A Wireless communication device and method based on Android control system

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Abstract. A wireless communication device based on STM32 is designed in the paper. It is an intelligent device based on the Android platform of wireless network. The paper introduces the overall structure design block diagram of the whole device and focuses on the working principle of the whole device and the circuit principle of each terminal node. The software design of communication equipment is completed and the ZigBee wireless network based on CC2350 is adopted. in the paper. WiFi module is used to connect the communication between the client STM32 and the terminal device in order to arrange the line. In order to achieve remote control and display terminal device status, the wireless communication device can control the terminal device anywhere through local area network or 4G network via mobile phone APP.

Introduction

With the development of science and technology, some intelligent appliances are also using wireless control gradually. Smart home has gradually spread to all households. And human needs for intellectualization are greater. The popularity of Internet speeds up the development of intelligence. In today's society, with the growing demand for scientific and technological culture, people are increasingly demanding. Smart home has undoubtedly become a trend of the times.

Smart home can provide convenience for people. It enables users to live more efficiently and conveniently. At the same time, it also plays a certain role in improving the energy consumption of family life and makes life greener and better. Smart home can monitor the temperature and humidity inside the house and detects air pollution. It gives users a more secure life [1]. Meanwhile, Smart home can do some housework instead of users and make life more comfortable. Smart home allows users to truly enjoy the fun of life and enables the society to develop more harmoniously and beautifully.

Overall plan

The wireless communication device consists of three parts. The first part is composed of mobile phone client and client. The second part is composed of client and coordinator. The third part is composed of coordinator and terminal node. The mobile terminal and the client are wireless communication through the WiFi module. The communication between client and coordinator is through serial port. The communication between coordinator and terminal node is achieved through wireless communication through ZigBee wireless network [2]. And the client design is based on STM32F407VGT6 embedded system main control part. ZigBee network is composed of RF module and terminal node based on TI's CC2530F256 chip and CC2591 chip. So that the mobile terminal can monitor the terminal devices remotely. And the WiFi module is equivalent to an intermediate bridge.
between the mobile phone client and the client. The ZigBee network is equivalent to an intermediate bridge between the client and terminal devices [3]. The overall network structure of the wireless communication device is shown in Fig. 1:

![Fig. 1 Network structure diagram of wireless communication device](image)

CC2530 uses 1.8V working voltage internally. So the power consumption is very low. External digital I/O interface using 3.3 V voltage. A self stabilizing loop is integrated on the chip which can convert 3.3 V voltage to 1.8V voltage. So this design only needs to provide 3.3V power to supply CC2530. The transceiver of CC2530 radio frequency signal is transmitted by differential mode. In this project, the on-board PCB antenna is used to transmit wireless signals [4]. Through the Babylon matching circuit, the sensitivity of wireless signal reception can reach -97dB. CC2530 needs a 16MHz reference clock to transmit and receive 250kbps data. The design uses internal body oscillator to generate clock signals.

The door protection device is a form of protection for families. The device is wireless communication with the main control STM32 through the ZigBee network [5]. So the client can monitor the terminal device in real time. The device is mainly composed of an optocoupler isolating circuit, a relay module, an infrared pair tube and other devices. Intelligent curtain terminal control is to control the stepper motor to drive the conveyor belt to drive the curtain on and off. The driving force is stepping motor. Due to the stepping motor has better control performance, the curtain can be accurately positioned [6]. The screw and nut transform the rotational motion of the stepping motor into linear motion. So when the stepping motor drives the coupling every turn, the corresponding node fixed on the conveyor belt drives the curtain a lead distance. According to the adjustment of the drive motor's fine fraction, the step angle can be known. Stepper motor rotation is through the STM32 controller's port each to send a pulse to the driver's PUL terminal. The 42 stepper motor selected in this design, as a result of the motor does not require much torque. The stepper motor driver module used here is the module with A4988 chip as the core. In fact, the internal circuit structure of the driver is driving of H bridge. H bridge composed of four MOS pipes to connect the stepper motor in the middle drive and the peripheral two MOS tubes are used to control the MOS conduction state in the H bridge. So as to drive the stepper motor forward or reverse. The front two MOS tubes are used as switches [7]. And the switch of MOS can be controlled by controlling the grid voltage. The 4 MOS tubes behind work in the amplifier area to drive the motor to rotate normally. Stepper motor drive and stepper motor circuit is shown in Fig. 2:

![Fig. 2 Circuit diagram of stepper motor and stepper motor](image)
Software analysis

The client software program of wireless communication device is developed on the platform of uC/OSII embedded system. The overall architecture of software is divided into three layers, including hardware support layer, operation system layer and application layer. The client software mainly includes the porting of uC/OSII on STM32F407, the driving of peripherals on chip, the driving of peripherals on chip, the graphical man-machine interface, the serial communication with coordinator and WiFi module, etc.

The ZigBee coordinator is the first device in the network, whose main function in network is to establish and activate the whole network. After the coordinator running, it selects a channel and a network ID. Then it builds and starts the whole network. When the network is configured and started, the coordinator's job is to be responsible for network routing [8]. Coordinator has both the function of configuring the network and the function of routing. Coordinator is the most complex device in the smart home domain network.

The Internet of things is connected to the Internet through WiFi module. Considering the cost and feasibility, the paper chooses the ESP8266-12F module of Lexin to realize the Internet accessing based on WiFi [9]. In addition, it can realize remote monitoring of mobile devices in wireless communication devices. The main controller communicates through the serial port and the WiFi module. Mobile phones and WiFi modules connect to the cloud at the same time, which can achieve remote communication between mobile phone and client via cloud. The mobile terminal can send control information to the client through the cloud server. The client controls the execution of the corresponding home devices through the ZigBee network. The client will upload the information such as temperature and humidity, security and so on through the cloud to the phone [10]. So users can monitor the environmental safety and remote control of the device in real time in different places.

Overall test analysis

The whole test of the entire wireless communication device is carried out in this paper, which tests the overall operation effect and stability of the system. The ZigBee network coordinator and the client control system are connected through the serial port [11]. Then all modules are powered on and the whole system is running. The real-time display of clock date and temperature and humidity can be seen on the main screen of the touch screen. The menu button on the touch screen is pressed and Menu interface is entered. Door lock control, lighting control and curtain opening and closing are tested in turn. All of these can be successfully realized. APP interface is opened on mobile phone. The real-time status of each terminal node can be monitored by APP [12]. The overall test of wireless communication device IOT system passed smoothly which shows that the system works well and is stable and reliable. The whole physical map is shown in Fig. 3:

![Fig. 3 System physical map](image-url)
Conclusion

The paper first describes the research background and the source of smart home development. The design and implementation of hardware system of wireless communication device in this subject are discussed. This paper describes in detail the design principle and implementation process of the hardware circuit of client, coordinator and terminal node. Then, the paper discusses the design and implementation of wireless communication device software system. And the paper analyzes the embedded system transplant of the wireless communication device client, implementation of touch human-machine interface, serial communication between client and coordinator and WiFi module, ZigBee wireless networking based on ZStack, terminal node controlling and software implementation of remote controlling modules.

The paper designs a wireless communication device IOT system to realize home appliances and wireless networking and communication of client controller. The centralized control function of home equipment is realized. It can also control the devices by terminal buttons. And it can be monitored remotely by mobile phone APP. The centralized management of smart home system, distributed control and remote monitoring have been realized, which has broad market prospect and application value.

References