Design of Remote GPRS-based Gas Data Monitoring System

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Abstract. In order to solve the problem of remote data transmission of gas flowmeter, and realize unattended operation on the spot, an unattended remote monitoring system based on GPRS for gas data is designed in this paper. The slave computer of this system adopts embedded microprocessor to read data of gas flowmeter through rs-232 bus and transfers it to the host computer through DTU. In the host computer, the VB program dynamically binds the Winsock control to receive and parse data. By using dynamic data exchange, the Kingview configuration software realizes history trend curve, real time trend curve, alarm, print, web browsing and other functions.

1. Introduction
With the development of science technology, the widespread application of computer network, and the increasing industrial automation level, the intelligent system is required now to monitor and manage the complex urban gas pipe network. In order to avoid the accident, this system can timely and accurately collect the parameters of the pipe network by automatic data processing, and issue a warning to the operation of pipe network when an abnormal situation occurs. The network operation data is all stored in the computer for inquiry.

As one of the most important means of wireless remote monitoring, remote data acquisition technology has become a hotspot in the scientific research field. Automatic flowmeter acquisition system is a new technology which combines computer technology, communication technology and network technology, it can automatically collect and process data [1]. Through the transmission controller, data can be transmitted to the host computer, and be processed, stored, detected, and managed. It has many advantages, such as short acquisition time, high accuracy of data, high real-time, and it can carry out real-time monitoring of the scene. Using automatic data acquisition management system can greatly economizes man-power and thing-power, so that can improve the quality of enterprise service and expand the scale of enterprises. For these reasons, this paper designs a remote gas meter monitoring system based on GPRS [2].

2. The Overall Design Scheme
The system consists of gas flowmeter, embedded microprocessor, GPRS module, remote monitoring system in the host computer. The overall structure of the system is shown in the following figure 1.

The system is equipped with GPRS module, using the network to transmit the gas data from the industrial site to the monitoring system in real time, so that the users can monitor the gas usage without going to the factory field.
3. Hardware design of the slave computer

The slave computer MCU uses the microcontroller based on STC15W4K, it has a high-precision R/C clock, 4K SRAM, 60K program space size, to ensure the high speed operation of CPU. The overall design diagram of the system hardware is as follows.

The main control chip receives data from the gas flowmeter through the rs-232 serial port, then store, parse, verify and package data, and transfer data to the GPRS module via another rs-232 serial port. After that, the GPRS module sends data to the remote gas monitoring system via wireless mobile network. After receiving the reply signal from the remote gas monitoring system, the GPRS module waits for a certain period of time (default 15 minutes), then sends the next set of data.

There are two kinds of gas flowmeter in the industrial fields, Corus flowmeter and Tianxin flowmeter. The Tianxin flowmeter can support the Modbus protocol but Corus flowmeter can't directly support. Because the data transmission between field equipment and remote monitoring system is based on the standard Modbus communicate protocol [3, 4], it is necessary to design a hardware circuit to convert it to the standard Modbus protocol.

The data transmission interface of CORUS flowmeter adopts the rs-232, and the interface circuit uses ST3232 as the serial communication level converter, the part of design is as below.
The hardware circuit was designed for data acquisition terminal according to the requirements of the remote monitoring system. This paper selects and designs the microprocessor and GPRS wireless module, and based on these models, GPRS peripheral circuit module and data acquisition interface are designed. The design of information collection terminal, and the development and debugging of related embedded software are also completed.

4. Software design of the host computer

4.1. VB Program

The host computer uses VB’s Winsock control to set up the listening port and uses the TCP protocol to receive the data [5]. Add two Winsock controls, one for listening online request signals, and the other is the initial connection port in the form of dynamic array, named sock(). When a connection request is obtained, the FindFreeSocket method is used to find the free sock, and if all are busy, an sock is dynamically added. The control uses the GetData method in the DataArrival event to Get data, then stores data in a byte array, the format as follows.

Table 1. Data format.

| Start bit | station address | gas data | check bit | end bit |
|-----------|-----------------|----------|-----------|---------|
| 8 bytes   | 2 bytes         | 18 bytes | 2 bytes   | 2 bytes |

4.2. Kingview Configuration Software

The data storage function is vital to any industrial system, so whether the design is reasonable has great influence on the performance of the whole system. Here, we select the history database provided by Kingview 6.5 which can provide millisecond high-speed storage and query of historical data [6].

Various interfaces of the configuration software are designed to achieve user management, site management, alarm, real-time trend display and other functions. The transmission pressure, temperature, instantaneous flow rate and real-time cumulative flows of each slave station are displayed in the form of graph, which can directly display the change of data. The interface of this system is simple and generous, which can real-time observation and understanding of the gas situation. The anomaly can be reflected in the host computer interface in time, which has brought great convenience to the staff and users, see our example below.
Figure 4. Daily report interface.

Web browsing has also been designed, and users can browse the system online through real-time web sites, which is convenient for users to know the practical conditions.

Figure 5. Web browser interface.

5. Conclusion
This paper designs an unattended remote monitoring system based on GPRS for gas data, which has the advantages of high efficiency, easy implementation and low cost. It has good practical application value, and can provide reference for the research and design of IOT system in other fields.

References
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