Design of Smoke Alarm System Based on STM32

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Abstract:With the rapid development of economy and the acceleration of urbanization, the loss caused by fire is more and more serious, so the effectiveness and accuracy of fire detectors are very important. In this paper, we design and implement a smoke detection with STM32and GSM/GPRS. The alarm system is based on multi-sensor fusion. The reliability of the system is tested by data simulation and scene simulation. The smoke alarm system has strong ability of fire monitoring and alarm, and has the advantages of small size, strong practicability, simple operation, timely alarm and so on.

Keywords: Smoke alarm; STM32; GSM/GPRS; multi sensor

1 INTRODUCTION

With the development of society and economy, fire prevention is becoming more and more important. But at present, many domestic research and development focus on the fire alarm. Therefore, it is necessary for us to develop a simple and economical household smoke alarm system. Smoke alarm system uses STM32F103D chip as the control core. The smoke detection module transmits the temperature and the smoke concentration to the processing module, and then the processing module converts the analog signal into a digital signal and judges whether the value exceeds the threshold value. If the threshold is exceeded, the buzzer will alarm, and the GSM/GPRS module will be sent to the residents outside the fire alarm call. It is of great significance to improve the reliability and accuracy of fire detection by using multi sensors.

The design includes two parts: hardware and software design. The smoke alarm system includes the following five parts: smoke detection module, temperature detection module, STM32F103D MCU main control circuit, voice alarm and remote alarm module. Smoke alarm system design block diagram as shown in fig 1.
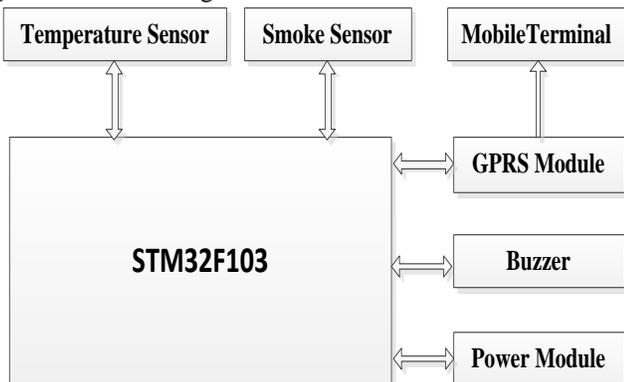

Fig 1: Smoke alarm system

2   SYSTEM HARDWARE CIRCUIT
2.1 Smoke Signal Acquisition Circuit

Smoke detection using MQ-2 sensor, MQ-2 sensor output signal value is 0V - 3.3V. In order to filter out the high frequency band from sensors in clutter, the signal is more accurate and stable, in the design of the circuit increases the RC low-pass filter, the voltage from the sensor output signal is first filtered, connected to a voltage follower circuit, the input load and effective isolation.
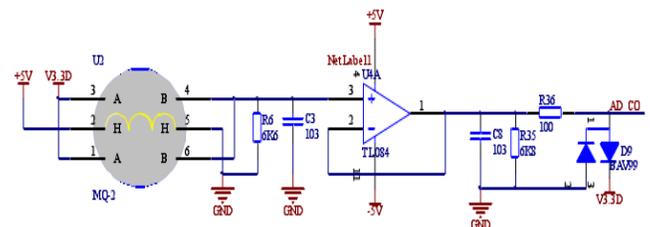

Fig 2:MQ-2 sensor signal acquisition and processing circuit

2.2 Temperature Sensor Circuit

Temperature sensor uses DS18B20 digital as temperature sensor. The temperature and humidity sensor interface circuit schematic of STM32F103 is shown in fig 3.
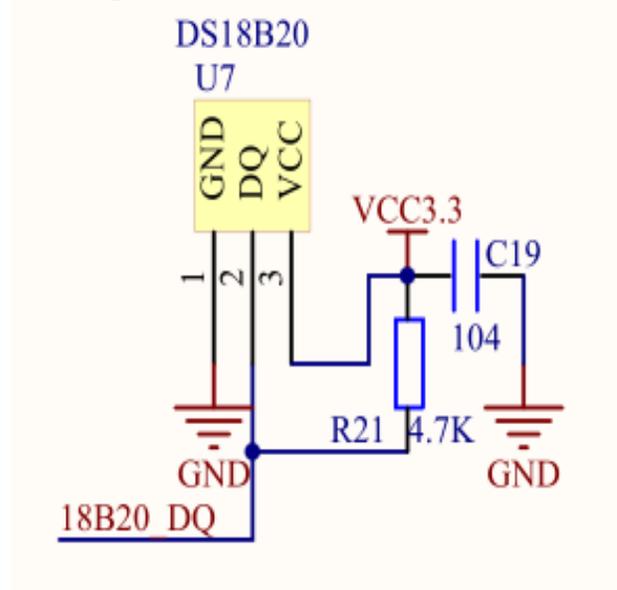

Fig 3:DS18B20 interface and STM32 connection circuit diagram

2.3 Sound Alarm Circuit

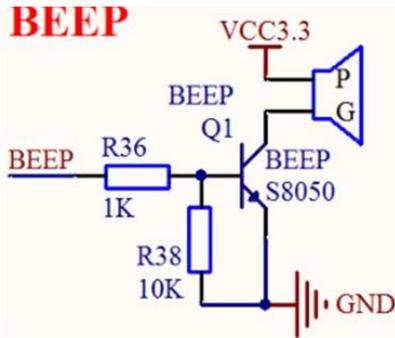Buzzer circuit diagram isas follows in fig 4.

Fig 4: Source buzzer schematic

The Q1 amplifier is used to expand the flow, and R38 is a pull-down feedback resistor to avoid MCU reset, so the buzzer may sound phenomenon. The BEEP signal is directly connected to the MCU PB8 above, PB8 can output pulse modulation wave, so if you want to control the alarm buzzer rhythm can be used as a pulse modulated wave output to control the buzzer, rather than simply the use of high and low level.

2.4 Mobile terminal Alarm Circuit

The mobile terminal alarm selects the GSM/GPRS communication module based on SIM900A, which can realize the data transmission, voice transmission and so on safely, quickly and stably. STM32 connects GSM/GPRS module through the RS232 serial.
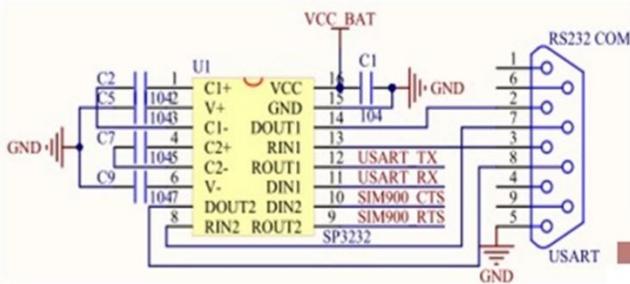

Fig 5:GSM/GPRS module RS232 serial schematic

3 SYSTEM SOFTWARE DESIGN
3.1 System Flow Design

The core of the whole alarm system is STM32, and its working process is as follows. The first part of the system is connected to the power supply, including the microcontroller port (input and output) settings, data storage circuit and drive circuit, such as initialization and preheating. Secondly, through the smoke sensor MQ-2 and temperature sensor DS18B20 to collect the smoke concentration, temperature and other analog signals, then these chemical parameters and physical parameters are converted to electrical signals can be measured. Finally, through the STM32 analog signal conversion circuit of digital signal to analog signal / smoke and temperature sensor output digital signal conversion and LED display on the small screen, then judged through the data analysis, the MCU, estimate whether the threshold needs to be alert. Finally, if only one of these conditions is satisfied, the system will send out alarm and send alarm information to the remote device. Meet two of course, will alarm, only when the two are not satisfied

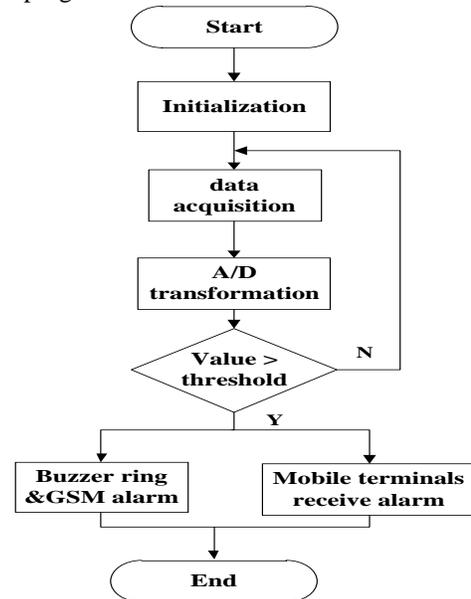with the alarm will not be issued. Figure 6 shows the flow of the system program.

Fig 6:System program flow

3.2 GSM/GPRS alarm implementation

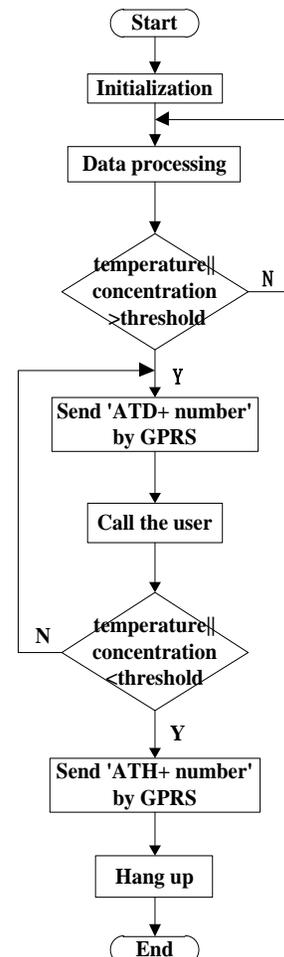Figure 7 shows software flow chart for GSM/GPRS alarm.

Fig 7:The GSM/GPRS alarm process

4 CONCLUSION

This paper analyzes the small intelligent fire alarm system. According to the actual needs, a fire alarm system is designed, andthe system can receive, display and transmit the fire alarm signal quickly, and solve the problem of the intelligent fire alarm system. With the improvement of the traditional fire alarm system, the system realizes the alarm of the indoor smoke and the temperature change, and realizes the comprehensive function of the system. The design of multi-sensor fusion can effectively reduce the false positive and false negative rate of fire. The fire scene of the remote alarm, can also be directly on-site information timely feedback to the residents, the residents can understand the status quo of the temperature and smog concentration in home cleaning, timely monitoring, timely prevention, reduce the loss caused by fire.

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