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Wireless thermal charging system based on GPRS technology[1]

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Abstract. The thermal station dispatch department needs real-time monitoring of users in different geographical locations, the purpose of real-time monitoring is to record the heat transfer station temperature, pressure and other parameters, and according to the various heat transfer stations to monitor the parameters of the data, the operation of the heat transfer station to adjust to ensure the normal operation of winter heating. In this paper, General Packet Radio Service (GPRS) technology made a brief introduction, according to the characteristics of thermal enterprise monitoring system, a solution based on GPRS wireless thermal monitoring system is put forward. Aiming at the running effect and practical application of the system, the test method to meet the requirements is put forward, and the test results are analyzed. The function and design of the module can effectively meet the needs of thermal remote meter reading business.

Key words. GPRS, wireless network, TCP/IP protocol, database.

1. Introduction

For all users of different geographical locations in the city, thermal dispatching departments need real-time monitoring and meter reading of thermal data [1–3]. The monitored object is represented by the basic parameters in the thermal network: temperature, pressure, flow, average flow and instantaneous value. At present, the heat industry meter reading information management is based on the traditional manual meter reading, as there is practically no application of intelligent automatic meter reading system. If all the work has to be done by manual meter reading, it is a time consuming and quite inefficient way [4–6]. Collecting or reproducing heat meters for real-time data requires manual operation, seriously affecting collection

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efficiency [7–10]. Although many thermal power companies have implemented a variety of meter reading management mechanisms, the meter reading effect is still unable to be fundamentally improved and improved, increasing the workload of thermal enterprises and reducing the efficiency of instrument reading [11–12].

Based on the above reasons, a GPRS-based wireless network with remote calorimeter reading information system is established, which can realize the collection of field parameters of various users and the real-time communication of data commands.

2. System working principle

Remote wireless heat meter reading systems include data collectors, data concentrators, data servers, wireless networks, and Internet. The data collector receives the hot data, analyzes them and sends them to the concentrator over the wireless network. The data concentrator sends the data to the data server over the GPRS network, which stores the hot data in the database. When the administrator needs to monitor the thermometer in real time, the data server sends the data acquisition command to the concentrator through the GPRS network, and the data concentrator performs the operation. An example of the network structure of 4G in remote meter reading system is depicted in Fig. 1.

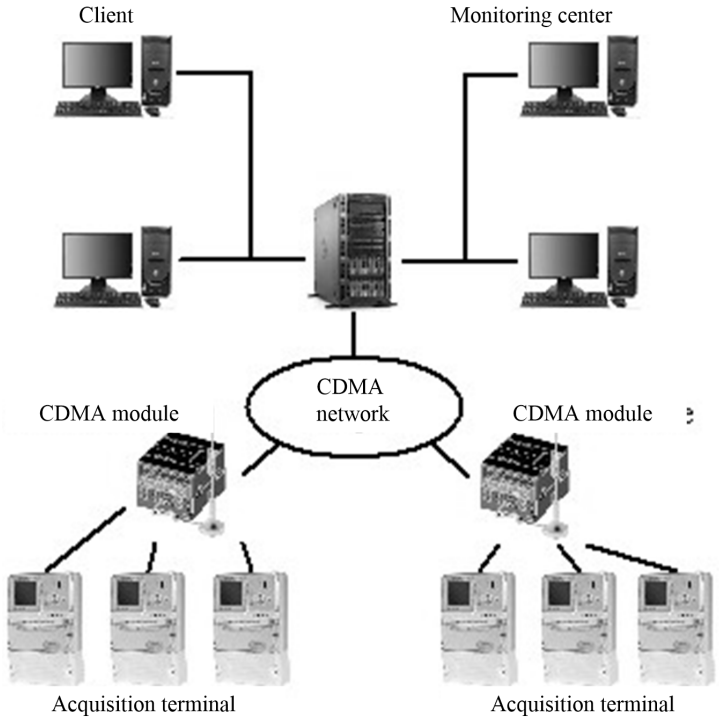

Fig. 1. Network structure of 4G in remote meter reading system

3. System outline design

3.1. Overall functional framework

Remote meter reading information system functions are: user management (import or export), heat table management (replacement table records), instrument readings display, system maintenance (rights management, system log, parameter maintenance), query statistics (user defined).

The system can automatically read the operating parameters of the heat meter, remote monitoring heat meter, read real-time heat values and real-time display hot-cost information.

Based on the demand analysis of the whole system summarized in the last section, the overall functional framework of the remote meter reading system is designed. The overall function frame diagram of the system is shown in Fig. 2.

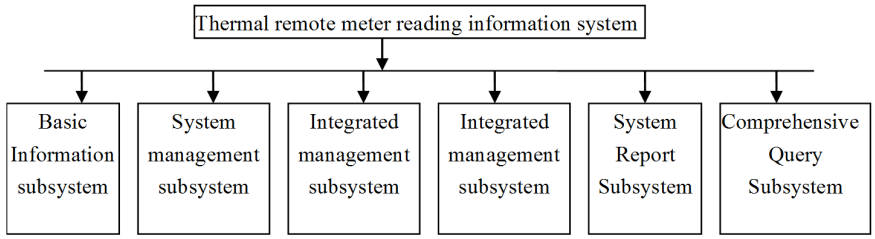

Fig. 2. System overall function

The software uses B/S structure and does not need to install the client software. It can be able to use the remote meter reading management function.

3.2. Database design

Information of the data involved in the system are mainly district information, heat exchanger station information, community information, building information, user information, user housing information, housing information, meter reading information, concentrator information, and heat meter and concentrator log information. Effective management and maintenance of these data is the core and the basis of the system. The performance of the whole system is good or not. The database design is based on the characteristics of different data and application processes, design science and reasonable database deployment plan to meet the unified management and efficient requirements on application of thermal remote meter reading information system.

The system database is a large database Oracle, version 11g Oracle. According to the analysis of the demand of the user data, the logical model of the system is established, and then the physical structure of the database is designed based on the logical model. Finally, the main physical structure of the database is as follows:

Large area information table xt_dqxx; heat exchange station information table xt_hrzxx; cell information table xt_xqxx; building information table xt_lfxx; user information table xt_yhxx; user housing information table xt_yhfwxx; housing information table xt_fwxz; meter reading information cb_cbxx; concentrator information table jzq_jbxx; heat meter information rlb_jbxx; concentrator log table jzq_log.

The main tables of the database are listed below in Table 1 and Table 2.

Table 1. Large area information table xt_dqxx

Serial number	Field name	Field	Type	Length	Remarks
1	Increment	id	integer		
2	Large area encoding	dqbm	VARCHAR2	30	Encoding: 00, 01 ···
3	Large area name	dqmc	VARCHAR2	50	
4	Operator	czr	VARCHAR2	50	
5	Operation time	czsj	DATE		
6	Remarks	bz	VARCHAR2	200	

Table 2. Exchange station information table

Serial number	Field name	Field	Type	Length	Remarks
1	Increment	id	Integer		Increment
2	The heat exchange station encoding	hrzbm	VARCHAR2	30	Encoding: big area code + station number: 0001, 0102 ···
3	The heat exchange station	hrzmc	VARCHAR2	50	
4	Large area ID	dqid	Integer		
5	Operator	czr	VARCHAR2	50	
6	Operation time	czsj	DATE		
7	Remarks	bz	VARCHAR2	200	

4. System detailed design and implementation

4.1. Basic information management subsystem

The basic information management subsystem includes regional information maintenance, heat exchanger station information maintenance, community information maintenance, storied building information maintenance, maintenance of the nature of housing, concentrator information maintenance, and heat meter information maintenance function.

Background class design: Create the Base Info Manage class and in Base Info Manage, the do Get do Post method of the Servlet class. Processing of the page region information maintenance, heat exchanger station information maintenance, community information maintenance, storied building information maintenance, maintenance of the nature of housing, concentrator information maintenance and maintenance of the heat meter.

Classes and methods used are: Check, Base Info Add Dao. The Base Info Manage and Base Info Change Dao classes are mainly designed in the basic information management module. Mainly for the user to submit a form of inspection, basic data add and modify, the use of the class and method presented is in Table 3.

Table 3. Classes and methods used in the design of basic information management

Classes and methods	Function
Check (form)	Check the integrity of the information
Do Get\ do Post method in Base Info Manage class	Processing information to add, modify, delete the form submitted by the page
Base Info Add method for Dao package Base Info Add Dao	Add data to the database table
Dao Base Info Change Dao class base Change	Modify, delete data in the database

4.2. Implementation effect of basic information management module

Figure 3 represents the basic information management module in the regional information maintenance list interface diagram.

5. System debugging and testing

5.1. Communication protocol testing

The information system of the thermal remote meter reading system based on GPRS is developed, which is based on the system software and communication protocol, and the function of the software is suitable, as well as its reliability and operability. Another important part of this system is data communication, which

relates to the transmission and two levels of communication protocol.

After the data concentrator starts and the data server establishes the connection, the login request information is sent first, the message type is 4 (04H) and the protocol test case format is as follows:

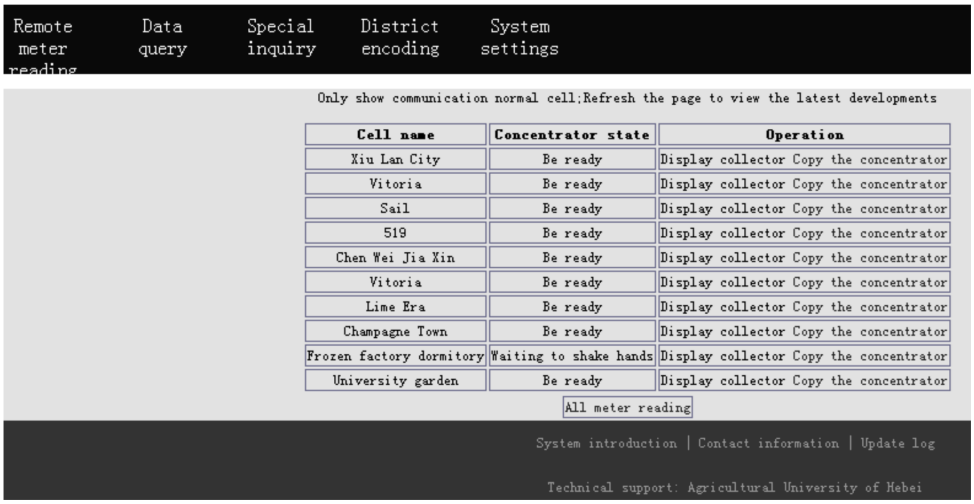

Fig. 3. Basic information management module

Table 4. Exchange station information table

Version number	Serial number	Message body length	Message type	Current time (1)	Test position
02H	00H	00H1AH	04H	13H06H16H15H00 H00H	92H
Equipment number		SIM card number (2)		Login password (3)	
30H30H30H31H		31H35H31H32H39H30 H38H32H39H, 35H39H		31H35H31H32H39H30H38H32 H39H35, H39H	

The data server receives a connection request for the data concentrator and analyzes the connection protocol: (1) the current time: 09 15 years 16 15 points 0 minutes 0 seconds (2) SIM card number: 18330226210 (3) login password: 18330226210 Analytical results: correct. The data concentrator connects the data server successfully and the data concentrator sends the hot table address for 0000 1011H and sends a request message to the current time: in September 15 16 15 0 0 seconds. Test for a communication request message is shown in Tables 5 and 6.

The data server receives the request message of the data concentrator, parses the message type, returns the data address of the heat meter to the data concentrator and returns the information format shown in Table 5-3.

Table 5. Test case for information of the heat meter

Version number	Serial number	Message body length:null	Message type	Current time (1)
02H	01H	00H00H	0BH	13H06H16H15H00H00H
Test position				
A4H				

Table 6. Test case returns results

Version number	Serial number	Message body length	Message type	Current time (1)	Test position
2H	01H	00H18H	0CH	13H06H16H15H00H02H	8BH
Total instrument number	Serial number	The number of the transmitting instrument	Instrument 1 address: 7Byt (E2)		Instrument 2 address:
03H	01H	03H	01H 00H 00H 00H 00H 11H 11H		02H 00H 00H 00H 00H 11H 11H
Instrument 3 address:					
03H 00H 00H 00H 00H 11H 11H					

The responses are

1. The current time: 09 15 years 16 15 points 0 minutes 2 seconds. The main content of the message returned by the server.
2. The address of the instrument: the low level in the front, the high position in the post, BCD encoding were 1000000001111, 2000000001111, 3000000001111.
3. Analytical results: correct.

After the test of the system, the test results show that the function of the system has been basically realized, the operation interface is simple and convenient, and the system function is perfect.

6. Conclusion

In this paper, we analyze and investigate the main business of remote meter reading system of thermal system, and analyze the information system of thermal

remote meter reading based on GPRS. We introduce the technology of GPRS, JS architecture, MVC mode, and develop the system according to the theory of software engineering, realize the centralized charging, centralized management, accounting, management, and also the function of the management system.

At present, the GPRS based remote meter reading information system is in the primary stage of application. There still exist many problems whose solutions need to be improved:

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