Design of Intelligent Classroom Fingerprint Attendance System Based on MCU

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Abstract: As a sign arrival system of work, fingerprint attendance system aims to automate the attendance procedure of an educational institution using fingerprint technology. A hand-held device is designed to mark the attendance without the intervention of teacher. After students made to place their fingers over the sensor before the class, the corresponding names are shown in green. Student attendance would be recorded to the SD card storage module. The absence name of student would not only be updated to computer using a micro usb-cable, but also be sent to the teacher in charge or sent to the corresponding parents or both in mobile phone by SMS Module if the faculty pressed the button. Therefore, the intelligent fingerprint attendance instrument in the classroom greatly improves the efficiency of the teacher's class registration.

1 INTRODUCTION

The attendance system is to maintain the normal working order, improve the efficiency and discipline, and make the employees observe the work time and labor discipline consciously. The traditional attendance registration which means register with artificial paper registration has many shortcomings, such as omission, misstatement etc. With the rapid development of the electronic industry, the electronic attendance machine quickly replace the paper-based manual registration, and is widely used in various management departments, for example, the management of the company's gate.

Fingerprint is the unique biological information of each person, which cannot be copied(Krithika, L.B., 2017). Therefore, fingerprint identification technology is an ideal identity recognition technology. Automated fingerprint identification not only has many unique information security advantages, but also has high practicability, feasibility and convenience. In recent years, intelligent products have developed rapidly. Fingerprint technology also has many applications in the registration of attendance, such as the company's fingerprint attendance instrument, which can be registered according to each person's fingerprint information (Ong, K. S., 2014). Such a fixed identity

could avoid the shortcoming of looking for someone to replace.

In the traditional classroom, teacher records the attendance of students by naming usually. The teacher prints a name list of students and calls these names one by one. There are many shortcomings in this traditional way of registration, for example, teachers need to take time to call the names and register the attendance, paper registration form is easy to lose, and final statistics is complicated. Each student's fingerprints are different in class. If fingerprint technology is applied to class, there will be no help attendance, and students just press fingerprints on the intelligent attendance instrument.

However, at present, in many colleges, fingerprint attendance technology has not been widely used (Zainal, N. I., 2015). On the one hand, the cost of attendance equipment based on fingerprint technology is relatively high. On the other hand, employees of each company are relatively fixed. Different from the company attendance, the turnover of college classroom students is large, and students in the same classroom are different at different time usually(Li, Q.Y., 2017). It is necessary to update the personnel fingerprint bank in time （Marwan, A.Z., 2016）. Therefore, a class intelligent fingerprint attendance system, which STM32F103ZET6 microcontroller was used as the main chip was designed in this paper. Faculty can give the head teacher a timely feedback,

which is convenient for the management of the head teacher. If the teacher presses a button, the intelligent attendance instrument can send the message to the teacher in charge of the class by SMS. It is also possible to send a student's absence to their parents. The use of SD card storage technology is to store this class of information in order to sum up the statistics at the end of the period and give right comments to the attendance.

The intelligent fingerprint attendance instrument in the classroom can greatly reduce the workload of the teachers and improve the efficiency of the work. Before the class, the teacher can turn on the computer to arrange the class information while the students sign in according to their fingerprints. At the same time, the use of low cost microcontroller as the main control chip, reduce the cost of the use of instruments, which can be further popularized in Colleges and universities.

The main contents of this paper are as follows:

(1) To build the minimum system, so that the STM32F103ZET6 MCU can work properly.

(2) To display the class list, the course and the teacher of the class, and the time of teaching on the TFT-LCD LCD

(3) To realize the fingerprint storage and fingerprint identification of the AS608 fingerprint module;

(4) Implementation of SIM900A SMS module to send SMS.

2 PROPOSED SYSTEM

The proposed system comprises five sections which is showed in figure 1: Microcontroller module, AS608 fingerprint module, SIM900A module, Graphic Liquid Crystal Display(GLCD), and SD card storage module. Microcontroller which controls the entire system in this design is STM32F103ZET6. AS608 fingerprint module is the heart of the system. The device prototype model is showed in figure 2.

Fingerprint attendance device is a hand-held device which can be carried to the classroom. In the first class, students have to register their fingerprint by selecting roll number and placing their fingers. From second class, they can mark their attendance. Faculty can take the device to his room after class hour and it can be connected to the computer. The attendance details can be updated using a micro usb-cable. The attendance system is mainly to achieve the function to record student attendance and storage to the SD memory card. Information of absence students can be sent to the class teacher and the

parents hand in the corresponding machine. Messages of the name of the student, the course, the faculty, and the class time are included in the text.
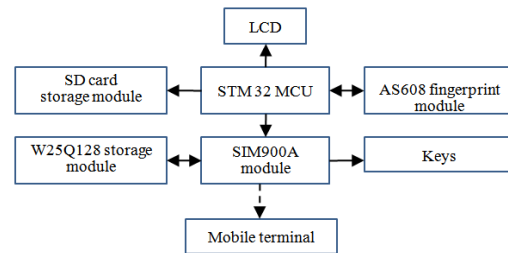

Figure 1: System Architecture

（a）

（b）

Figure 2: The device prototype model, a: internal diagram, b: outside view drawing

3 HARDWARE SYSTEM DESIGN

3.1 MCU Selected

The intelligent classroom attendance system adopts STM32F103ZET6 microcontroller as the main control chip, which is produced by Italian Semiconductor Company for the application of high performance, low cost and low power consumption. The chip is powerful and rich in resources.

In addition to meet the basic requirements of classroom intelligent attendance instrument, but also there is a large number of surplus I/O and other resources for the selected chip. Thus the classroom attendance intelligent instrument can be used for the corresponding expansion and upgrade according to the upgrading of products or the actual situation, and has JTAG and SWD download port, convenient program download and debug.

3.2 TFT-LCD

TFT-LCD liquid crystal display is used to displays the class student list, the specific course and the teacher and the time of teaching use by intelligent fingerprint attendance instrument. TFT-LCD is a thin film transistor liquid crystal display. Different form simple passive matrix of TN-LCD, STN-LCD, it in every pixel LCD screen are arranged on a thin film transistor (TFT), which can effectively overcome the crosstalk non gating, to display the static characteristic and the LCD screen is independent of the number of scan lines, thus greatly improving the image quality.

3.3 AS608 optical fingerprint identification module

The fingerprint module used in the system is the AS608 optical fingerprint identification module

which got from a well-known fingerprint identification chip technology Co., Ltd. Hangzhou company (Synochip). The chip has a built-in DSP operation unit, which integrates the fingerprint recognition algorithm, and can efficiently and quickly collect images and identify fingerprint features. The module is equipped with serial port and usb communication interface. Users do not need to study complex image processing and fingerprint recognition algorithm. Only by simple serial port and usb can control module according to communication protocol. Its function realization and flow chart are as follows:

(1) Logging in to a template with two fingerprints in the flash fingerprint library.

(2) Reading the field fingerprint from the sensor and search the fingerprint from the fingerprint library.

3.4 SIM900A SMS module

The SIM900A SMS module is used to send message. RS232 and LVTTL serial port communization were supported by the SIM900A SMS module (i.e. 3.3V/5V support system). With the advantage of wide scope of work in support of 5V~24V, the module can be easily connected with other products to realize the implementation of SMS and GPRS data transmission and other functions. The schematic diagram of the SIM900A SMS module is shown in Figure 3.
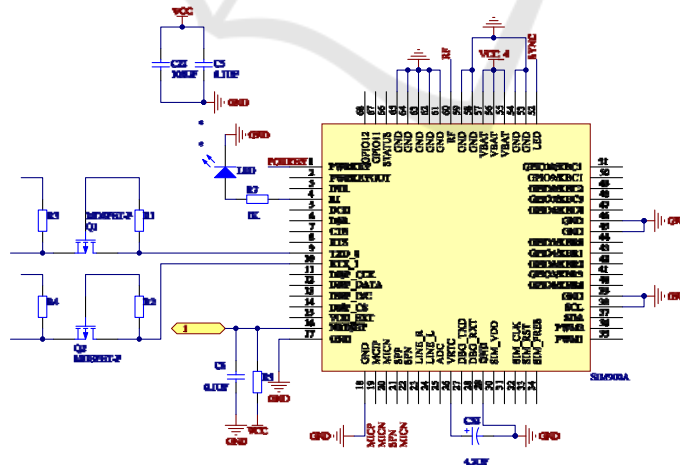

Figure 3: SIM900A SMS module diagram

3.5 SD memory card

Students' attendance data are stored into the SD memory card by the class intelligent fingerprint attendance instrument. SD card is a new generation of semiconductor memory devices based on flash memory, because of its small volume, high data transmission speed, hot swap and other excellent characteristics. In the classroom intelligent fingerprint attendance checking system, the STM32F103ZET6 interface is directly driven by the SDIO interface of the microcontroller, the 4 bit mode, the highest communication speed can reach 24 MHz, and the maximum per second can transmit data 12 M bytes.

4 SOFTWARE DESIGN

The control flow chart of the class intelligent fingerprint attendance system is shown in Figure 4. After starting the machine, the system was initialized, and the class student list, the specific course and the teacher and the time of teaching was displayed on the TFT-LCD. At this point, the initialization was completed, followed by the student to sign in by fingerprint. If a student signed in according to the fingerprint, the name of the TFT-LCD display was green, indicating that the student has arrived. The name on the list was not the same. The SD memory card stored the attendance data. Finally, the attendance system was waited for the teacher's instruction. The absence name of student would be sent to the teacher in charge or sent to the corresponding parents or both if the faculty pressed the key.
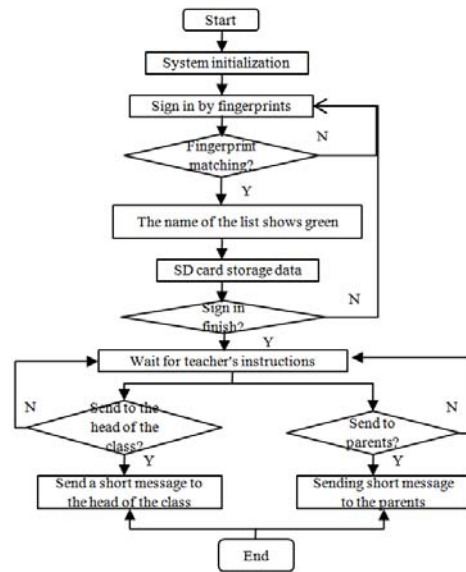

Figure 4: Flow chart of system

5 CONCLUSIONS

The attendance system is to maintain the normal working order of the unit, improve the efficiency and discipline. It can also be used to make the employees observe the work time and labor discipline consciously. The intelligent fingerprint attendance instrument in the classroom mainly uses fingerprint technology, GSM communication technology, SD card storage technology and so on. Before class, students sign in and sign in. The teacher can send the message to the teacher in charge of the class by SMS. It is also possible to send a student's absence to their parents. The intelligent attendance instrument of the classroom is convenient and quick to record the attendance of students in class, reduce the time of teacher's class name, and improve the efficiency of the teachers. In the present market, there are few systems. If this system can be popularized well, the market prospect is better.

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