

Smart Home Security System Based on MSP430 Microcomputer

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ABSTRACT

Safety has become people's primary requirement for smart homes. The home security system has become an important part of the smart home. We design a smart home security system based on MSP430 microcomputer. It combines smoke detection module, fire detection module, man-made illegal intrusion detection module and voice control alarm module, and its peripheral auxiliary circuit. It constitutes a multifunctional anti-theft alarm system that integrates various detection functions such as anti-theft, fire prevention, and anti-poisonous gas. This system has the characteristics of lightness and dexterity, simple circuit and easy to realize, and high sensitivity.

Keywords: MSP430, MQ-2, DHT11, HC-SR501, GSM.

1. INTRODUCTION

With the rapid development of human society and economy and the continuous improvement of people's living standards, people urgently need a smart home security alarm system. It can reliably carry out daily safety precautions, detect various dangers in time and notify the head of the household, so as to eliminate the dangers in the bud. Many scientists have done researches in this area to help people improve safety. Huang, Huiping et al.[1] designed a low-power consumption remote home security alarm system developed by applying WSN and GSM technology. Two sets of piezoelectric transducer (PZT) are used by Sultana, Sadeka et al.[2], the buzzer indicating the problem detection and LED light showing the problem occurring place. Anitha, A.[3] used a microcontroller known as Arduino Uno to interface between the components, a magnetic Reed sensor to monitor the status, a buzzer for sounding the alarm, and a WiFi module, ESP8266 to connect and communicate using the Internet. Azid, Sheikh Izza[4] introduced a home security system equipped with motion sensor, smoke detector, temperature sensor, humidity sensor and light sensors. Koehler, Marcus et al.[5] showed a positive influence of community features in the case of non-intrusive devices and pointed out the influence of personal relationships on perceived security. Sahani, Mrutyunjaya et al. [6] proposed a system based on 'Remote Embedded Control System' (RECS) which works both on the web and gsm platform for authentication and monitoring. Megalingam, Rajesh Kannan et al.[7] suggested a Low Power Intelligent, Wireless, Home Security System (IWHSS) for Elders.

In this research, a smart home security system based on MSP430 is designed. This system is capable of preventing fire, theft and poisonous gas. The system uses pyrosensor to detect illegal intrusion, gas sensor to detect gas and other harmful gases, and temperature sensor to detect fire. Combining various alarm circuit devices and peripheral auxiliary circuits, using a single-chip microcomputer as the intelligent control center, it constitutes a multifunctional anti-theft alarm system that integrates multiple detection functions such as anti-theft, fire prevention, and anti-poisonous gas. This system has the characteristics of lightness and dexterity, simple circuit and easy to realize, and high sensitivity.

2. HARDWARE DESIGN

2.1. Block Diagram

The block diagrams are very important in the design of the research. The block diagram of the smart home security alarm system is shown in Figure 1. It is composed of the following parts: anti-theft detection, gas leak detection, fire detection, remote communication, alarm and mobile APP.

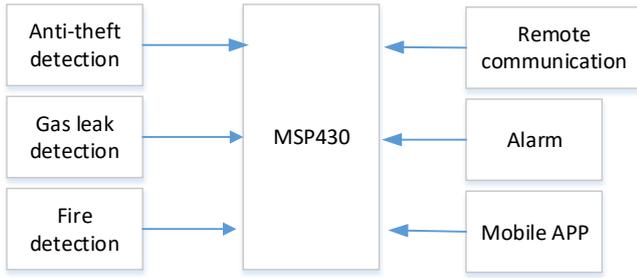


Figure 1 smart home security alarm system block diagram

2.1.1. Anti-theft detection

Pyroelectric infrared sensor module is a sensor that can detect infrared rays emitted by people or objects and output electrical signals. The model is HC-SR501, and the outline drawing is shown in Figure 2. It has delay adjustment and distance adjustment. In this design, the delay is set to 100s and the distance is set to 20cm. It has the characteristics of large detection angle, high performance and low power consumption.



Figure 2 Outline drawing of HC-SR501

The sensing module is a dual-element probe, when the human body walks across the probe laterally, the dual-element probe detects the change of the infrared spectrum and generates a difference, and then sends an alarm signal.

2.1.2. Gas leak detection

We use the gas-sensitive smoke sensor MQ-2 and its peripheral circuit to control the detection of excessive smoke as shown in Figure 3.

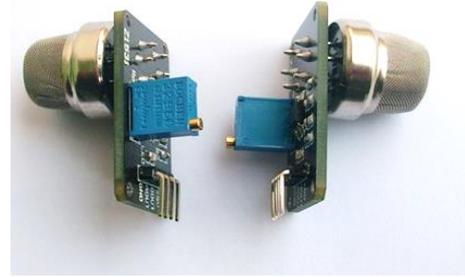


Figure 3 MQ-2

MQ-2 can be used as smoke and combustible gas detection alarm. The working voltage of MQ-2 smoke/combustible gas sensor is 5V, the output is TTL digital quantity 0 and 1 (0.1 and 5V), and the concentration of detectable combustible gas is 300-10000ppm. It is very sensitive for natural gas and liquefied gas. The purpose of smoke detection is to detect the concentration of combustible gas through the change of resistance value of the gas-sensitive resistor in the environment of different concentrations of combustible gas, and complete the I/O output through the voltage comparator. By reading the high and low levels of the smoke sensor and judging whether there is a smoke alarm according to the level, when a smoke alarm is detected by the smoke alarm, the message is sent to the microcomputer.

2.1.3. Fire detection

This design uses DHT11 as the temperature and humidity measurement module. It is shown as Figure 4. Besides the VCC and GND of the power line, there is only one data line OUT, which can greatly save IO port resources. When detecting that the temperature exceeds the alarm threshold, the alarm module sends an alarm message to the user.

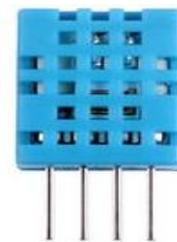


Figure 4 DHT11

2.1.4. Alarm

Sound and light alarms are mainly used in the following situations. One is that someone intrudes illegally. Second

is that when the ambient temperature exceeds the set value. The last one is that the concentration of harmful gas exceeds the set value. When alarming, the buzzer will sound and light up the led, and send SMS to the user's mobile phone via GSM. The typical circuit is shown in the Figure 5.

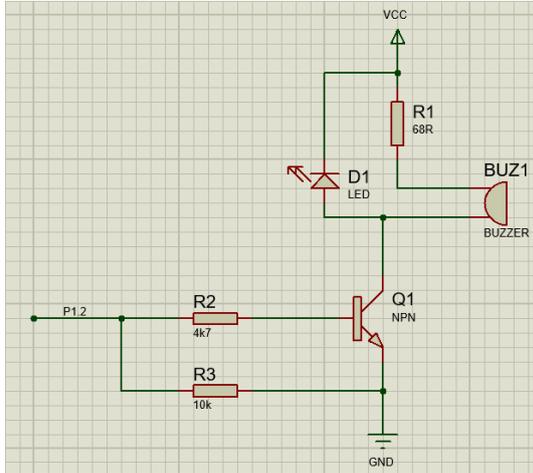


Figure 5 Typical circuit of alarm circuit

2.1.5. Remote communication

The remote communication module is SIM800A, as shown in Figure 6.



Figure 6 Remote communication

The module has functions such as calling and sending text messages. Using serial communication protocol, it can be directly configured through the serial port module of the computer and the microcomputer. When the system has alarm information, it will automatically send SMS reminders to users.

2.1.6. Mobile APP

APP module is the core of system human-computer interaction. Use the mobile phone APP to complete the

user's configuration of the hardware system SMS receiver number. In the module status query, the mobile phone completes the query and display of the module status of each module through the WIFI network and socket link. In this process, the mobile phone and the WIFI module use TCP connection to ensure data continuity and avoid packet loss as much as possible. In the module control, the WIFI network and socket connection are also used, and the control information is sent through the mobile phone.

3. SOFTWARE DESIGN

The software flow chart is shown in Figure 7.

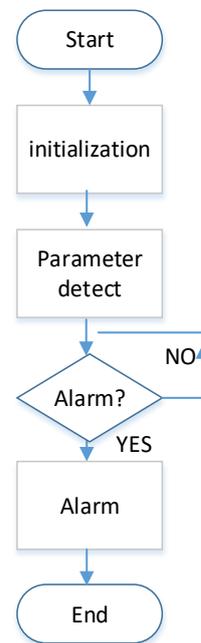


Figure 7 Software flow chart

After the system is powered on, it performs parameter detection. When an intrusion is detected, the concentration of harmful gas is too high, or there is fireworks, an alarm signal is generated. Then the bell runs and light is on. The homeowner will receive a reminder short message on the mobile phone and can take timely measures to avoid excessive losses. If there is no warning, it continues to detect and keep looping, unless the system is shut down.

4. CONCLUSION

A smart home security system based on MSP430 is designed in this paper. We use HC-SR501 sensor to detect the illegal invasion, MQ-2 to detect natural gas and liquefied gas, DHT11 to detect the fire. Buzzer and light

are used to alarm. We use SIM800A to send mobile alarm message to users, and use APP to observe the home in time. The experiment is done based on this system, and the result shows that the system is high effective and easy to realize.

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