Design of Electric Quantity Detection System Based On Iot

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\textbf{Abstract.} With the development of social economy, the electricity consumption of residents is increasing year by year. And the problem of electricity safety is still becoming more and more prominent. Especially in college dormitories, due to regulatory loopholes and students use prohibited electrical appliances and other reasons. There is a frequent occurrence of fire in the dormitory. This not only causes certain property losses to students, but also threatens the safety of students. If we can carry out the real-time network monitoring of the dormitory electricity consumption, we can cut off the power in the home in the early stage of the accident. To avoid a similar incident to a certain extent, this project aims at designing a student dormitory electricity monitoring system for this safety problem. By using the STM32 processor and the ESP8266 network communication module, the real-time monitoring of the electricity consumption in the dormitory is completed, so that the school supervision department and the students can grasp the electricity consumption of the dormitory in real time. The automatic alarm can be realized over the electricity limit.

1. Introduction
The safety of college students is becoming more and more popular in the society. The frequent occurrence of the student dormitory fire not only causes the loss of property to the students, but also has a certain influence on the reputation of the school. Among them, the dormitory fire is mainly caused by the use of prohibited electrical appliances and the absence of dormitories. If we can monitor the electricity consumption in dormitories, we can avoid similar incidents. This paper makes full use of the advantages of embedded system and Internet of things communication, using the STM32 processor and the ESP8266 network module communication module to complete the real-time monitoring of the dormitory electricity use, and alarm for the real-time system of the dormitories exceeding the rated power. It also put an end to the hidden dangers of unused electricity and students' sleeping time.

2. System Design
This design is mainly composed of STM32 embedded system module, CC546A power detection module and ESP8266 Internet of things communication module. The main functional block diagram is shown in Figure 1.
A. Design of the hardware part of the system

Embedded system module

The embedded control module designed in this system uses the STM32F407ZET6 produced by the Italian semiconductor company as the main controller. The processor uses the advanced Cortex-M4 kernel, and has the capability of floating point operation and enhanced DSP processing command. On the storage space, you can swim up to 1M bytes of on-chip memory, 196KB's built-in SRAM and flexible external memory interface. The processor can achieve up to 210DMIPS processing capability at run speed. Moreover, the processor reduces the peripheral circuit design of the system by using the peripheral modules such as ADC DAC and Chun Kou communication, and enhances the stability of the system. The internal block diagram and minimum system of the processor Cortex-M4 kernel are shown in Figure 2.

Power acquisition module

The electric quantity acquisition designed in this study adopts the CS5460A special chip of Cirrus Logic Company of the United States. The power acquisition chip has the function of single phase bidirectional power / Energy Metering IC with serial interface, including the two-way serial port of the communication between two converters and Microcontrollers, and the pulse output frequency of the...
power collection chip. The rate is proportional to the amount of function and has the function of high speed electric energy calculation. In practical applications, the size of the power signal is used in industrial applications to achieve power acquisition function in single-phase / three phase electronic watt hour meters. At present, this chip is different from the previous popular CS5460, the unique self guidance function, so that the chip can automatically initialize and work independently in the case of power up, start running from the external E2PROM guide, and read the current data through the bus transmission way to transmit the data to the main controller. Its module circuit is shown in Figure 3.

![Fig 3. CS5460 module circuit](image_url)

IoT communication module
In this research, the wireless communication module uses the ESP8266 WiFi module. Through the built-in Tensilica L106 32 bit RISC processor, the module enables the module to perform ultra low power operation in normal work, and has up to 160 MHz CPU clock running speed. The module also supports the support of real-time operating system (RTOS) and Wi-Fi protocol stack. At present, the module is mainly used in mobile products, wearable electronic devices and Internet of things equipment. Through a number of proprietary technologies, the ultra low power operation in actual work has been realized. The power saving mode of ESP8266EX module is suitable for various low-power applications. Its module circuit is shown in Figure 4.
B. System software design

This research design software mainly uses Keil C51 as the software development platform. It is the 51 series compatible MCU C language software development system produced by Keil Software Company in the United States. Compared with the assembler, the C language has obvious advantages in function, structure, readability and maintainability, so it is easy to learn and use. The Keil software compiler provides the user with a complete development scheme including the C compiler, macro assembler, linker, library management and a powerful simulation debugger. The user can fulfill the functions of reasonable call, serial communication and data receiving and receiving of the internal resources of the processor according to the design requirements. The main program flow chart of this study is shown in Figure 5.

Fig 4. ESP8266 module circuit diagram

Fig 5. System software flow chart
3. Test Result
The design of the system is completed through theoretical calculation, program design, module debugging and system commissioning. The sample is shown in Figure 6, and the real-time monitoring of the electricity consumption in the dormitory is completed. The results of the test are shown in Table 1. Users can check the power consumption of their dormitories through mobile phones and other terminal devices. If the power exceeds the rated power, the terminal will alarm. Tester. The instrument is AC/DC power analyzer AN87310.

| Test apparatus | System Test voltage | System Test current | Instrument Test voltage | Instrument Test current | Error value % |
|----------------|---------------------|---------------------|-------------------------|-------------------------|---------------|
| charger        | 215.8V              | 0.09A               | 215.3V                  | 0.09A                   | 0.2           |
| Notebook       | 214.6V              | 0.32A               | 214.6V                  | 0.314A                  | 0.18          |
| Kettle         | 215.9V              | 5.89A               | 215.6V                  | 5.86A                   | 0.6           |

By comparing the physical test data with the special electric quantity tester, the system has higher accuracy and smaller error. It meets the needs of the design of this study.

4. Conclusion
This project innovatively applies the thinking of the Internet of things to the traditional voltage and current detection. Through the wireless communication, the building managers can know the electricity consumption of each dormitory in real time. Moreover, we should carry out the standard red warning to the dormitory with more than rated power, so as to complete the supervision process of the high-power use of the dormitory. And in the whole system, the human infrared detector is added to the system, which can automatically reduce the rated power of the dormitory in the dorm and the sleeping period of the students. The hidden dangers of unused electricity and students' sleeping period are eliminated, which makes the system's ability to monitor the safety of electricity consumption further improve.

The finished product is a general electricity monitoring module system. After the follow-up function upgrade and stability test, it can be used in such practical applications as greenhouse vegetable electricity control, laboratory power control, office electricity use and household electricity control. This is of great significance for realizing the intellectualization of household electricity, industry and agriculture.

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