

Hardware circuit design and development of health care intelligent life system

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Abstract. With the progress of society, health care has become an industry in social development. Based on the current social demand for health care system, In this study, raspberry Pie is used as the main controller, D695 sensor is used as the monitoring input device, ESP8266 is used as the wireless data transmission device and hardware controller, The camera component is a monitoring device, and the client is designed through the WeChat applet. Tencent cloud server is used as the data storage and event processing back-end, the hardware circuit of the health smart life system is designed and realized the intelligent monitoring of health care environment.

Keywords: Health care intelligent life system; Hardware circuit; Design.

1. Introduction

Health care refers to health maintenance; and health care industry refers to the sum total of health care products and services provided to the society. Health care intelligent life system is one of the health care product series, It mainly uses electrical technology, network technology, automation technology, audio and video technology, sensor technology and home life related equipment to build a health care environment intelligent management system. Its purpose is to realize the intelligence of health care environment and improve the quality of life of the elderly.

At present, there are few documents about the intelligent life control system of health care at home and abroad, Therefore, based on the personalized needs of health care environment, it is necessary to design and develop the hardware of health care intelligent life system, which is of great significance to the realization of health care in an aging society.

2. Requirements and scheme for hardware circuit of health care intelligent life system

2.1 Design requirements

In this study, raspberry Pi is used as the main controller, d695 sensor is used as the monitoring input device, esp8266 is used as the wireless data transmission device and hardware controller, camera component is used as the monitoring device, and through the wechat small program design client, Tencent cloud server is used as the data storage and event processing back-end, Design a healthy intelligent life system. The specific requirements are as follows [1]: 1) realize the collection of indoor air quality parameters; 2) realize the client with interface; 3) realize the cloud storage of data; 4) realize the data processing and forwarding of local server; 5) realize the intelligent mail alarm; 6) realize the remote control.

2.2 Design scheme

Based on the design requirements, the hardware circuit of the system is designed with bramble pie (bcm2837) as the main control chip, WiFi module as the communication mode in LAN, six in one sensor module (PM2.5, temperature and humidity, etc.) to collect indoor environment data, infrared sensor as anti-theft alarm device, CSI camera to collect video data, wechat applet development client, Tencent cloud as data storage, The hardware design is shown in Figure 1.

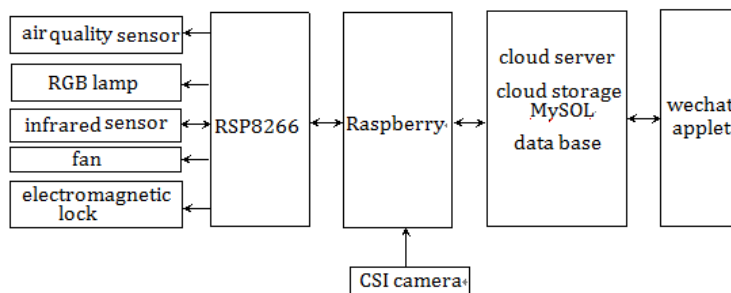


Figure 1. System hardware design block diagram

3. Hardware circuit design of health care intelligent life system

3.1 Introduction of raspberry PI main controller

Raspberry Pi is a small computer with the function of a central controller. In this design, its main functions are [2]: (1) using the network to access the cloud database; (2) using TCP protocol to establish the local server, waiting for the connection of two intelligent hardware; (3) when the lamp on command is queried in the database, it will control the I / O port through the interface circuit; (4) it can receive all kinds of data input by the intelligent hardware, and store it through the cloud database; (5) it has the ability to send e-mail, and can realize the intelligent alarm function of e-mail; (6) it has a camera interface circuit, which can collect image information; (7) it has built an Apache server for clients to access photos, and its hardware layout is shown in Figure 2 [9].

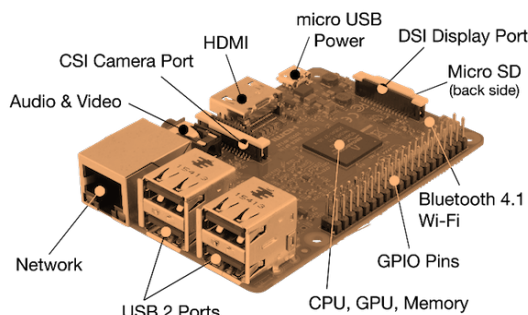


Figure 2. Raspberry Pie hardware layout

3.2 Introduction of ESP8266

Esp8266 is a WiFi chip developed by Shenzhen Lexin company. It can realize LAN communication. Esp8266 module can support three working modes of STA / AP / SRA + AP. It has the characteristics of low price, low power consumption and wide application [3].

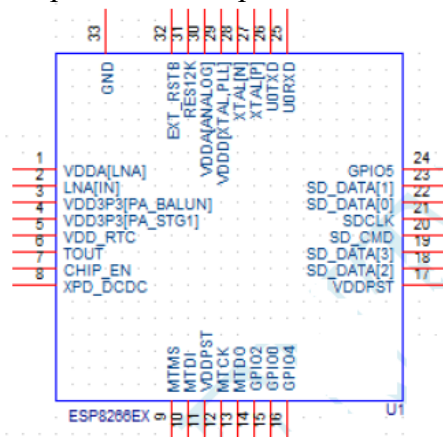


Figure 3. ESP8266 pin diagram

In this system, EPS8266 plays the role of a lower computer. It has the following functions: (1) set up a socket to connect to the raspberry Pie Server; (2) initialize UART serial port to send the environment data to raspberry pie; (3) use the established socket connection to send the current infrared trigger status to raspberry pie; (4) When it receives the light on command, the system immediately initializes the I / O port, and controls the PWM duty ratio output by the I / O port to achieve the mixed RGB light effect.

3.3 Design of data acquisition circuit and control circuit

3.3.1 Six in one sensor module

The six in one sensor module is composed of a series of sensors and signal processing circuit chips. For the sensor, it adopts dip package, which integrates temperature sensor, humidity sensor, formaldehyde sensor, PM2.5 sensor, TVOC sensor, CO2 sensor, etc. to realize the detection of environmental parameters. For the signal processing circuit chip, it is to carry out digital compensation and data integration for the signal collected by the sensor, and send the data in the form of serial port [4]. The specific object is shown in Figure4.

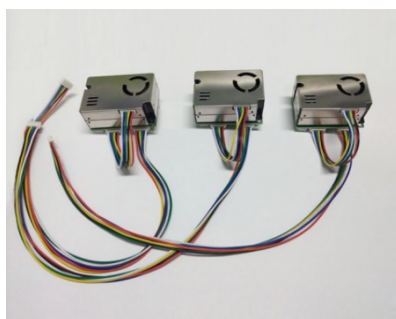


Figure 4. Physical graphics of six in one sensor

3.3.2 Design of data acquisition circuit.

The function of the data acquisition circuit of the system is to collect the ambient air quality data and the infrared trigger alarm state respectively, but the two acquisition methods are different. For the ambient air quality data acquisition, it communicates with the internal chip of the sensor directly through the UART protocol of the hardware serial port, and processes directly after reading the environmental data. For the acquisition of the infrared trigger alarm state, it needs to set the trigger alarm range in advance. When the system sensor detects that the infrared signal enters the trigger range, the sensor will output a high level at the designated COM port to make the system send the alarm signal [5]. The specific circuit is shown in Figure 5.

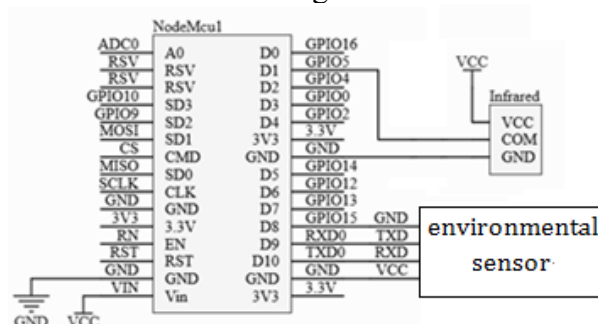


Figure 5. Data acquisition circuit

3.3.3 Design of control circuit of household appliances.

The control circuit of household appliances is composed of three parts: light control, fan control and access control system. It completes the whole control process through the esp8266 chip. For light control, The PWM signals of esp8266 output control the luminous intensity of the RGB lamp respectively, so as to form different light color mixing effects; For fan control, the output signal of

esp8266 is driven and amplified by integrated circuit tb6612 to control the rotating state of fan; for access control system control, the output signal of esp8266 is amplified by triode 8550 to control the switching of relay working state and realize the function of opening / closing door, and its schematic diagram is shown in Figure 6.

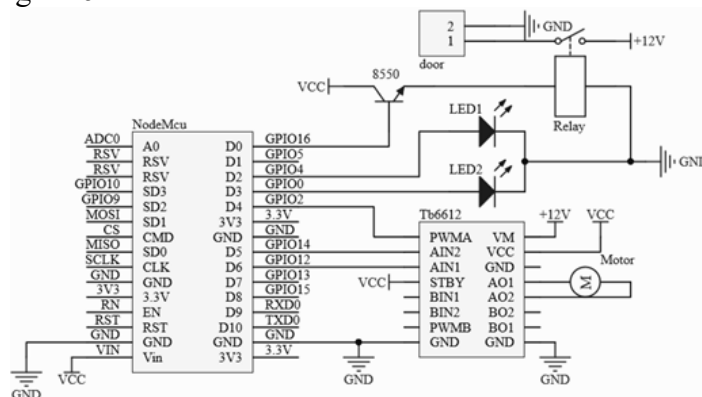


Figure 6. Control circuit schematic diagram of household appliances

3.4 Design of video acquisition module

3.4.1 Introduction of ov5647 module.

The design of video acquisition circuit is realized by ov5647 module. Ov5647 camera module is a high-performance video acquisition module, which has the ability of auto zoom and drive, much higher picture quality than the traditional USB camera, and the circuit structure is simple, its structure is shown in Figure 7.



Figure 7. Ov5647 camera module

3.4.2 Installation and configuration of camera.

Because the ov5647 interface adopts Mipi standard CSI interface, you only need to directly connect the ov5647 interface with the CSI interface of raspberry esp8266, as shown in Figure 2.

To realize normal communication between ov5647 camera module and raspberry esp8266, the camera needs to be configured. The specific configuration process is as follows [6]: (1) update the system with the command "Su root apt get update apt get upgrade"; (2) configure and activate "raspi config" of the camera; (3) select "enable camera" command to enable the camera and set the status to "enable"; (4) Restart the system and the camera will work.

4. Software design of health care intelligent life system

The software design of the health care intelligent life system is based on the completed hardware circuit design. It adopts the modular design method. In the process of design, we use "Python" language, "Lua" language and "node. JS + HTML + CSS" language to design the lower computer program, the central control processing program, Tencent cloud server program and client-side small program, Its characteristic is that the program code of each module not only has relative independence, but also has certain relevance [7].

5. Client page design and database development of health care intelligent life system

5.1 Design of client page

The client page design of the system is a reasonable layout for each page, and binding the event response to the logic of each button. The purpose is to complete all functions assigned by the project. It should be noted that in the design of video monitoring, due to the limitation of bandwidth, the system needs to refresh the pictures once in 5 seconds. The client page is composed of three subpages: device control, environment monitoring and data broken line. Taking environment monitoring page as an example, its display effect is shown in Figure 8 [8].

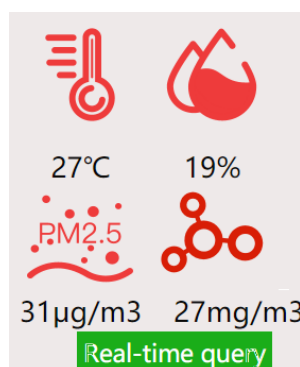


Figure 8. Environmental monitoring diagram

5.2 Design of database

Database design is to design the database forms in the cloud server. In the design process, use the standard syntax of the database to realize the form creation, data query, data increase, data modification and other operations. It completes the main work of cloud server and is the key place of data exchange of the whole system.

6. Conclusion

From the above discussion, we can see that this design adopts Raspberry pie 3B as the system control core, and integrates the hardware circuit of health care intelligent life system with camera equipment, sensor and controller. Through the design of system software, client page and database, it realizes the monitoring of temperature and humidity, light intensity, formaldehyde, smoke and other data information of health care environment, through wireless technology, the information exchange and communication are completed, the remote control of the system is ensured, and the safety and comfort of the health environment are realized.

Acknowledgments

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