# Design of Attendance Checking Management System for College Classroom Students Based on Fingerprint Recognition

Dongmei Feng [1], Peng Wang [1], Lei Zu[2]

1. School of Information Science and Engineering, Tianjin Tianshi College, Tianjin 301700
E-mail:tjtsfdm@163.com

2. Shenzheng Zookingsoft Co.Ltd, Shenzhen 518000
E-mail: 798075653@qq.com

**Abstract:** In view of the situation that the traditional way of is checking in attendance by teachers in the daily classroom in Colleges and universities, exist such as answering on behalf of others, wasting class time, low efficiency which are not conducive to the management of students' attendance. The independent pressure fingerprint recognition modules of SM-2B series launched by Hangzhou Zhongzheng Company are redeveloped against the background of the present situation of students' classroom attendance in Tianjin Tianshi College. The fingerprint attendance system for college students is designed by combining VB, VC++ programming language and MySQL database. The fingerprint registration and attendance checking management platform was established on the classroom teacher's computer, and the attendance information was stored in the database which ever can be inquired on the server. The test results show that the attendance system can query and manage the students' attendance conveniently, and the system is stable and scalable.

**Key Words:** Fingerprint recognition, College classroom attendance,Data base, Visual Basic, Visual C++, MySQL

## 1 INTRODUCTION

In recent years, with the expansion of enrollment in Colleges and universities, the number of school students is growing. The traditional teacher roll call in the classroom not only wastes time, but also may exist the phenomenon of proxy [1-2]. At the end of the semester, teachers must be collect students' attendance through roster, which is not only a waste of time and inefficient, but also not conducive to the overall management of students' attendance [3].

In view of the above problems and the needs of college teachers for the attendance system, the system realized special attendance management system for college students based on fingerprint identification. The system realized completes fingerprint information storage, transmission, check-in information query, statistics and other functions, which through fingerprint collection, comparison, identification, database establishment, data transmission and the design of upper and lower computer interface. It greatly improved the efficiency of students' roll call in class, simplified the workload of teachers, reduces the cost of system development and maintenance, and is easy to expand[4].

## 2 DESIGN SCHEME

The program design of the system is mainly divided into four modules: fingerprint collection and comparison, establishment, reading and writing of database, network connection and the design of upper and lower computer interfaces. The overall structure of the system is shown in Figure 1. The fingerprint instrument adopts SM-2B series independent pressure feeling sensitive fingerprint identification module which launched by Hangzhou Zhongzheng company. VB and VC++ are used as programming languages. MySQL is used as database .

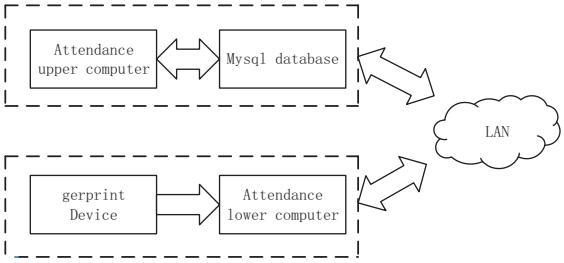


Fig. 1 The overall structure of the system

The teaching computer in the classroom is used for lower computer in the system which connects the fingerprint instrument through the USB interface. The functions of fingerprint information collection, comparison, identification, student's attendance and teacher interface management are realized by the lower computer. The upper computer is located in the Educational Administration Office (or teaching supervisor office) of the school, which is mainly operated by the administrator to realize the query management of attendance. The communication between the lower computer and the upper computer is realized by LAN.

## 3 SYSTEM DESIGN

### 3.1 Lower Computer Design

The lower computer consists of three parts: Students' fingerprint information collection and attendance, login interface and the design of database.

Fingerprint information collection is divided into three processes: fingerprint template collection, feature extraction and fingerprint recognition. Fingerprint template collection is to collect user's fingerprint image by fingerprint instrument, extract fingerprint features from fingerprint image to form fingerprint template and store it in database [5]. Fingerprint recognition consists of two processes, registration process and recognition process. The specific recognition principle is shown in Figure 2.

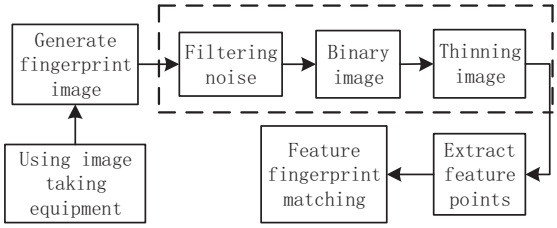


Fig. 2 Principle of fingerprint recognition

In the process of registration, users need to collect fingerprints first, and then the computer system will automatically extract the features which one will be saved as templates in the database or other designated places. The features compared with the template of the database and the comparison results will be given. The process is a general process, which is applicable to all biometrics. The process of student fingerprint information collection is shown in Figure 3. First, the teacher opens the teacher's login interface and enters the correct account number and password. Then, enter the student fingerprint collection or attendance interface. Next, students fill in personal information according to the prompt information which including student number, name, gender, major and class. After filling in, three fingerprint acquisitions are combined to form a string template [6]. A text box pops up in the interface to prompt "registration succeeded", and the corresponding student information is written into MySQL database to complete fingerprint acquisition.

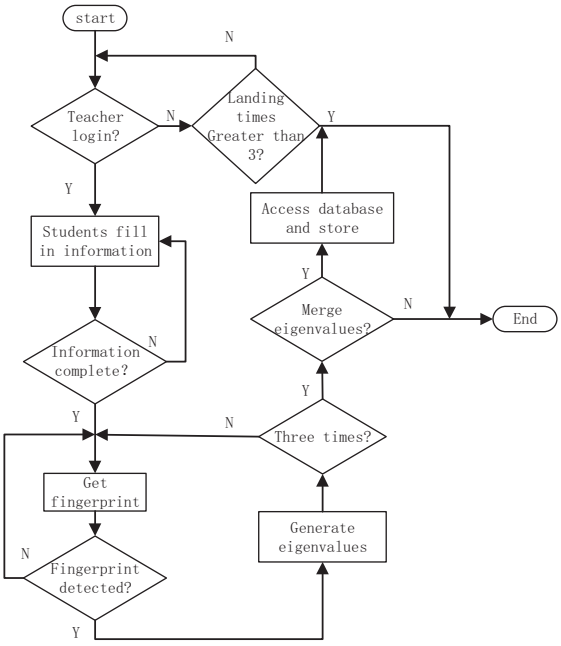


Fig.3 Flow chart of fingerprint collection for students

The basic information of students can exist in the database after inputting the fingerprint. In order to facilitate the management and maintenance, the fingerprint can exist in the database in the form of fingerprint number and student number. Each teacher machine only needs to register fingerprint information once to sign in permanently.

The attendance process of students is shown in Figure 4. The students select the class and the course to be signed in when they entering the sign in interface after the teacher logs in and click the "sign in" button. The students enter the fingerprint of their own registered by the fingerprint analyzer and comparing with the template fingerprint information. The attendance time information is Wrote into the time column in the attendance database when the comparison is successfully.

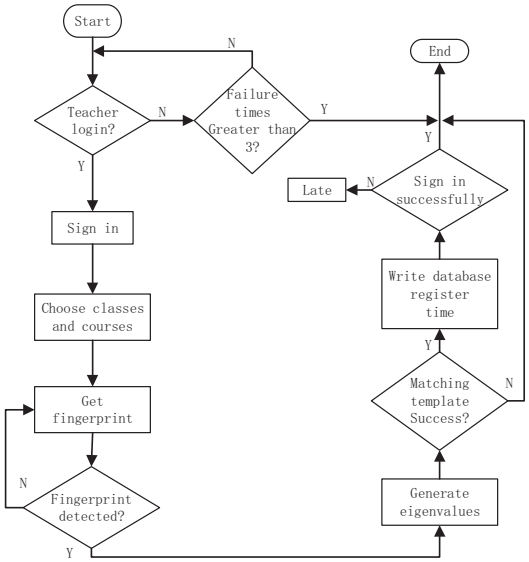


Fig.4 Flow chart of student attendance

The lower computer realizes the functions of teachers' login, students' fingerprint collection and attendance. In the process of attendance, the input fingerprint is detected first. If the fingerprint information does not matched, the student will be prohibited to sign in that eliminated the phenomenon of Instead of check-in. At the same time, the system needs to collect fingerprint information for three times before generating feature template ensured the integrity of input fingerprint information, which lays a solid foundation for later attendance fingerprint feature matching.

### 3.2 Upper Computer Design

The interface design of the upper computer is realized in the environment of Visual Basic 6.0. VB6.0 is classic software for programming windows, which is relatively simple compared with other software. The upper computer mainly completes the query of sign in information, which is divided into the query of teacher and student. The query interface can switch between teacher and student. When the teacher inquires, they shall input the registered name and the password. If the teacher log on more than three times by erroneous password, who will be refused to log in. When the teacher logs on successfully, they can enter the query class and course, click "query" and the program access database

will screen out all the sign in information that meets the class and course requirements.

When the student inquires, they shall input the student number and the password. Also, if the student log on more than three times by erroneous password, who will be refused to log in. When they log on successfully, they can screen out all the sign in information that meets the student number and course requirements. All inquiry information includes: class, name, student number, course, check-in times and late times.

### 3.3 Database Design

Database is an important part of the system, mainly responsible for the storage of fingerprint attendance data and login information of teachers or students [7]. The system completes the design of database on Navicat for MySQL platform.

#### 3.3.1 Construction of Database Model

In the whole attendance system, the main objects in the database are: students, teachers, administrators and the specific information of attendance fingerprint. Among them, the relationship model associated with students includes: student number, name, gender, major, class, fingerprint information and login password; the relationship model associated with teachers includes: name, password, substitute class, course taught. The relationship model associated with the administrator includes: time and times of attendance, details; the relationship model associated with the attendance information object includes: the date and serial number of attendance, student number, attendance time, late and early leave time, absence or not, absence times[8], etc.

#### 3.3.2 Setting of Main Parameters of Database

According to the previous design of the database, the corresponding table is created for each relationship model, and the student ID is used as the primary key between the table and the object of the table to identify the identity of students. The specific design is shown in table 1-3.

Table 1 Setting parameters of student information table

| Field name | Field name | Type | Constraint | Is it the primary key? |
|---|---|---|---|---|
| Student ID | ID | Nchar(13) | Not empty | Y |
| Fingerprint number | UCID | INT | Not empty | |

Table2 Setting parameters of attendance information table

| Field name | Field name | Type | Constraint | Is it the primary key? |
|---|---|---|---|---|
| Student ID | ID | Nchar(13) | Not empty | |
| Task number | TASKID | BIGINT | Not empty | |
| Attendance time | ComeTime | Nchar(6) | Not empty | |
| Whether to read | Isread | INT | Not empty | |

Table 3 Parameter setting of teacher information table

| Field name | Field name | Type | Constraint | Is it the primary key? |
|---|---|---|---|---|
| Task number | TASKID | BIGINT | Not empty | Y |
| Start time | BeginTime | Nchar(6) | Not empty | |
| Object set | TaskPersonID | INT | Not empty | |
| Administrator number | MangID | Nchar(13) | Not empty | |
| Late setting | IsAgain | INT | Not empty | |

#### 3.3.3 Database Connection

The upper and lower computer must be connected with the database respectively after the design of interface which can complete the storage and transmission of information.

After the fingerprint attendance meter collects information, the string generated will be stored through the following database connection code:

```
StrConn = "DRIVER={MySQL ODBC 5.3 ANSI Driver};" & _
"SERVER=" & db_host & ";" & _
"DATABASE=mysql;" & _
"UID=root; PWD=root; port=33066"
```

StrConn sets the database driver, which must match the version of its own computer and database. After installing the driver, the similar driver name is written here. “SERVER” sets the database address. “Database” is the database name.

UID, PWD, port are database user name, user password and database port number respectively, which are filled in or generated information when establishing database. The information is set in the program to connect to the database must be consistent with the sampled information completely; otherwise it cannot be accessed successfully.

When accessing the database, the fingerprint string should be matched with the fingerprint information at the time of registration. After matching, you can know the courses and the specific time of students' attendance by accessing the database “select” instruction. Then the program compares the scheduled check-in time with the actual check-in time of the students in the database to determine whether the time difference is within the predetermined value range, so as to make a successful check-in or late assessment, and then stores the check-in information in the check-in form.

### 3.4 Data Transmission

In class, students check their attendance on the fingerprint acquisition device connected to the teacher’s computer, and transmit the information of the attendance (attendance date and time, name, student number, etc.) to the central server in real time through the school LAN.

The central server is also a server for student attendance information management, through which the school’s academic administrators can query the attendance of each student, as well as the current class and time of the students.

## 4 FUNCTION TEST

The test environment of the system is:

System software: Windows 7

Application software: VB6.0 VC + + 6.0

Database: Navicat for my SQL

Hardware: Zhongzheng fingerprint collector, 2 computers

Network environment: LAN

The system is applied to the certain class check on work attendance in our school to carry out the actual running test. In the classroom A, the teacher computer connects the fingerprint instrument by the USB interface and runs the attendance system and database of the lower computer; in the central server of the academic affairs office, the upper computer attendance system and database are run, and the data transmission is realized through the LAN connection.

According to the design of the whole system, it can be divided into landing, check-in, late, truancy and other modules. Through the modular processing, it is convenient to test the system. The system mainly tests these modules.

On the teacher's computer, teacher open the login terminal and input the teacher's name and password in turn according to the prompts, click “login”, and enter the “registration fingerprint” interface after the prompts are successful. In the interface, students enter their names, student numbers, classes and click to “enter fingerprints” according to the prompts. They enter their fingerprints three times and the dialog box “registration succeeded” pops up. After registration, they click “fingerprint attendance” to enter the attendance interface and select attendance course, then click “start sign in” to enter the interface of input students’ fingerprint information, until prompt to sign in successfully. The successful check-in interface is shown in Figure 5.


Fig.5 Student check-in success interface

The attendance of one course, class or classmate can be queried on the upper computer.

The actual test is to track the attendance of a class in a week. There are two methods to record attendance, one is manual method, and the other one is fingerprint attendance system. The fingerprint attendance results of the power electronics course by the students of Class I level 15 automation are shown in Figure 6, which is consistent with the manual attendance.

The attendance management system has been to run stably, which has the following advantages: simple operation and simple interface. Even without computer operation basis, it can complete attendance statistics and other operations through system prompt and guidance, which is highly praised by teachers and students participating in the test.


Fig.6 Teachers' inquiry of class attendance information

## 5 SYSTEM IMPROVEMENT PLAN

In the system, the fingerprint instrument must be connected with the PC, which is not ideal in terms of convenience. Therefore, the idea of realizing the function of the lower computer in the embedded system based on arm is proposed[9]. The structural schematic diagram of the whole system is shown in Figure 7.

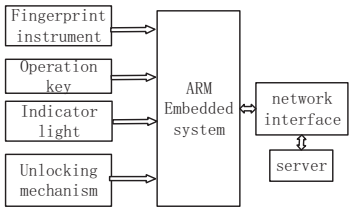


Fig. 7 The schematic diagram of ARM embedded system

The embedded system based on ARM can select different operations through fingerprint instrument and operation key to complete fingerprint template acquisition, comparison, feature extraction and fingerprint identification [10], etc.

Fingerprint information is received and sent through sensor network devices and wireless data receiving devices by Wi-Fi wireless transmission technology, and different operation processes are indicated by indicator lights [11-12].

It can also be extended to the attendance system based on Wi-Fi fingerprint location technology to improve the efficiency of the system [13-14].

The system can also connect the unlocking mechanism to open the door lock by comparing the fingerprint information and upload the unlocking record to form the fingerprint lock. Fingerprint lock can also be installed on the safe or office door as access control or it can be used for the access control management of hotels or office buildings through network functions, forming an important part of smart home[15]. For example: in the hotel access control management, the service desk enters the fingerprint template of the customer, which is transmitted to the fingerprint controller of the guest room through the network. The customer enters the fingerprint on the fingerprint meter of the guest room. If the comparison is

successful, the door can be opened and the unlocking record can be uploaded.

## 6 CONCLUSIONS

This system meets the needs of college teachers, and designs a class attendance system composed of fingerprint instrument, upper computer and lower computer. Students only need to register fingerprint information once, and then they can carry out fingerprint attendance for permanent. The academic affairs office can easily query and manage the students' attendance problems that save the teachers' manual roll call in class and reporting attendance after class, which is convenient, fast and time-saving Strength, greatly enhancing the supervision of students. The system has the advantages of strong practicability, wide range of use, easy expansion, low cost of installation and maintenance, and has a long-term development prospect. The improved system is compact, portable and easy to operate. It can be widely used in many fields, such as public security, banking and computer network information security and so on.

## REFERENCES


[1] Y. H. Wu, Z. M. Liu, J. C. Lin, Design of the classroom fingerprint attendance system based on S3C2440,Journal of Sanming university, Vol.32, No.2, 33-38, 2015.

[2] L. Li, Y. Yin, X. J. Cui, Fingerprint attendance system based on hypersphere covering of biomimetic pattern recognition, Journal of Shanghai Normal University(Natural Sciences),Vol.44, No.1,81-87, 2015.

[3] J. N. Wang, Design and development of student attendance management system based on Android, Modern Electronics Technique, Vol.37, No.8, 99-101, 2014.

[4] L. J. Su, B. C. Liu, L.M. Zhao, Design of portable fingerprint attendance and information management system, Computer Measurement & Control,Vol.25, No.6, 181-184, 2017.

[5] X. M. Xie, Research on Effective Way to Improve Attendance Management in University, 2nd International Conference on Humanities Science, Management and Education Technology (HSMET 2017), 332-337, 2017.

[6] P. Qi, P. Tian, W. L. Cai, Design and implementation of fingerprint acquisition and recognition system based on Single-Chip microcomputer, on Electronic technology, No.6, 63-65, 2016.

[7] M. G. Zhang, Design and Implementation of a Fingerprint Based Attendance Management System via VC, Jilin University, Changchun, China, 2013.

[8] R.B. Liu, A Study of the Design and Key Question of the Students Fingerprint Attendance Checking System, Huaqiao University, Quanzhou ,China,2014.

[9] R. B. Guo, M. J. Chen, X. T. Lan, et al, Research on fingerprint entry platform based on the internet of things, Information Communications, No.1, 135-136, 2018.

[10] A. L. Qu, C. L. Ma, H.M. Liu, Design of student attendance system based on ARM and barcode technology, Journal of Beijing Vocational College of Agriculture, Vol.31, No.5,102-106, 2017.

[11] Y.F. Wang, H.J. Ai, W. P. Tu, Wi-Fi fingerprint clustering application in indoor area of interest, Computer Applications , Vol.36, No.2, 488-491, 2016.

[12] X. M. Peng, J. Ye, Design and implantation of remote fingerprint attendance system based on 3G/Wife, Computer Applications and Software, Vol. 33, No.5, 102-107, 2016.

[13] J. M. Sun, X.Y. Fan, W. W. S. Guo, Design and implementation of intelligent attendance system based on Wi-Fi fingerprint location technology, Electronic Design Engineering, Vol.27, No.4, 74-78, 2019.

[14] X.J.Hu, Research on Wi-Fi fingerprint adaptive indoor location method based on dynamic environment, China New Telecommunications, No.1, 70, 2017.

[15] X. D. Hu, F. Tang, Secure control methods of the entrance guard system for smart home, Journal of Chongqing University of Posts and Telecommunications(Natural Science Edition), Vol.28, No.6, 863-869, 2016.