Design of remote intelligent meter reading system based on GPRS

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Abstract: Power energy is the most important industrial energy, and it plays an important role in the daily life of most industry, enterprises and residents. For the State Grid, the cost of manual meter reading has always been a difficult problem. The former method of meter reading is an electrician to the field manual meter reading. This traditional meter reading method not only has high manpower cost, but also has a large labor intensity, and the information of the collection is relatively simple, and more important is a series of problems such as poor meter reading, wrong copying, missing copy, miscalculation and unstable cycle[1]. In addition, the data obtained from the meter reading system also need to be manually input into the computer management system, which greatly reduces the advanced nature of modern management. Because of the above disadvantages, the experts believe that improving the remote meter reading technology is the need to improve the safety of electricity use and the automation management. It is the inevitable trend of the network development. That is to use the technology of communication and computer to automatically record and deal with the meter data, so that it can be very simple to remove the shortcomings of the previous, and can be very good. To promote the modernization of power management.

Keywords: GPRS, concentrator, power meter reading system.

1. Overview

1.1 present technical exposition of meter reading

1.1.1 Infrared meter reading meter
The electrician takes the infrared meter in the neighborhood of the data concentrator of the residential building (the meter has the information of the user), enters the
infrared communication way to collect the data of the electric energy meter, and then sends it to the computer of the main station. This way is relatively low and easy to be influenced by the outside world.

1.1.2 GPRS meter reading system
The GPRS meter reading system is connected to the Internet and the host computer by mobile network. The data of the residents are processed by the GPRS module, then sent out after encapsulation, and received via the GPRS to receive through the Internet to the main station, so as to realize the real time connection between the consumption of the residents and the data of the main station. GPRS is based on GSM network. It adopts the efficient transmission method of packet switching, and overcomes the shortcoming of low conversion speed of GSM circuit. The transmission efficiency of GPRS is high, and it is seldom used. It can ensure that the user is online and can be charged by traffic, reducing the cost of service. It is very suitable for the reality of our country (the sudden small flow data).

1.2 GPRS technical advantages
(1) low cost. GPRS technology has a packet switching pattern, which makes the time of occupying a resource limited to sending and receiving data, which means that multiple users can be allowed to use simultaneously, and the utilization of resources has been significantly improved. On the other hand, the accounting method of GPRS communication is based on traffic calculation, that is, multi use and multi payment, without zero payment.
(2) high efficiency. The speed of GPRS communication can reach ten times of that of GSM network.
(3) the reaction is sensitive. GPRS technology can be packet switched and implemented in less than one second, which can greatly improve work efficiency, and also make the interconnection equipment smooth.
(4) based on IP protocol, it can provide powerful Internet access capability.
(5) always online, high reliability and strong anti-interference ability[2].

2. Overall design plan of remote meter reading system based on GPRS

2.1 GPRS meter reading system design requirements
(1) Technical requirements and performance: We must use our confident technology when designing our system, and it is best to make our technology more advanced for a period of time, which can extend the use time of our equipment.
(2) Maturity of the system: The most important links are: data collection, data communication must be very stable, all parts of the system must overcome the
previous shortcomings, and can better adapt to the current environment. 
(3) The system must have good openness: the trend of social development is now diverse, so the interface of hardware in our system should be as open as possible and as much as possible.

2.2 GPRS intelligent meter reading system's overall design
The GPRS smart meter reading system has four layers of structure: master station, concentrator, collector, and meter. The main station is composed of computer and meter reading software. The main function is to control the concentrator and calculate the energy data transmitted by the concentrator. The concentrator is mainly the data of the electricity meter in the collector, and the data transmission and exchange with the primary station. The collector mainly collects the electric energy data of the electric meter. The energy meter is located at the user's location and is mainly used to record the electricity consumed. In the entire smart meter reading system, GPRS communication is connected to the concentrator and the main station (computer), so GPRS is the most important communication method. The concentrator communicates with the RS-485 communication mode that can be used in the collector. The bridge of the whole system is the concentrator, which plays the most important role in the entire meter reading system. Therefore, the reliability and stability of the concentrator are very critical.

3. Concentrator design
3.1 CPU selection
The system uses 32-bit LM3S9B96 this microcontroller. The main reasons are as follows:
(1) The CPU of LM3S9B96 has high data processing capability, which can well meet the requirements of the concentrator of the system to connect the upper layer communication and connect the lower layer communication at the same time.
(2) The concentrator has a large amount of tasks at the same time. The single-threaded method can not meet the requirements of the system, and the LM3S9B96 can solve this problem well.
(3) The storage space of the LM3S9B96 is relatively large, enough to store the intricate parameters and data of the system.
(4) LM3S9B96 has enough IO ports or pins, can arrange more peripherals, and has sufficient openness to meet the needs of the development of contemporary technology. It can be improved with enough IO ports in a certain period of time.
(5) The LM3S9B96 itself contains an ADC circuit that automatically alarms when the
battery is under voltage. 
(6) The LM3S9B96 itself contains a watchdog circuit, which improves the reliability of the concentrator operation.

### 3.2 LM3S9B96 minimum system schematic

As shown in Figure 1, the minimum system schematic LM3S9B96 minimum system is shown in the figure, which contains a crystal oscillator circuit to provide a 16M clock crystal oscillator and a reset circuit. The LM3S9B96 microcontroller itself integrates the watchdog timer, so there is no need to repeat the design. The LM3S9B96 is used to detect the remaining amount of the battery is the foot 5, the interface of the RS-485 communication circuit is connected to the 22 feet - 25 feet, the most important GPRS interface is connected to the 26 feet and 27 feet, 28 feet - 31 feet and 33 feet Connect to the memory circuit, the clock circuit is connected to 34 feet - 36 feet[3].

![Fig. 1 Minimum system schematic](image)

### 4. RS-485 circuit design

(1) Hardware circuit design As shown in Figure 2, in this circuit, an RS-485 interface chip SN75LBC184 is used, which uses a single power supply VCC, and the voltage can work normally in the range of +3 to +5.5V.
(2) 4.2V power supply circuit design
The 4.2V voltage is mainly used to supply power to the GPRS module. In order to ensure that the output voltage of the MIC29302 is about 4.2V, R2 and R3 are selected as 43K and 500K respectively. The circuit diagram is shown in Figure 3.

(3) Design of 3.3V circuit
The 3.3V voltage mainly supplies power to the LM3S9B96 microcontroller, and there are some peripheral software. Because the current requirements are not large, the existing +5V power supply can be used to convert the +5V power supply to +3.3V using the AS1117-33 power supply chip, and the output current is 800mA, which is sufficient for circuit use[4]. The circuit is shown in Figure 4.

5. System software design
In the main program, after the initialization work is finished, it enters an infinite loop through a WHILE(1) statement, and then cyclically detects the status flags defined in each task module, and judges whether to enter each task according to the indications of various status flags. The module performs the corresponding operation [5]. If the corresponding operation is performed, it will jump back to the main program and continue to execute downward after the execution of the post-operation. In addition,
during the execution of the program, when the enabled interrupt flag is set, it will go to the corresponding position for interrupt task processing, and then return to the position before entering the interrupt and continue to execute downward.

![Circuit Diagram](image)

**Fig. 4 3.3V circuit diagram**

### 6. Conclusion

China is a major problem in the use of electricity power and the user's meter. At the same time, our country has a wide geographical area and a large population. If we still use manual meter reading, it will only cause the loss of financial and material resources, and this time the design is very good. Solved this problem. Because the meter reading staff does not have to physically arrive at the scene, it can solve the security problem very well. There are also many problems in the design of the system. I know that this system has many flaws. I will work hard in the future study life optimization.

### References


