

Design of Intelligent Energy-Saving Household System Based On 51 Single Chip Microcomputer

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Abstract: When the traditional home life has been unable to meet people's needs for intelligent, comfortable and integrated life, smart home comes into being. In order to let more people know about smart home system, this paper designs several smart home system modules that are closely related to our daily life based on 51 single-chip microcomputer, and realizes remote control and detection. In our paper, the STC89C51 single-chip microcomputer are used as the main control chip in this paper, which includes the control system modules of lighting, household appliances, temperature and humidity environment detection, security and so on. The ESP8266 Wi-Fi chip is selected as the AP mode, which is connected to the upper computer and other stations. By sending corresponding instructions, it realizes the functions of remote operation of household appliances switch, real-time monitoring of the external environment, fire alarm, security access control and other smart home functions.

Keywords - Single chip microcomputer; ESP8266; Remote control; Security system

Date of Submission: 06-05-2019

Date of acceptance: 20-05-2019

I. Introduction

Along with the development of society and the improvement of science and technology, people begin to pursue an efficient, convenient and intelligent life ^[1]. Characteristics of the traditional home with its simplicity, intelligent household in the reserved under the premise of all its functions, through the PC to realize various remoted, integration of traditional switch operation; Realize the normalization and visualization of the environment through various sensors ^[2]. Of course, the most important part of the smart home is the security: smoke sensor with flame sensor can achieve high precision testing whether indoor fire, confirm the occurrence of fire, immediately triggered buzzer alarm, make indoor people escape inside in the first place; RFID access control system can record the travel time of each person, beeper warning is issued when entering illegally, and the owner can also choose to control the door switch remotely. In general, smart home not only facilitates our life, but also strengthens our life safety and property safety.

II. Structure Design Of Intelligent Home System

2.1 Hardware system overview

The design of intelligent household can be remote control led lighting each room; Through the HC - SR501 human body infrared sensor module real-time detection to control the illumine of the sitting room; Through a relay connect all kinds of ordinary high voltage electrical appliances, such as electric water heater. If you want to take a bath, you can open the electric water heater remotely in advance. After washing, it will be closed conveniently, which saves a lot of energy. The sitting room is equipped with DHT11 temperature and humidity detection sensor to detect the temperature and humidity of the indoor environment in real time. The corresponding instructions are sent by the upper computer to obtain the indoor temperature and humidity value anytime and anywhere. Through the RFID - RC522 module, cooperate with steering gear, the ID of the corresponding IC card is written into the program to open the door by swiping the card, delay the automatic closing operation, and people can remote control door switch; Smoke sensor and flame sensor work in parallel, detect open fire or smoke and immediately trigger the buzzer alarm, and feedback the alarm information; The bathroom adopts energy-saving intelligent thermostatic control valve, with temperature detection and upload function, thermostatic water, reduce the waste of cold water. The function of the intelligent household is not limited to this, the more practical and convenient function is waiting for us to create.

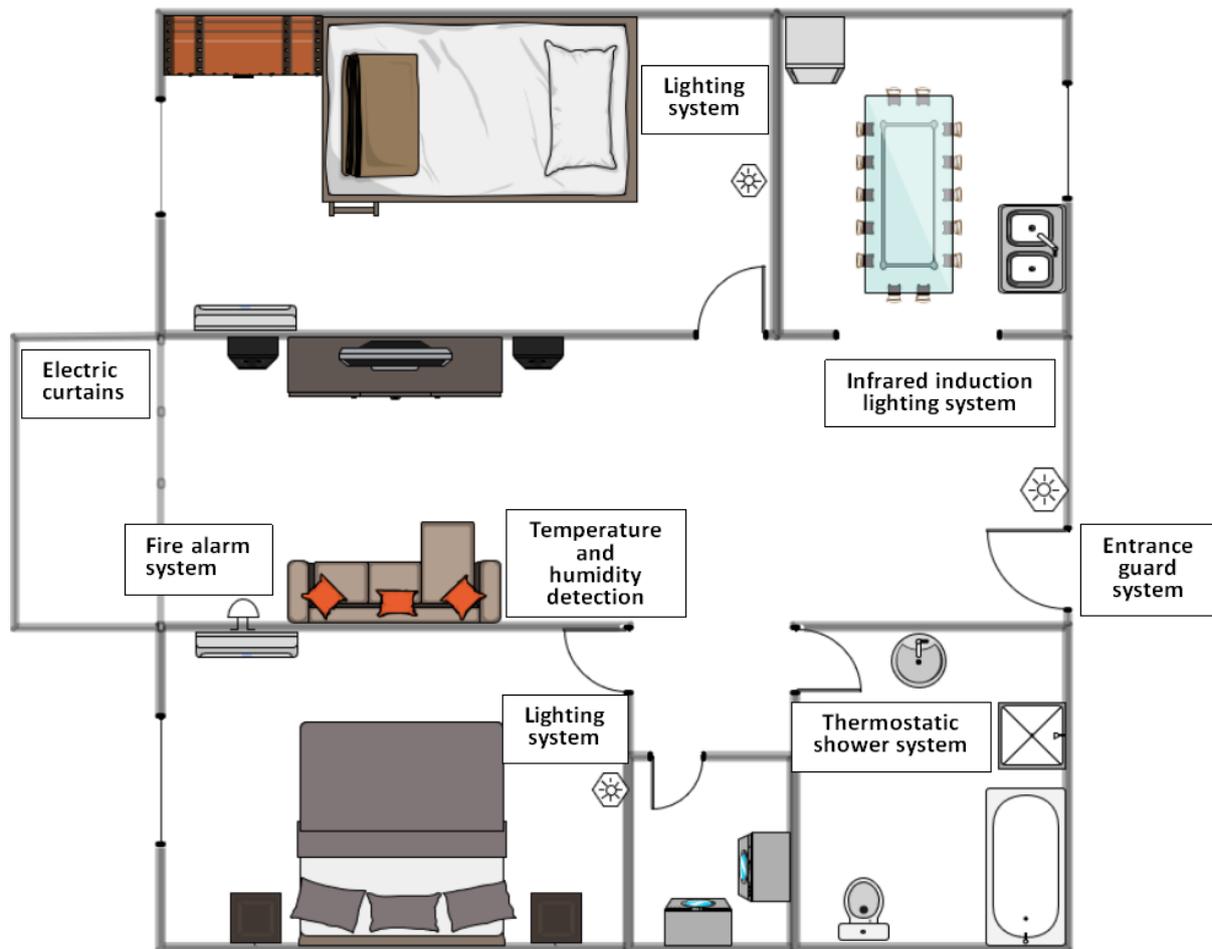


Fig.1 Intelligent household structure

III. Control System Design Of Intelligent Home

The core of the intelligent home is the internet of things. In general, the internet of things includes three parts: perception layer, network layer, application layer^[3]. Perception layer is to point to by various sensors to collect environmental data, including the temperature and humidity sensor, smoke sensor, flame sensors, RFID tags and read/write device, the human body induction sensor, and so on. Its main function is to be measured quantity into electrical signals. The network layer refers to the network created by Wi-Fi module to receive and send data and realize reliable data transmission function. Application layer refers to the combination of the analysis and processing of collected data and the application and operation of objects^[4]. The design of intelligent household has multiple modules as shown in Fig.2, which is given priority to with ESP8266 network module, through the establishment of the client and server communication, to realize the remote control and data detection, and so on.

The intelligent home design uses STC89C51 chip as the main control chip, including crystal oscillator circuit, reset circuit, flame detection module, smoke detection module, temperature and humidity detection module, motor drive module, relay module, access control module, and serial communication module and so on. In order to solve the problem of intelligent home security, choose high sensitivity, good stability and response speed of the MQ2 smoke sensor, cooperate can detect 700 nm to 1000 nm heat source of KY - 026 flame sensor work in parallel, due to the high flame sensor sensitivity, easy to be outside the strong light interference to false alarm, and in general may not have smoke fire when the fire broke out, have the characteristics of fire and smoke, so will run in parallel flame sensor and smoke sensor, when detects smoke alone would trigger a brief buzzer alarm, when smoke is detected and flame is detected at the same time, the lighting system will flicker and operate the buzzer to continuously alarm. It reduces the probability of false alarm and provides a reliable guarantee for people's safety^[5].

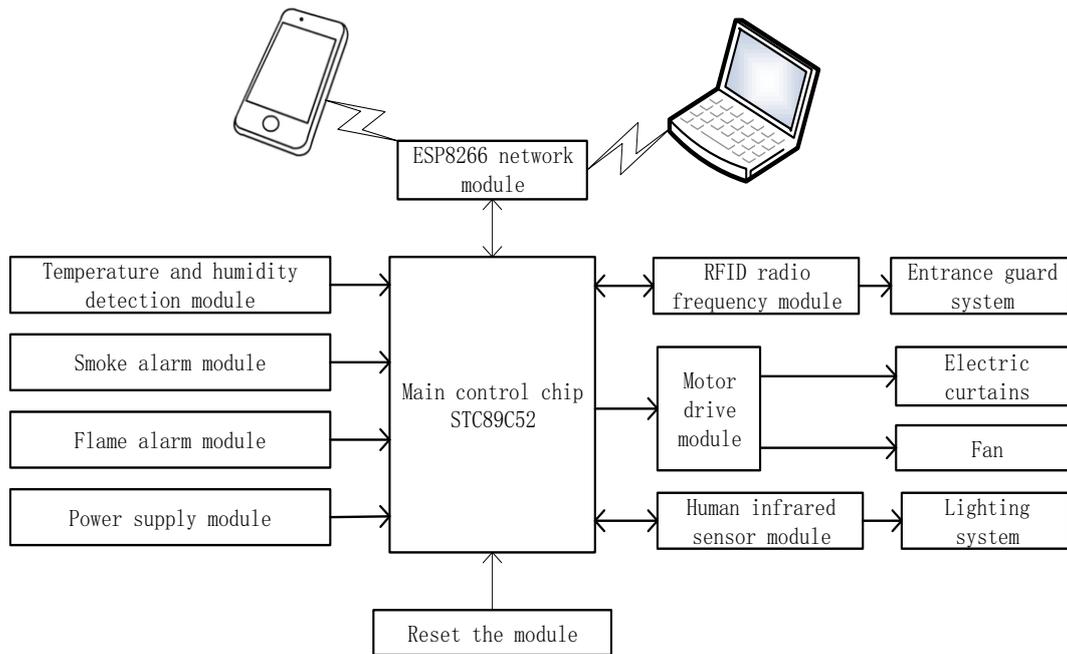


Fig.2 Block diagram of intelligent household system

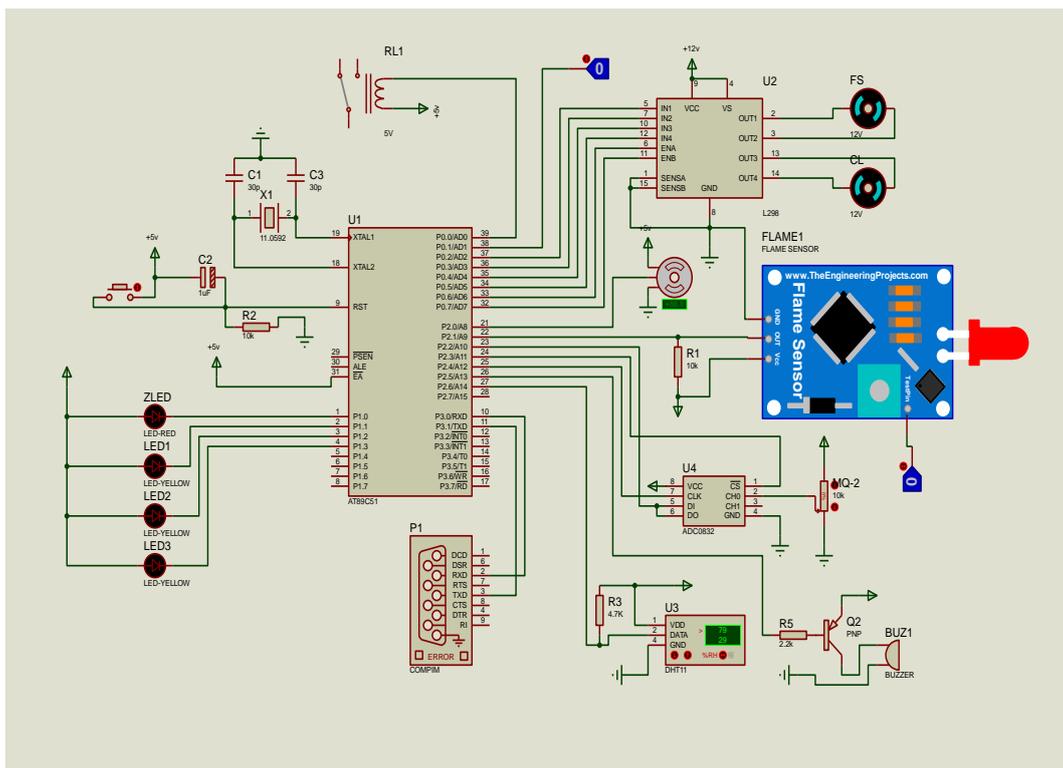


Fig.3 The total circuit of intelligent household

The serial port sending and receiving in this design is established on ESP8266 Wi-Fi chip. ESP8266 is a low-power Wi-Fi chip, which makes ESP8266 work in AP mode by swiping corresponding AT instructions through the debugger. The hot spot of ESP8266 chip is used to connect other devices to form LAN. When the device is connected, a series of commands can be implemented according to the sequence diagram shown in Fig.4. Enter the IP address and port number of the ESP8266, connected a hot spots which created by ESP8266, according to the program instructions, send the command control intelligent household. This design include sensor module, terminal equipment, each module, can get the sensor data, also can control actuators, at the same time can also be used with terminal equipment for data exchange [6].

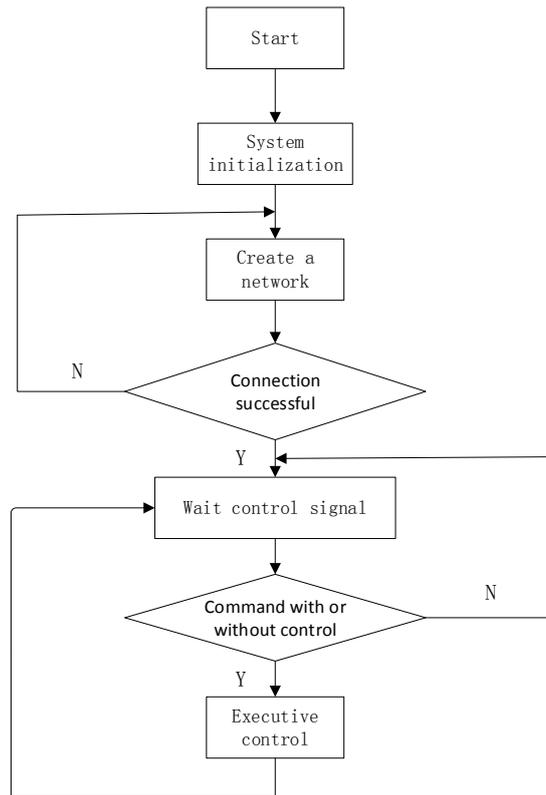


Fig.4 System control sequence diagram

IV. Experiment

As shown in Fig.5(a), when the flame sensor detects the flame, it will trigger the buzzer alarm and LED1 will light up. As shown in Fig.5(b), when the smoke sensor detects the smoke, LED1 will light up and the buzzer will alarm. As shown in Fig.5(c), the remote control of the relay can be realized by the mobile phone. As shown in Fig.5(d), the positive, negative and stop of the motor can be remotely controlled by the mobile phone; As shown in Fig.5(e), when the human body infrared sensor module detects the infrared of the human body, the LED1 lights up. When the infrared module of the human body is blocked, the LED1 is time-extinguished. As shown in Fig.(f), the illumination of LED1, LED2, and LED3 is remotely controlled by the mobile phone.

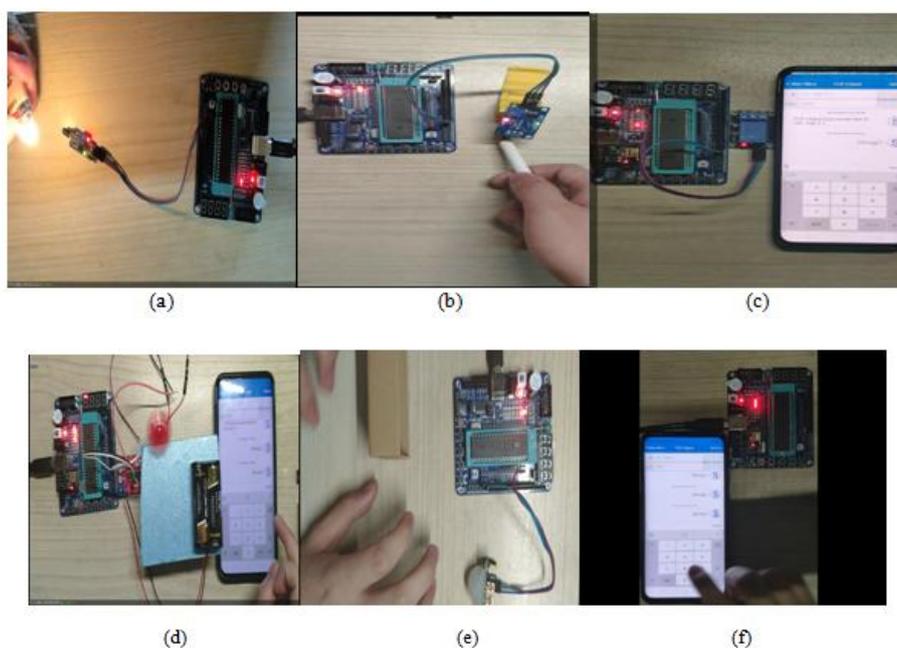


Fig.5 Module physical experiment

According to the structure diagram of intelligent home, build the appearance of the house composed of ABS plastic board and distribute each sensor module reasonably. Connect the corresponding pin to the 51 minimum versions. Connect to the power supply, after the buzzer rings briefly (indicating that the connection has been created), use the mobile phone (upper computer) to connect to the hot spot, open the mobile terminal Net Assist APP, select TCP Client mode, input the IP and port number corresponding to ESP8266, and connect. After the connection is successful, the control command can be sent to realize the remote control of the intelligent home. When the indoor flame and smoke sensors are triggered, the buzzer will alarm, and all lighting systems will flicker. When the mobile terminal sends the temperature and humidity command, the current temperature and humidity data can be obtained; The corresponding instructions can also be used to control the lighting system and fan system separately. If abnormal operation, use the reset button can restart the system.

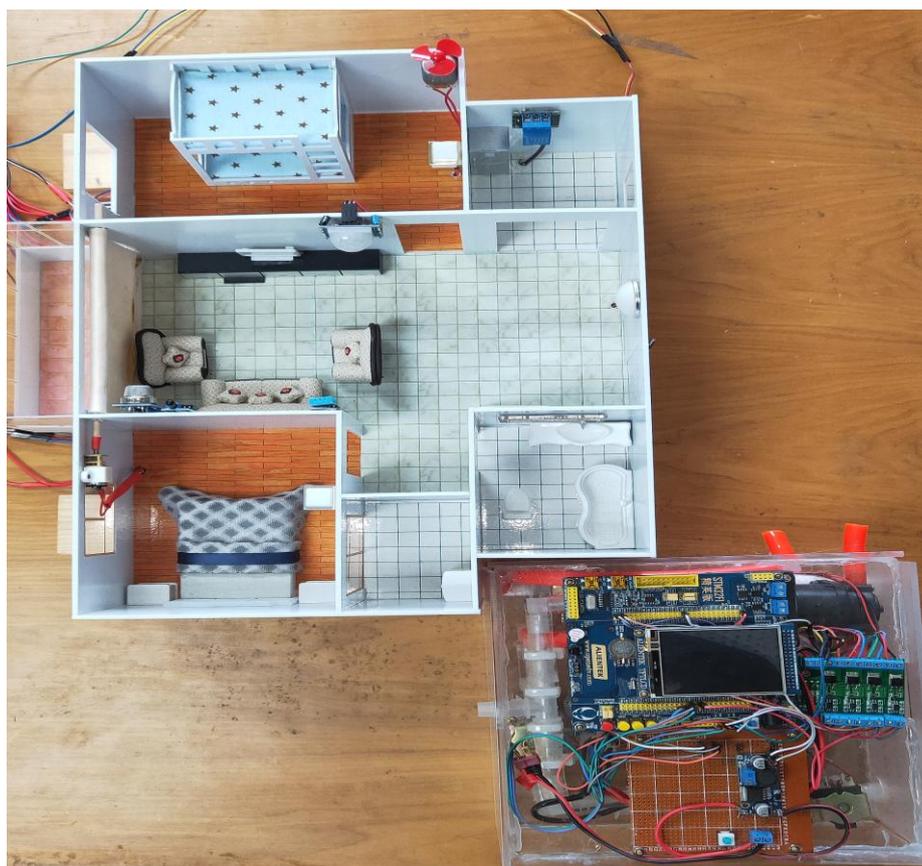


Fig.6 Experimental environment

V. Conclusion

The development of intelligent household improves people's life quality to a certain extent, and increases life comfort, convenience and safety. Meanwhile, the environmental protection and energy saving of smart home will be an indispensable part of the future. On the premise that the economy can meet the basic needs of life, it will become a development trend to further promote the concept of intelligent home, experience new lifestyles and realize modern intelligent home^[7]. Intelligent household, for the purpose of this study wisdom STC89C51 as main control chip, using ESP8266 chip to create a LAN, building intelligent household system, basic meet the needs of intelligent household, has realized the remote control, data monitoring, anti-theft security, and other functions, and hopes that this design let more people understand intelligent household, accepted wisdom to live in.

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IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEEE) is UGC approved Journal with SI. No. 4198, Journal no. 45125.

Mingquan Du1" Design of Intelligent Energy-Saving Household System Based On 51 Single Chip Microcomputer." IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEEE) 14.3 (2019): 64-69.