Elevator alarm system design

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Abstract: Based on the requirements of the traditional elevator alarm system, this paper proposes an elevator fault alarm system using the Internet of Things technology, which has active alarm and passive alarm functions. The system installs all kinds of sensors on the elevator, the sensor collects the real-time data related to the operation of the elevator, the microprocessor analyzes the data and transmits the data to the server through the Internet, so as to realize the remote real-time alarm of the elevator. The experimental results show that the design of the system can comprehensively improve the safety, reliability and ride comfort of the elevator, and can be effectively applied to various brands of elevators.

Key words: Internet of Things; Elevator; Alarm; Sensors

Introduction

With the development of modern society and the increase of building height, elevator as a necessary means of vertical transportation, its application is becoming more and more popular. Elevator as a complex mechanical and electrical integration equipment, while providing people with convenient access, it will also cause failures due to various reasons such as elevator aging, hardware and software or illegal use by users, bringing security threats and injuries to people. Therefore, on the one hand, in order to avoid similar threats and injuries as much as possible, improve the safety, reliability and comfort of the elevator; On the other hand, in order to shorten the response time of rescue workers and improve the efficiency of rescue services after the elevator failure, this paper designs an intelligent elevator alarm system based on the Internet of Things.

1. The current elevator alarm methods and deficiencies

At present, the elevator alarm method widely used in the elevator is mainly the use of wired networking, through the alarm bell and telephone two ways to achieve(1). When the elevator fails, such as a sudden power outage, the elevator rider can contact the outside world through the alarm bell or phone installed in the car and request rescue. The above alarm mode mainly has the following five problems:

(1) the alarm is a passive alarm after the event, without early warning ability, while delaying the rescue time;

(2) the alarm device (alarm bell, telephone, etc.) is damaged or lost, such as telephone loss, aging line, etc.;

(3) specific users can not use the alarm terminal correctly, such as the elderly and children;

(4) the alarm signal is not answered, such as the elevator management is not on duty;

(5) the alarm system usually adopts the wired networking mode, which has the disadvantages of complex wiring, poor expansion, inconvenient maintenance and high cost in the process of elevator installation, elevator maintenance and elevator upgrading.

In order to ensure the personal safety of elevator users, improve the reliability of the elevator and reduce the cost of the elevator, the current traditional alarm method has been far from meeting the needs of The Times.

2. Elevator fault alarm system based on Internet of Things

With the rapid development of electronic technology, the Internet of Things technology is becoming more and more mature, and has been widely used in(2-6) various fields, such as chemical workshops, farmland management, coal mine operations, etc., to achieve good application results and economic benefits.

In this system, the use of the Internet of Things technology to the elevator fault alarm information collection, processing and transmission, not only according to the operation of the elevator in real time active alarm, but also can realize the elevator failure, trapped personnel for good and effective passive alarm. The combination of active alarm and passive alarm can effectively improve the rescue efficiency and rescue quality after the elevator failure, which is a scientific and effective elevator alarm mode.

3 Fault alarm system design

3.1 Overall design of the system

The main function of the elevator alarm system based on the Internet of Things is to carry out real-time monitoring of the operating data of the elevator, and remotely transmit the monitored data to the elevator monitoring center for fault alarm processing. In order to realize these functions, the system needs to solve three problems: how to collect data; How to transmit the data; How to process the data.

According to the above requirements, from the point of view of cost reduction, easy maintenance, easy expansion and upgrading, the system mainly designed eight components, respectively, sensor, router, coordinator, alarm host, sound and light alarm, screen display, SMS alarm and database server. Among them, the communication between the sensor and the router and the coordinator adopts ZigBee wireless network; The communication mode of SMS alarm and over-limit data upload database server adopts GPRS wireless network; The coordinator and the alarm host are placed in the monitoring center together, and the communication between them adopts RS-232 bus.

The overall design block diagram of the system is shown in Figure 1.

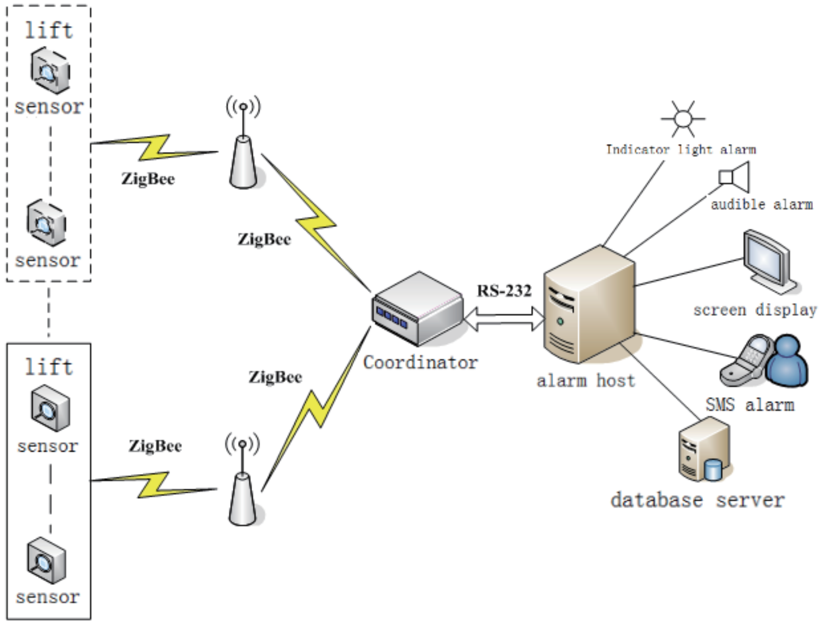

Figure 1 Overall system design block diagram

3.2 Hardware Design

The sensor node part is usually composed of four parts: sensor module, processor module, communication transmission module and power module. The data processing module, as the core of the whole sensor node, is responsible for the control box to coordinate the work of each component of the sensor node, and its performance directly determines the performance of the sensor node; Communication transmission module is responsible for wireless communication between sensor nodes and other nodes or various types of terminals, which is the most energy consumed part of sensor nodes. In order to extend the life cycle of sensor nodes, it is particularly important to choose a low-power wireless communication processor. Therefore, according to the system requirements of low cost and low power consumption, Atmega128L is selected for the processor module of the alarm system, and CC2420 is selected for the wireless communication module.

The communication mode between Atmega128L and CC2420 follows the master-slave mode: Atmega128L is the host, CC2420 is the slave mode. Atmega128L processor has 4 SPI interfaces, which are MISO, MOSI, SCLK and SS. SS interface is used to control the synchronization of the two communication parties, MOSI controls the output of data, MISO controls the input of data, and SCLK provides the clock frequency. CC2420 also has 4 SPI interfaces, namely CSn, SI, SO and SCLK, which correspond to the 4 SPI interfaces of Atmega128L and are connected to each other. The hardware connection of Atmega128L chip and CC2420 wireless communication chip is shown in Figure 2. Through these 4 data connection lines, the main processor Atmega128L exchanges data with the communication chip CC2420, and sends control instructions.

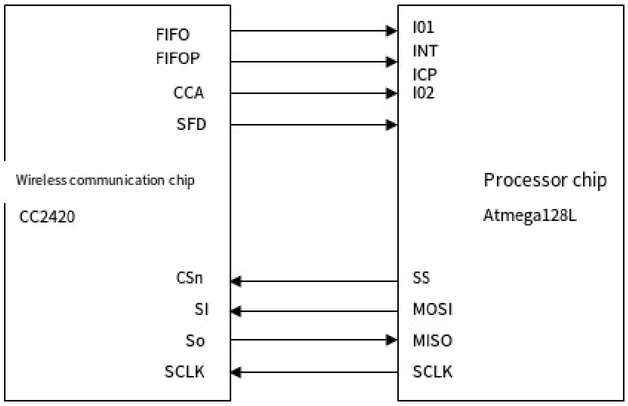

Figure 2 Block diagram of hardware connection between Atmega128L and CC2420

3.3 Software Design

According to the elevator operating parameters and performance indicators, in addition to the comprehensive consideration of the sensor device's own power consumption, measurement range, accuracy, cost and other factors(7), in this system, the data perception module according to the specific needs of the corresponding sensor, such as the temperature and humidity sensor selected SHT11 produced by Sensirion company of Switzerland. The smoke sensor uses MQ-2 produced by Weisheng Technology and so on. The software structure of the sensor node designed by this system is shown in Figure 3.

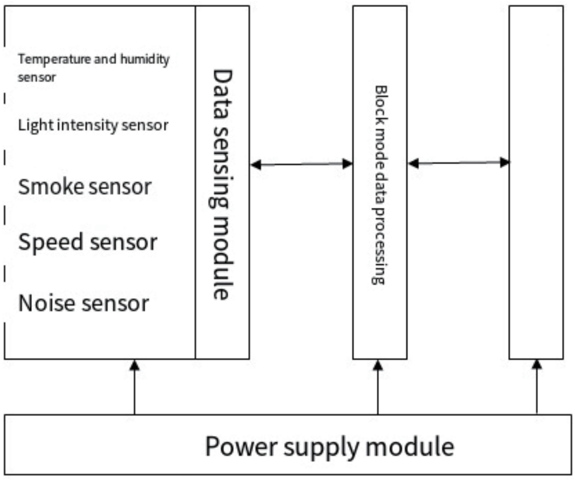

Figure 3 Sensor node software structure block diagram

4 System Test

In the process of system performance test, we take the temperature parameter monitoring inside the elevator car as an example, set the sensor node to collect data once every 2 minutes through the ZigBee network to the coordinator node, the coordinator node then through the RS-232 serial port to upload the data to the alarm host for processing, the specific communication parameters are set as follows: Use serial port COM1, 9600bps baud rate, 8-bit data bit, 1-bit stop bit, do not consider parity check.

Through the statistical analysis of the data obtained from multiple tests, when the temperature in the car exceeds the pre-set threshold, the system will take the initiative to notify the relevant personnel. The test results show that the system alarm reliability is high, the system stability is strong, can meet the needs of elevator real-time alarm.

5 Conclusion

As an independent system, the elevator alarm system based on the Internet of Things uses various types of sensors to collect the status signal of the elevator operation and the car, and does not have any electrical connection with the original elevator control system. It is easy to install, independent and expansible, and can be applied to various brands of vertical elevators.

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