Intelligent fingerprint identification sign-in system based on STM32

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Abstract

In order to eliminate such bad phenomena as much as possible, and in order to manage the attendance of personnel more conveniently, we designed a smart fingerprint identification and sign-in system based on STM32, which is suitable for all kinds of places that need to check in. The system mainly uses STM32F103C8T6 as the main controller, which consists of AS608 fingerprint identification module, WIFI wireless transmission module, LCD liquid crystal display, matrix keyboard module, etc., which realizes fingerprint identification sign-in and sign-off, display screen displays personal information, and remotely transmits to the higher level, so that the work of checking becomes more realistic, convenient, efficient and intelligent.

Keywords

Fingerprint identification sign-in system; STM32F103C8T6 main controller; AS608 fingerprint recognition; WIFI wireless transmission; LCD liquid crystal display.

1. Introduction

At present, in people's daily life, whether it is going to work, going to school or meeting, almost all of them will sign in to confirm the presence of personnel. However, the traditional sign-in form, such as paper-pencil check-in or swipe card sign-in, is the biggest flaw that is easy to sign for others. In this case, this will inevitably lead to unreality of the attendance situation. In addition, the method has the disadvantages of being easy to lose, easy to damage, and poor in convenience. In view of the above drawbacks of traditional sign-in, we designed a smart fingerprint identification and sign-in system based on STM32F103C8T6 with computer, fingerprint identification technology and remote information transmission technology to achieve the intelligent, systematic and convenient reporting of check-in and attendance.

On the basis of the sign-in function, the system we designed also realizes the intelligent reporting of the attendance situation. After each person's fingerprint is checked in, the information will be stored in the background of the system. When the entire work is completed, the attendance personnel can directly transmit the system-generated check-up situation to the superior through wireless transmission, thereby simplifying the task reporting manner between the attendant and the superior unit, shortening the task execution time, enhancing the real-time performance of the task report, and reducing resource consumption, to minimize the workload between the two sides, greatly saving time and labor costs.

Therefore, whether it is the fingerprint identification of the system or the intelligent reporting of the attendance, the research and design of the traditional sign-in mode has certain far-reaching significance.

2. Overall system design

In order to meet the needs of users as much as possible, the overall design of the system is divided into system hardware design and system software design. The hardware system design includes main controller STM32F103C8T6, AS608 fingerprint identification module, WIFI wireless transmission module, LCD liquid crystal display, matrix keyboard, etc. The software system includes fingerprint module driver development, wireless transmission module driver development, display and matrix keyboard driver development, and finally implements the entire system function through software execution flow. The MCU is divided into a master and a slave in this hardware design. The control chip controls other peripheral modules. These peripheral modules are composed of the following parts: LCD display, fingerprint sensor AS608, matrix keyboard, WIFI wireless transmitter module, and a buzzer. Fig.1 is a block diagram of the overall design structure of the system.

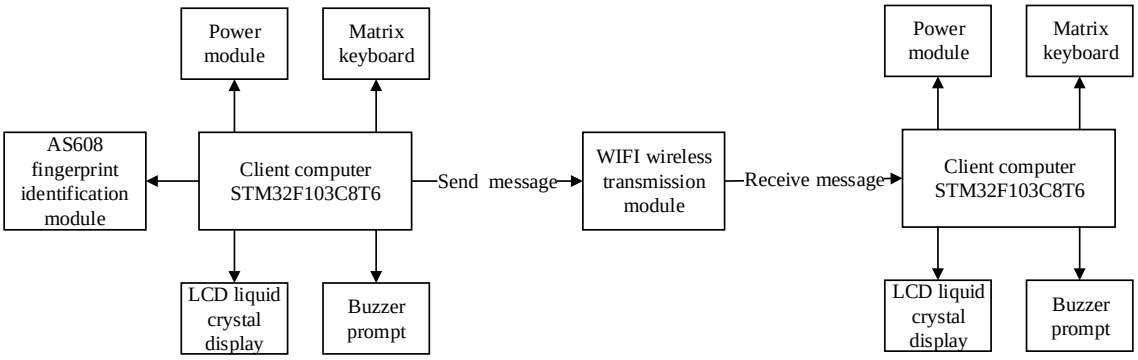

Fig.1 System overall design block diagram

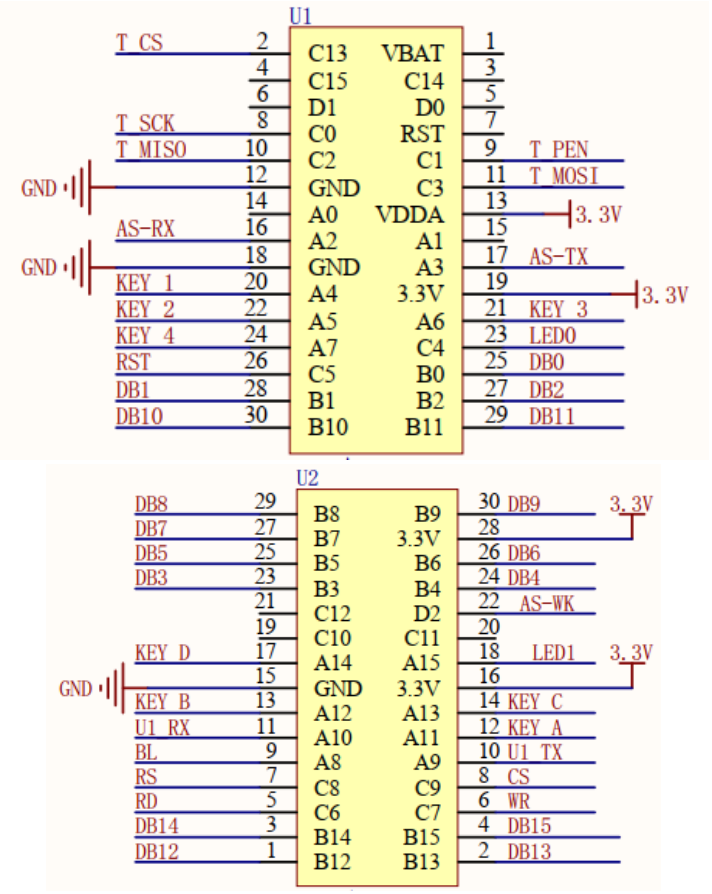

Fig.2 Schematic diagram of STM32F103C8T6 microprocessor

3. The system hardware design

3.1 STM32F103C8T6 microprocessor

The STM32F103C8T6 is based on the ARM Cortex-M core. The STM32 family of 32-bit micro-control features high performance, low power consumption and fast operation. It has 64k of flash program memory and up to 20k bytes of SRAM supply voltage of 2.0 ~ 3.6V, operating temperature of -40 ° C ~ 85 ° C. Up to 80 IO ports, 7 timers, and 9 communication interfaces include 2 IIC interfaces, 3 USART interfaces, and 2 SPI interfaces. The schematic diagram is shown in Fig.2.

3.2 AS608 fingerprint identification module

This system uses the ATK-AS608 fingerprint identification module. The ATK-AS608 Fingerprint Identification Module is a high performance optical fingerprinting module from ALIENTEK. The ATK-AS608 module uses the AS608 fingerprint identification chip of the famous fingerprint identification chip company Hangzhou Qianyuan Chip Technology Co., Ltd. (Synochip). The chip's built-in DSP unit integrates a fingerprint recognition algorithm to efficiently capture images quickly and identify fingerprint features. The module is equipped with a serial port and a USB communication interface. The user does not need to study complex image processing and fingerprint recognition algorithms. The module can be controlled by a simple serial port and USB according to the communication protocol. This module can be applied to various attendance machines, safe cabinets, fingerprint access control systems, fingerprint locks and other occasions. The schematic diagram of the module is shown in Fig.3.

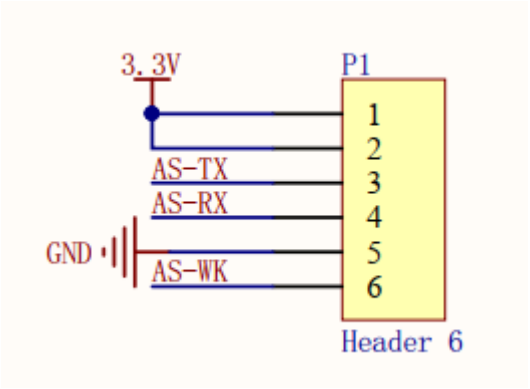

Fig.3 Schematic diagram of ATK-AS608 fingerprint identification module

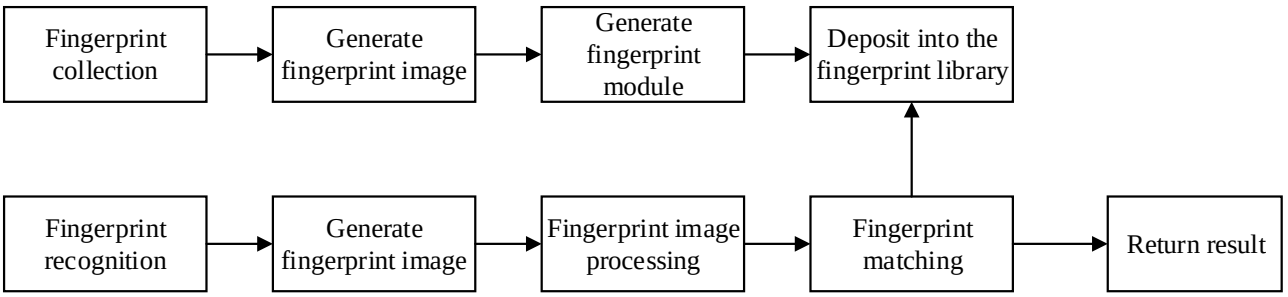

Fig.4 Fingerprint identification process block diagram

The specific working process of fingerprint recognition is: pressing the fingerprint (getting the fingerprint image), turning into a specific unique feature of the fingerprint, and generating a fingerprint template. The overall characteristics are those that can be directly observed by the human eye, including the pattern, pattern area, core point, triangle point and number of lines. The fingerprint template is “photographing once”. The CMOS chip inside the fingerprint module collects the fingerprint information once, and then performs fuzzy processing to generate two kinds of record information of 0 and 1, and stores it in the FLASH chip of the fingerprint module. When switching

to the recognition mode, the fingerprint module will let the CMOS chip collect a fingerprint and compare it with the data of the FLASH chip. Determine if it exists, and if it exists, return the corresponding fingerprint number. In this way, fingerprint recognition and registration can be performed by the single chip microcomputer. Fig.4 is a block diagram of fingerprint identification.

3.3 WIFI wireless transmission module

WIFI is a wireless LAN technology based on the IEEE 802.1l standard. The wireless WIFI communication module used in this system is Ai-Thinker's ESP8266 module. The module communicates with the single-chip controller through the serial port. The module has built-in TCP/IP protocol stack, which can realize the conversion between serial port and WIFI. Data can be transmitted via WIFI by configuring the serial port of the microcontroller controller. The working voltage of the wireless WIFI communication module is 3.3V, and the three working modes are (1) AP, (2) STA, and (3) AP+STA. It has the advantages of low price, convenient and fast networking, independent operation, good data transmission rate and system stability. This system is to realize the wireless transmission of information between the master and the slave through this module.

3.4 LCD liquid crystal display module

The interactive module of the fingerprint identification check-in system and the user is an LCD liquid crystal display, and the standby state displays information such as the date and time of the day. When the user presses the fingerprint module, the fingerprint module is activated, and the fingerprint module compares the collected fingerprint with the fingerprint of the fingerprint library, and displays the comparison result on the LCD screen. For example: “Check-in is successful, welcome!”, “Sign-in failed, please try again!” and other prompts are convenient for users. The schematic diagram is shown in Fig.5.

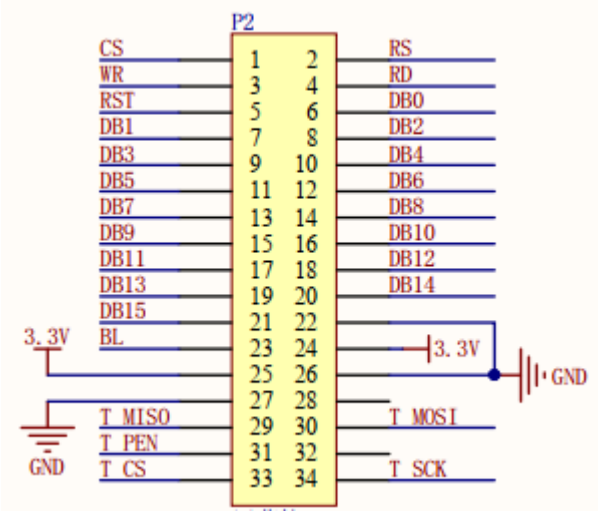

Fig.5 Schematic diagram of LCD liquid crystal display module

4. The system software design

The software design of the whole system can be divided into PC software design and client software design. The upper computer is used to receive the check-in information sent by the client, and control the permission of the fingerprint adding and fingerprint deleting functions. The system administrator performs the operation and sends the function instruction to the client, and the client is facing the sign-in person to perform fingerprint identification, fingerprint addition, fingerprint deletion function operation. Client software design can be divided into four parts: client main program design; client fingerprint identification program design; client fingerprint addition program design; client fingerprint deletion program design. The combination of the host computer and the client makes the fingerprint check-in more systematic, so as to better meet the needs of the market and users. The software design of each part and the corresponding flow chart will be described in detail below.

4.1 System PC software design

The upper computer is mainly responsible for sending functional commands to the client, including fingerprint addition instructions and fingerprint deletion instructions, and receiving the check-in information sent by the client, and displaying the information content through the display screen. The software design flow chart is shown in Fig.6.

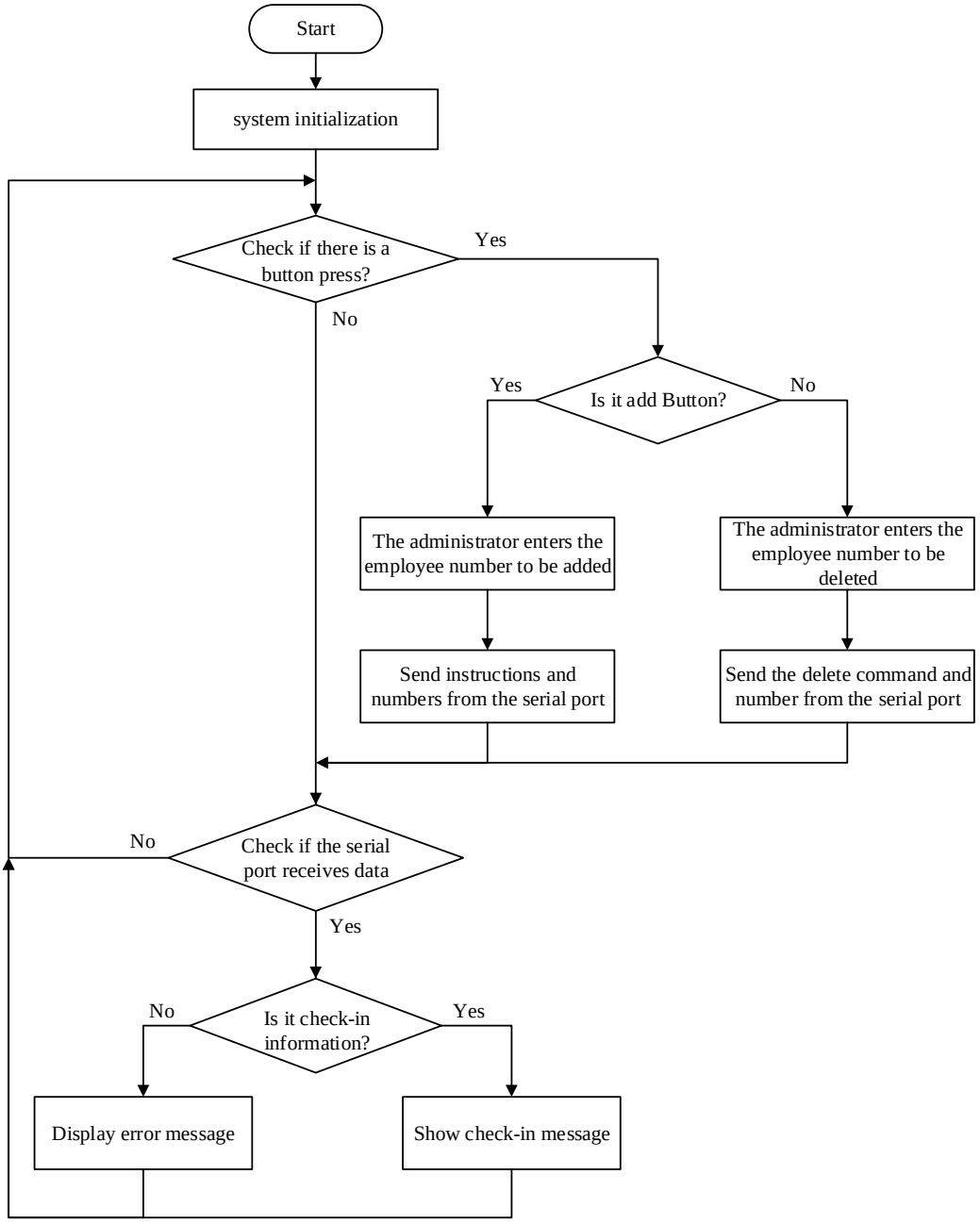

Fig.6 System host computer software design flow chart

4.2 System client software design

4.2.1 System client main program design

The client main program is mainly responsible for controlling the execution of fingerprint recognition, fingerprint addition, and fingerprint deletion procedures. It controls the execution of the fingerprint recognition program by detecting whether there is a fingerprint press; and controls the execution of the fingerprint addition and fingerprint deletion program by detecting an instruction sent by the upper computer. The program design flow chart is as follows:

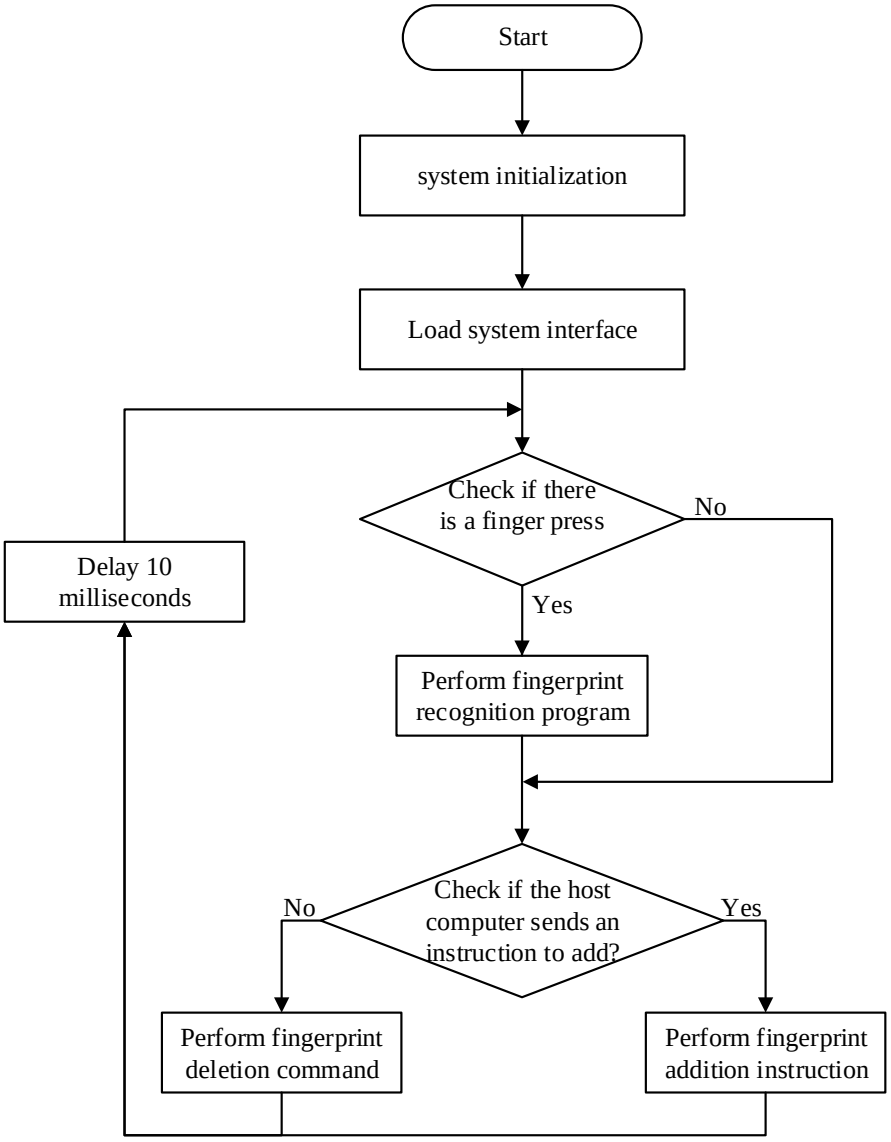

Fig.7 System client main program design flow chart

4.2.2 System client fingerprint recognition program design

The client fingerprint recognition program is used to implement the fingerprint recognition function. By acquiring the fingerprint image of the sign-in person, the fingerprint feature information is generated, and the fingerprint information is generated corresponding to the existing fingerprint information database to find out whether there is a fingerprint matching to determine whether the fingerprint identification is successful. At the same time, the matching information is uploaded to the upper computer. The specific program design flow chart is shown in Fig.8.

4.2.3 System client fingerprint add program design

The client fingerprint adder is used to implement the fingerprint addition function. In order to avoid accidentality as much as possible, by acquiring the fingerprint image twice, two fingerprint feature information is generated for matching. If the matching is successful, the fingerprint may be added, and instead, the fingerprint is re-pressed. The programming flow chart is shown in Fig.9.

4.2.4 System client fingerprint deletion program design

The client fingerprint deletion program is used to implement the fingerprint deletion function. It searches for the fingerprint according to the fingerprint number in the deletion instruction sent by the host computer. If it can be found, it deletes it. If it cannot be found, it returns an error message to the host computer. The program design flow chart is shown in Fig.10.

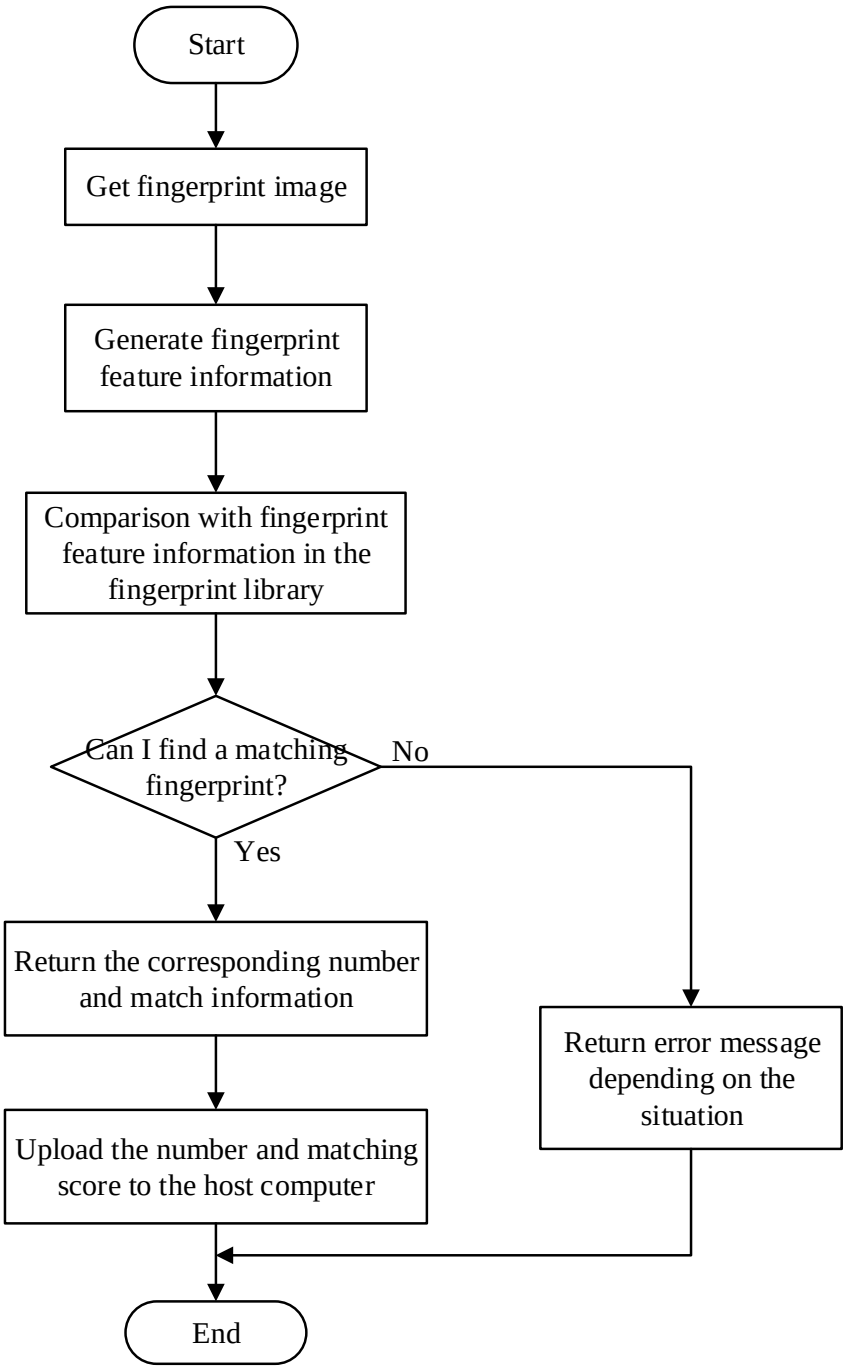

Fig.8 System client fingerprint recognition program design flow chart

5. Conclusion

This paper uses STM32F103C8T6 as the main controller, adopts AS608 fingerprint identification module, WIFI wireless transmission module, LCD liquid crystal display module, etc., and designs a smart fingerprint identification and sign-in system based on STM32. The sign-in system is simple, practical, intelligent and efficient. It can save a lot of work time and make the sign-in work more realistic as much as possible. The WIFI wireless module can send and receive data quickly and stably, and can be transmitted to the slave in real time, realizing smart sign-in and intelligent reporting. The fingerprint sign-in system solves the existing sign-in problem very well, and with its many advantages, it will have a good development prospect in the future.

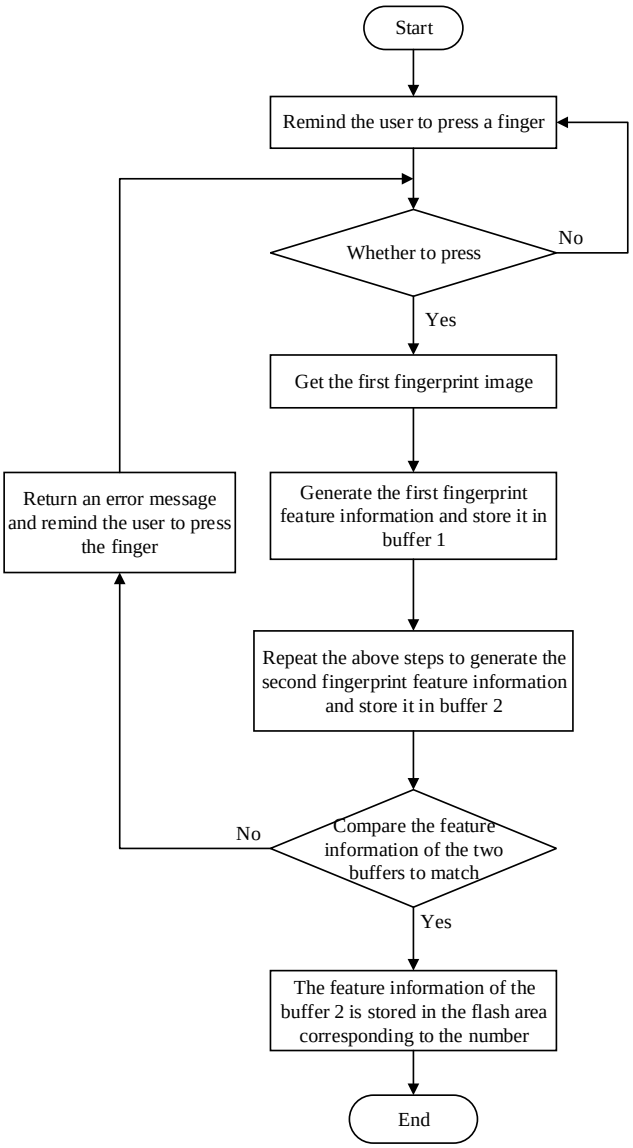

Fig.9 System client refers to the add program design flow chart

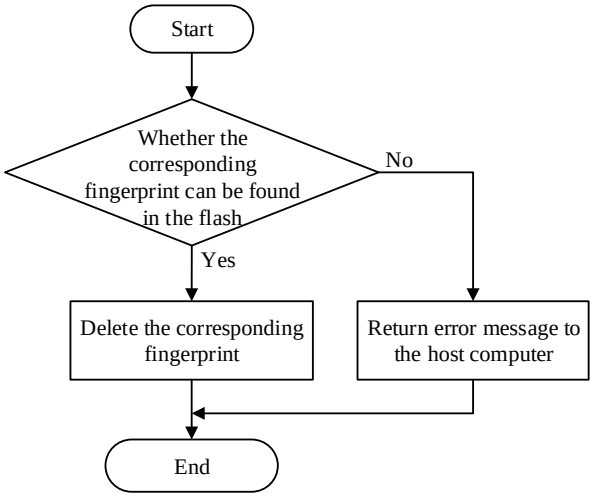

Fig.10 System client fingerprint deletion program design flow chart

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