

Design of Intelligent Security Systems based on HarmonyOS

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Abstract

Intelligent security systems is significant to protect properties. An intelligent security system is designed based on Hi3861 chip. The system is developed using Harmony OS. Sensors are used to detect different information like temperature, light intensity, suspicious object and combustible gas. A light supplement led, motor fan, and buzzer are also used for early warning and effective adjustment. After debugging, the system can realize intelligent security.

Keywords

Harmony OS; Hi3861; Intelligent Security Systems.

1. Introduction

With the rapid development of the IoT (Internet of Things) technology, the application of intelligent security systems has much more bright future.[1] The system is significant for theft prevention, fire prevention, and gas leakage prevention. The comprehensive real-time monitoring of human, financial, and material information is necessary for the system. Effective early warning can make the entire system more valuable. With the increasing demand for user experience, intelligent security systems are no longer satisfied with the interconnection within the local LAN. Interaction between device and mobile system has become indispensable.

Currently, IOS and Android are the commonly used mobile operating systems, which occupy the main market. The closed nature of the IOS system is safe. The Android system faces fragmentation, stagnation, and security issues. Both are relatively difficult to develop for IoTs. Since the number of IoT devices is increasing quickly. The Harmony operating system has achieved rapid development with the technical characteristics of being distributed, customizable, and easy to develop. [2-4] It is more suitable in the field of IoT. Hi3861 chip is selected as the main control chip, which is a SoC chip integrated with WIFI module. The chip can be well compatible with the Harmony operating system. An open development and debugging environment is provided, which is easy to use.[5]

In this paper, an intelligent security system is designed based on the Hi3861 chip and the Harmony operating system. The system is equipped with sensors to monitor temperature, illumination, infrared ray, and combustible gas. Other components such as a fill light, motor fan, and buzzer are used to realize warning and regulating of the indoor environment.

2. Hardware Structure Design

2.1. Overall Design

The specific design is provided in Figure 1.

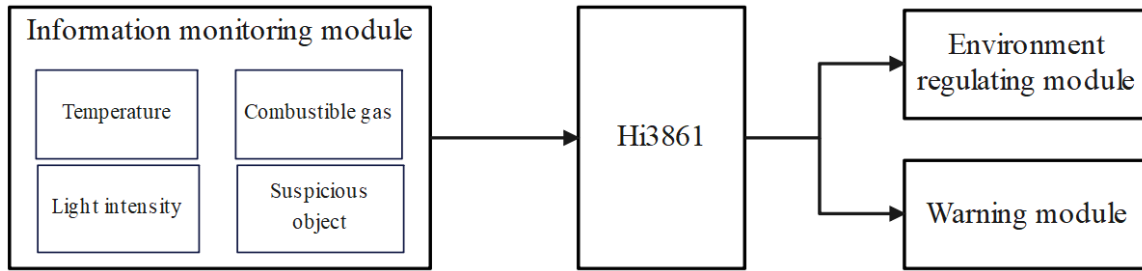


Figure 1. System structure diagram

The entire system consists of four parts: information monitoring module, warning module, indoor environment regulating module, and main control module Hi3861, which integrates wireless communication function. The environmental monitoring includes the following parts: temperature monitoring, combustible gas monitoring, light intensity monitoring and suspicious object monitoring.

The environment information is collected using the sensors including temperature sensors, combustible gas sensors, photoresistors, and infrared sensors. The information is sent to the display screen and the gateway simultaneously. Fans, fill lights and buzzers can be controlled automatically. The fan will work when the temperature reaches the threshold value. The alarm will be given by the buzzer when the combustible gas reaches the threshold value or an illegal intrusion is detected by the infrared sensor. Light supplement will be given by LED when the photosensitive resistor reaches a certain threshold value.

2.2. Suspicious Object Monitoring and Alarm

HW-201 infrared sensor is selected to monitor the suspicious object. A buzzer is used to give an alarm signal. The circuit diagram is shown in Figure 2. When the HW-201 infrared sensor detects an object, the information will be uploaded to the Hi3861 through GPIO10. Hi3861 will trigger the buzzer through GPIO01.

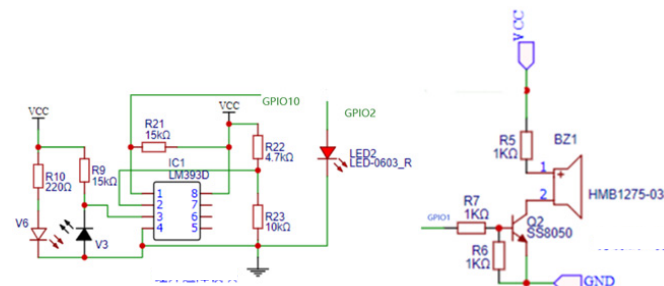


Figure 2. Suspicious object monitoring and alarm

2.3. Combustible Gas Monitoring and Alarm

MQ-2 combustible gas sensor is selected to detect the combustible gas. As shown in Figure 3, the sensor is connected to the Hi3861 via GPIO13.

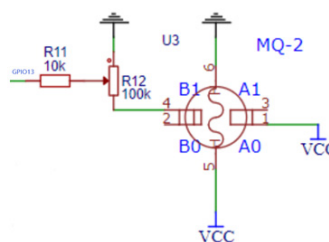


Figure 3. Combustible gas monitoring and alarm

The same buzzer in Figure.2 will be triggered to achieve a timely warning when the value of combustible gas exceeds the threshold value.

2.4. Light Intensity Monitoring and Light Supplement

A photosensitive resistor which is connected to Hi3861 through GPIO7 is used to monitor the environment light intensity. The circuit diagram is shown in Figure 4.

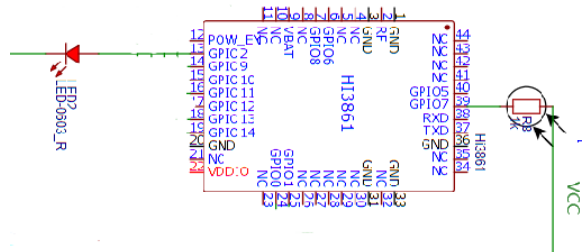


Figure 4. Combustible gas monitoring and alarm

The LED which is controlled through GPIO02 will be turned on when the resistance reaches the threshold value.

2.5. Temperature Monitoring and Regulation

As shown in Figure 5, temperature information is collected using the DS18B20 temperature sensor. The information is transmitted to Hi3861 through GPIO0. If the temperature exceeds 25 °C, a signal will be sent to the relay with optocoupler isolation through the GPIO14. After being amplified by a three-pole amplification circuit, the signal is sufficient to drive the switch to make the electric fan work.

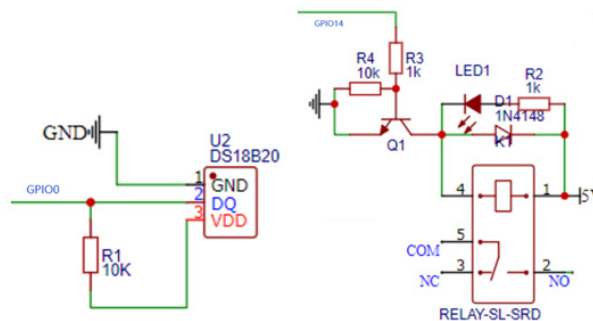


Figure 5. Temperature monitoring and regulation

3. Establishment of Development Environment

The development environment consists of two parts. A Linux server is used for compiling source code. A Windows host is used for code editing and binary file burning. The Linux server and the Windows hosts should be connected through network cables or wireless routers.

Software including VS code, RaiDrive, and Hibern should be installed on Windows hosts. VS Code is used to edit the code. The folders on Linux server are mapped to the Windows host and RaiDrive is used to view the folder. Binary files which are used to control the hardware is burned using Hibern. Optional software MobaXterm can be installed to log in the Linux server remotely as a super terminal.

On the Linux server, it is necessary to build a compilation environment for Harmony system. Software packages should be installed, including scons, kconfiglib, gcc_Riscv32, gn and ninja.

4. Software Design

The main program design flowchart of the system is shown in Figure 6.

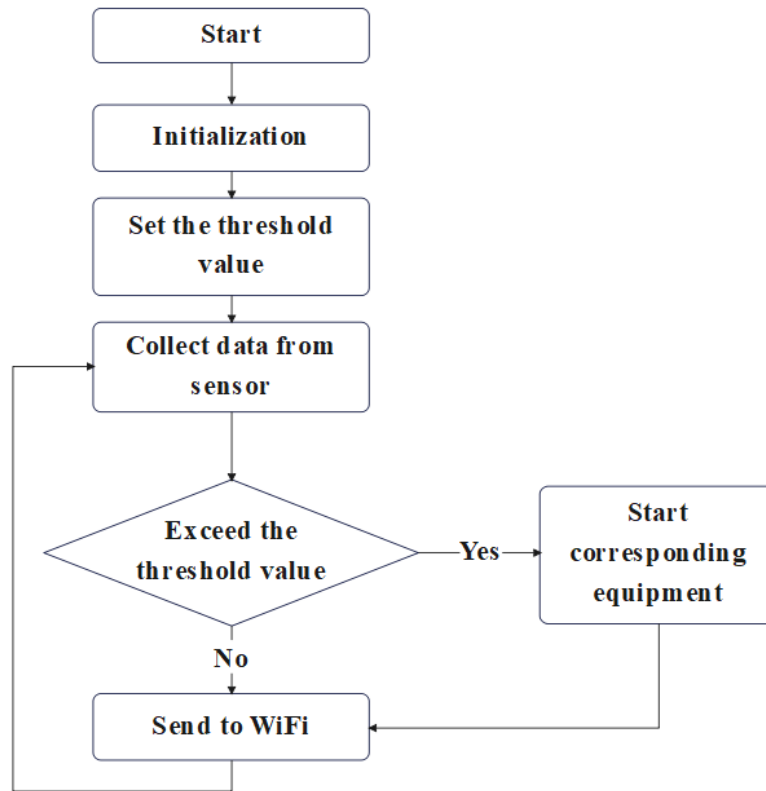


Figure 6. Software flow chart

After initialization, the threshold values of different objects are set. Different environment parameters are collected using different sensors, including MQ2 combustible gas sensor, photosensitive resistor, infrared sensor, and DS18B20 temperature sensor. The data is transmitted to the Hi3861 chip to judge if the collected value exceeds the threshold value. If it exceeds, the corresponding hardware device will be started. The data is sent to the database with WiFi.

5. Results

The system is shown in the Figure 7.

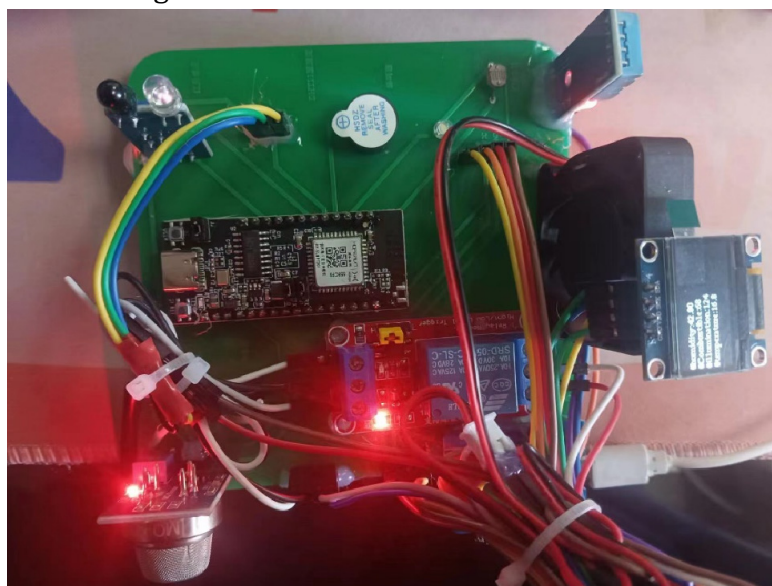
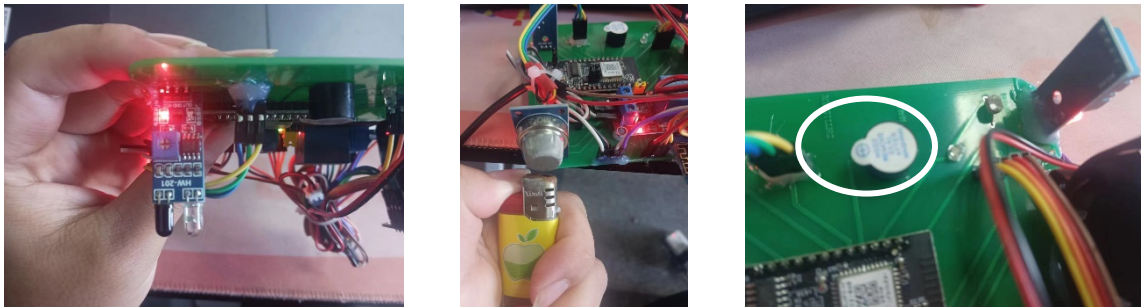


Figure 7. System debugging

As shown in Figure 8, the buzzer starts to work when the HW-201 infrared sensor detects an object. The buzzer also works when the value of combustible gas which collected by MQ-2 combustible gas sensor exceeds the threshold value.



(a) HW-201 infrared sensor (b) Combustible gas sensor (c) buzzer

Figure 8. Suspicious object monitoring and alarm

As shown in Figure 9, the light intensity will be measured using the photosensitive sensor. When the data of the light reaches the threshold value, the led will be turned on.

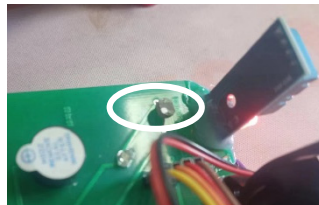
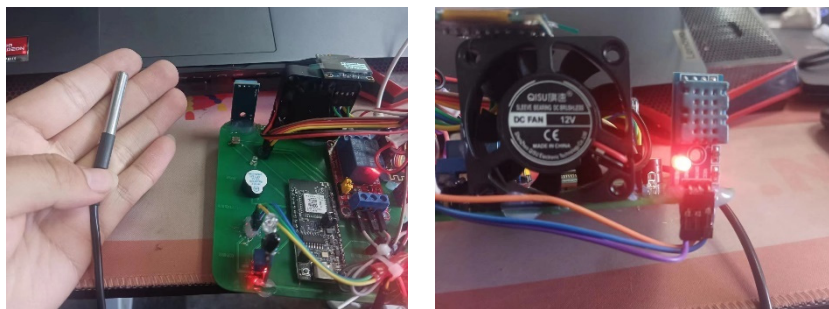


Figure 9. Photosensitive sensor

As shown in Figure 10, the small fan starts to work when the temperature collected by DS18B20 sensor reaches or exceeds 25 °C.



(a) Temperature sensor (b) small fan

Figure 10. Temperature monitoring and regulation

6. Conclusion

An intelligent security system is designed using Hi3861 chip and the Harmony OS. Information including temperature, light intensity, suspicious object and combustible gas can be monitored remotely. A light supplement led, motor fan, and buzzer are also used to achieve early warning and effective adjustment of the environment. The system is significant for improving user experience in the home scene.

Acknowledgments

This study was supported by Key Supported Project for Graduation Design of Suzhou Institute of Industry and Technology.

References

- [1] Giriprasad M , Shivaranjani. M S, Sakthisowmiya. R , et al. Intelligent Smart Home Automation and Security System Using Arduino and Wi-fi[J]. International Journal Of Engineering And Computer Science, 2017.
- [2] Dube P , Halim N , Karenos K , et al. Harmony: Holistic messaging middleware for event-driven systems[J]. Ibm Systems Journal, 2008, 47(2):281-287.
- [3] Gao R, Xing W , Zhao H , et al. Teaching Reform for HarmonyOS Mobile Application Development[J]. Computer education, 2021(12):6.
- [4] Hu Yaxin, Li Hongwei, Jiao Limin, et al Research on Smart Home Appliances Equipped with Harmony OS [J] Home Appliance Technology, 2021:486-488.
- [5] Guo Decai, Peng Shilin Design of intelligent irrigation system based on Hisense chip and Hongmeng operating system [J] Single Chip Microcomputer and Embedded System Applications, 2022,22 (3): 11-15.