released successfully, the user input monitoring website in the browser and then can login in monitoring interface. So it comes true to realize the remote monitoring purpose of soil moisture content. The proper operation is allowed within the authority for the user. Figure 5 is the main interface and Figure 6 is the remote monitoring interface in browse.

Figure 5 the main interface

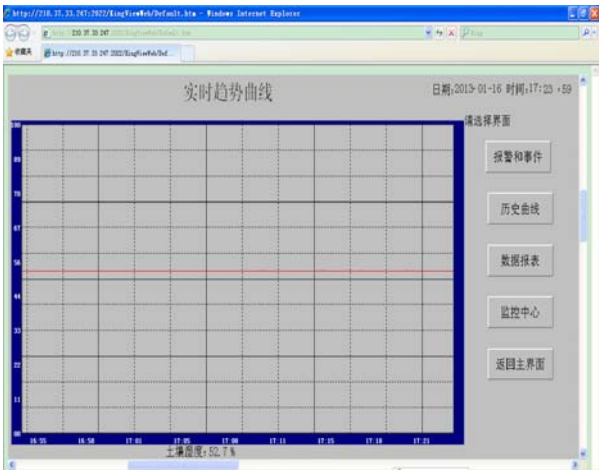

Figure 6 the remote monitoring interface in browse

VII. CONCLUSION

The remote monitoring system is developed based on configuration software platform with the characteristics of low cost and short development cycle. It takes the system very short time from initialization to receiving the first packet. If changing these sensors on data acquisition layer, the system can be used for different monitoring purpose. And if configuring more GPRS modules, the system can realize more monitoring sites, so the system has a good scalability. Besides the system has a good stability according to the test result.

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REFERENCES

[1] Ge. Bo, Shen. Wen. Jie， Zhao.Xua，“Application and Comparison of Industrial Control Configuration Software,” Computer Measurement &Control,Vol.8, Oct, 2002, pp.550-552.

[2] Shen .Zhenrong, “Water resources scientific experiment and research: the mutual transformation relationship of atmospheric water, surface water, soil water, groundwater”. Chinese Science and Technology Press ,China, 1902.

[3] Yang.Weizhong, Wang.Yiming, Shi.Qinglan, Gao.Jing, “Development and application of soil moisture monitor system in Jilin Region,” Transactions of the CSAE , Vol.26 Supp.2 Dec,2010, , pp.177–181.

[4] Chen.Tianhua, Tang.Haitao, “Remote monitoring and forecasting system of soil moisture based on ARM and GPRS,” Transactions of the CSAE, Vol.28, No.3 , Feb, 2012, pp. 162–166.

[5] Mo.Shaoli,Wu.Haiyan,Huang.Tiezheng,Qiao.li, “Application of Configuration Software Based on Web,” industrial control computer,Vol.21,No.6,2008,pp.3-4.