

Research on Communication of Wi-Fi in Intelligent Devices

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Abstract

With the development of Internet of things and the impact of 4G/5G network, a large number of intelligent devices, especially smart home products, have been put into the market. This paper first discusses the wireless fidelity (Wi-Fi) technology, and then makes an in-depth study of the Wi-Fi module in the intelligent device, the communication between the whole machine and app, so as to provide technical support for the unsuccessful communication connection and poor connection stability between Wi-Fi and intelligent devices, and enhance the user experience of intelligent devices.

Keywords

Wi-Fi module; Intelligent device; Communication; App.

1. Introduction

With the rapid development of Internet plus and AI technology, intelligent technology is widely applied in various fields, and intelligent devices are becoming more and more popular. In order to realize the grand vision of "Internet of things", intelligent device manufacturers connect a large number of traditional devices to Wi-Fi through Wi-Fi chips, thus making devices intelligent, which also promotes the vigorous development of the Internet of things in recent years. However, when intelligent devices access to wireless networks, there are many problems, such as complicated operation, difficult operation for ordinary users, long time consuming and difficult implementation. This paper mainly analyzes the technology and characteristics of Wi-Fi, and preliminarily introduces its role in the Internet of things, as well as the communication logic between Wi-Fi module, app and intelligent device, so as to provide necessary help for users who use app to communicate with intelligent devices through Wi-Fi.

2. Wi-Fi Technology and Its Characteristics

2.1. Wi-Fi Technology

Wi-Fi is a radio wave transmission based on Maxwell's electromagnetic field theory, which is a high-frequency radio technology. Through this technology, mobile phones, computers, tablets, smart home appliances and other intelligent devices can be connected together, and can be seamlessly connected to the Internet, bringing great convenience to people's work, life and study.

2.2. Wi-Fi Features

Compared with Bluetooth and other wireless communication technologies, Wi-Fi has the following characteristics:

1) At present, router signals can be connected everywhere in office or home environment. Devices with Wi-Fi function can be connected to the network when there are network Hotspots or wireless broadband routing coverage. In many areas, Wi-Fi can be used for secondary development and application. Such as Wi-Fi remote control aircraft, cars and other toy fields, Wi-Fi network radio, cameras, digital cameras, medical equipment, data acquisition, handheld

devices, smart card terminals, instrumentation, wireless POS machine, modern agriculture, military and so on.

2) Simple point-to-point connection, can directly access the Internet, intelligent devices and smart phones real-time communication, real-time information feedback. (as shown in Figure 1)

Experts said: "Wi-Fi direct connection and Bluetooth are two different technologies. Although they may intersect in some aspects, Wi-Fi direct connection emphasizes the sharing of multimedia, content and applications, and it has a typical range and speed of Wi-Fi technology. For tens of thousands of consumer electronics and mobile terminal products, Wi-Fi direct connection technology can be described as "desirable." In addition, Wi-Fi direct connection also supports point to multipoint connection.

3) The network bandwidth is relatively large, the transmission speed is relatively fast, the networking is convenient, and the connection can be used.

4) The transmission range is wide, and the transmission distance is between 20-200 meters.



Figure 1. Example of APP real time information feedback

These characteristics make it the most widely used wireless technology in intelligent devices.

2.3. Working Mechanism of Wi-Fi

Specifically, it is to install an app on a mobile phone or a handheld computer. When a smart device is needed to perform functions, just open the corresponding app and turn on the Wi-Fi function. The app can automatically identify and connect to the hardware system of the remote switch of the smart device to establish communication. When you click the icon of the corresponding function on the app, the app on the mobile phone or the handheld computer will use Wi-Fi Or the 4G/5G wireless network sends a string command to the hardware, and the controller analyzes and judges after receiving the string command, so that the hardware relay of the system terminal connected with it can make the action of opening or closing. When the command is executed successfully, the device terminal hardware controller will send a message back to the app, and the app software will automatically change the indication state of the terminal device.

3. Composition and Communication Principle of Wi-Fi intelligent Device

Intelligent devices using Wi-Fi technology are composed of Wi-Fi module, app and the whole machine. Only when these three parts communicate with each other can all kinds of devices be truly intelligent.

3.1. Wi-Fi Module

Wi-Fi module, also known as serial Wi-Fi module (see Figure 2), belongs to the transmission layer of Internet of things. Its function is to convert the serial port or TTL level into an

embedded module that meets the Wi-Fi wireless network communication standard, with built-in wireless network protocol and TCP/IP protocol. Traditional hardware devices are embedded with Wi-Fi module, and directly connect to the Internet through Wi-Fi. For example, esp8266ex is a Wi-Fi module launched by Lexin company with a price of only about 10 yuan. Although the price is low, it has a built-in 32-bit processor with ultra-low power consumption, and the CPU clock speed can reach up to 160 MHz. It supports real-time operating system and Wi-Fi protocol stack, and can leave up to 80% of the processing power for application programming and development. It is extremely powerful and has great advantages. Wi-Fi module is a small single chip microcomputer with 8 pins, which can be connected to other devices to achieve the required functions. The intelligent device with WiFi module can directly access the routing network.

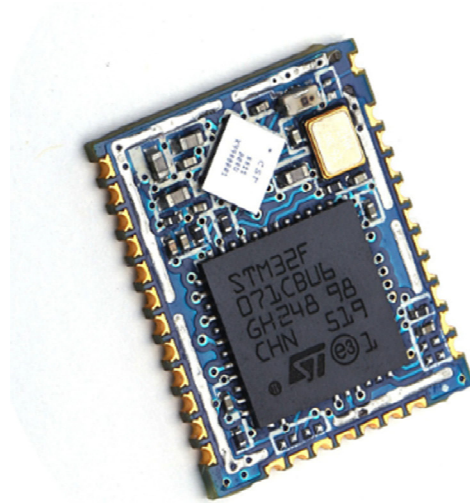


Figure 2. Wi-Fi module

3.2. APP(Application)

App refers to the third-party applications of smart phones. With the popularity of smart phones and iPad and other mobile terminal devices, people are gradually used to operating app clients to access the Internet. In this paper, its function is mainly used for equipment distribution network. Many smart devices can't input Wi-Fi account and password through the interface display window. Instead, they first upload to the server through app, and then let the server act as a translator to give instructions to the device. Here, the smart device also receives the information transmitted by Wi-Fi.

3.3. Whole Machine

The main body of the intelligent device is called the whole machine. The whole equipment is connected to the Internet through Wi-Fi module, and the command from Wi-Fi module and app is executed through the main control system. After the Wi-Fi module is matched, the data is transmitted to the cloud data platform of the intelligent device system. The app side is based on the device status data on the cloud data platform, and the two realize the interactive function.

4. Communication Process Between App, Wi-Fi Module and the Whole Machine

There are many steps in the interaction logic of Wi-Fi module, app and the whole machine in Wi-Fi intelligent devices, which can be roughly divided into four processes: power on start, distribution network data transmission, whole machine state change, APP issuing command. The specific interactive communication is as follows.

4.1. Power on and Start

After the whole machine is powered on, the Wi-Fi module is powered on, then the Wi-Fi module will work immediately, send the start signal to the whole machine, the whole machine will receive the response, and transmit its mid and other information through the serial port. Secondly, Wi-Fi module will transmit hot spot signal to wait for distribution network. At the same time, the Wi-Fi module will send a command code to the whole machine to query the working status of the whole machine, and the whole machine will reply to the queried status after receiving it. After that, every other period of time (30s), the Wi-Fi module will initiate communication status and query the whole machine function.

4.2. Distribution Network Data Transmission

Once the intelligent device is connected to the network, the Wi-Fi module needs to be initialized and reset before entering the distribution network stage. After the Wi-Fi module is reset, the device will send out a hot spot. At this time, open the app to enter the distribution network interface and query the hot spot signal. After the user selects the correct hotspot, app will send the encrypted string command to WiFi module. At this time, a local area network will be established automatically to obtain the corresponding IP address, port number, mid, MAC address and other information for system initialization. After that, the WiFi module connects with the router, sends mid and other information, binds Mac and key, calibrates the time by connecting to the server and logging in to the server, sends the real-time status, and reports the data to the server. App writes the configuration information to the whole intelligent device, and the whole intelligent device can be connected to the network server for data transmission and remote control after the server is registered successfully.

4.3. State Change of the Whole Machine

When the state of the whole machine changes, the whole intelligent device will send special function instructions through the serial port, and the Wi-Fi module will reply to a specific letter to indicate receipt, and refresh the device cache. The app starts a fixed time cycle to actively query the module information in time, and the Wi-Fi module returns the whole machine status value according to the query. The whole machine app actively queries the information of the whole machine. According to the query return status value, the module replies to a specific letter to indicate that it has received it, and refreshes the device cache to change the state of the whole machine.

4.4. App Issue Command

The data and remote control sent by app to the whole device are transmitted to the device network center connected to the Internet through the server, and the device network center forwards the data to the device terminal through the WiFi module. App issues commands in the form of specific strings. WiFi module parses the commands of specific strings, refreshes the device cache, and sends the corresponding command status to the whole machine. The whole machine makes a response to indicate that it has received it.

To sum up, the intelligent device mainly relies on the core terminal to receive the corresponding information of the node, and then sends the corresponding information to other control nodes with the set program, so as to control the intelligent device.

5. Conclusion

Through the above analysis of the communication mechanism between the app, Wi-Fi module and the whole machine in the Wi-Fi intelligent device, it can be found that the app, Wi-Fi module and the whole machine There are many communication links in the module and the whole intelligent device. In the process of intelligent device function test, the key points of the problem

can be analyzed according to the four processes of its communication mechanism, which can simplify the user's operation steps, reduce the user's operation difficulty, and improve the user's debugging success rate. To solve the problem of convenient and stable communication between Wi-Fi modules and smart devices, as Greg Ennis, technical director of Wi-Fi alliance, said, "now Wi-Fi can establish connections between smart devices, which is another important step towards the realization of the vision of Wi-Fi digital home."

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