Fingerprint Based Student Attendance System Using GSM

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Abstract*: In this paper provides the design method of portable fingerprint based student attendance system using GSM. The system includes terminal fingerprint acquisition module and attendance module. It can realize automatically such functions as information acquisition of fingerprint, processing, wireless transmission, fingerprint matching and making an attendance report. After taking the attendance, this system sends the attendance of every student to their parent's mobile through GSM. Attendance system facilitates access to the attendance of a particular student in a particular class. This system eliminates the need for stationary materials and personnel for the keeping of records.*

Keywords: Fingerprint identification, Attendance System, Wireless communication

1. Introduction

The most common means of tracking student attendance in the classroom is by enforcing the students to manually sign the attendance sheet, which is normally passed around the classroom while the lecturer is conducting the lecture. There are numerous disadvantages of using such system. The attendance sheet is passed around the class; some students may accidentally or purposely sign another student's name. Another issue of having the attendance record in a hardcopy form is that a lecturer may lose the attendance sheet. As a consequence of that, lecturer can no longer trace the students overall attendance record throughout the particular semester.

Currently, the magnetic card attendance system is widely used [1]. This pattern is flexible and practical. But it has also some disadvantages. For example, the card is easy to lost and damage. And most of all, parents are not aware if their children are absent from the class. Aiming at the disadvantages of traditional attendance system, a design method of wireless fingerprint attendance system based on GSM technology is proposed. In this system students report their attendance via biometric system and parents can receive SMS notification of attendance [2]. The fingerprint has a lot of advantages, such as unique, permanent, good anti-fake and easy to use. So it is recognized increasingly by people [3]. Figure 1 shows the general architecture of a biometric system [4]. Biometrics systems work by recording and comparing biometric characteristics. When an individual first uses a biometric system, their identifying features are enrolled as a reference for future comparison. This reference may be stored in a central database or on a card (or both) depending on the needs of the application.

When biometric recognition is required, the individual's biometric characteristics are recorded again. This time however, the identifying features are compared by the system with the stored reference to determine if there is a close match.

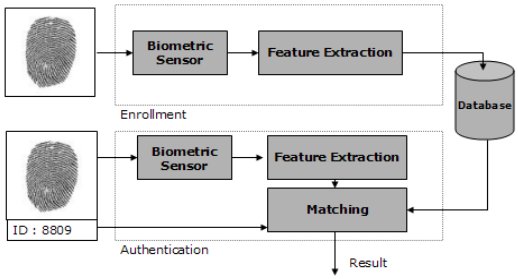

Figure 1: General biometric system

GSM is the Global System for Mobile Communications. It is called 2G or Second Generation technology. It is developed to make use of same subscriber units or mobile phone terminals throughout the world. A unique feature of GSM, not found in older analog systems, is the Short Message Service (SMS). SMS is a bidirectional service for short alphanumeric (up to 160 bytes) messages. Messages are transported in a store-and-forward fashion. For point-to-point SMS, a message can be sent to another subscriber to the service, and an acknowledgement of receipt is provided to the sender. SMS can also be used in a cell-broadcast mode, for sending messages such as traffic updates or news updates. Messages can also be stored in the SIM card for later retrieval.

2. System Structure

The system consists of fingerprint acquisition module and a GSM modem. Fingerprint acquisition module is used for capturing the fingerprint and pre-treatment. GSM modem is used to send the attendance of the students to their parents in the form of SMS.

3. System Hardware Design

The system hardware includes: fingerprint acquisition module, GSM modem, microcontroller, RTC, EEPROM, MAX-232, and LCD.

3.1 System Block Diagram

Figure 2 shows the block diagram of the fingerprint based student attendance system. Attendance is marked after

student identification. For capturing the fingerprint, a fingerprint scanner is used. After capturing the fingerprint by the fingerprint scanner, system matches this captured data with the data stored in the memory chip. If it is matched attendance is marked of that student and the ID number of that student is display on the LCD screen. After that, weekly attendance is sends to the parent's mobile through GSM modem.

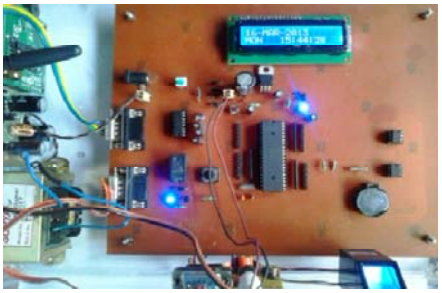

Figure 2: Fingerprint based attendance system

When the attendance of a student is marked enrollment number of that student is display on the LCD screen with date and time as shown in figure 3.

Figure 3: Enrollment ID

Students will hand over the device to other students whose attendance is not marked. After a time interval, device will not input any attendance. The main function of the device will be fingerprint identification of students followed by report generation and sending report through GSM. Fingerprints are considered to be the best and fastest method for biometric identification. This system has advantage to track the attendance of the student by their parents.

3.2 Fingerprint Acquisition Module

Fingerprint acquisition equipment mainly has three kinds, Optical Fingerprint Sensors, Semiconductor Fingerprint Sensors and Ultrasonic Fingerprint Sensors. In this system SM630 fingerprint sensor is used shown in Figure 4. It consists of optical fingerprint sensor, high performance DSP processor and Flash. It has 64kb user flash memory. It can store 768 fingerprint templates. It boasts of functions such as fingerprint login, fingerprint deletion, fingerprint verification, fingerprint upload, fingerprint download, etc. When reading fingerprint images, it has self-adaptive parameter adjustment mechanism, which improves imaging quality for both dry and wet fingers.

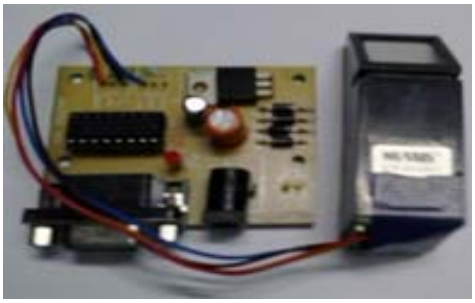

Figure 4: Fingerprint Device

A fingerprint scanner system has two basic jobs - it needs to get an image of the finger and it needs to determine whether the pattern of ridges and valleys in this image matches the pattern of ridges and valleys in pre-scanned images. The heart of an optical scanner is a charge coupled device (CCD). A CCD is simply an array of light-sensitive diodes called photosites, which generate an electrical signal in response to light photons. The scanning process starts when the finger is placed on a glass plate, and a CCD camera takes a picture. The scanner has its own light source, typically an array of light-emitting diodes, to illuminate the ridges of the finger. The CCD system actually generates an inverted image of the finger, with darker areas representing more reflected light (the ridges of the finger) and lighter areas representing less reflected light (the valleys between the ridges) [5].

3.3 GSM Modem

GSM stands for Global System for Mobile Communication and is an open, digital cellular technology used for transmitting mobile voice and data services. It uses narrowband Time Division Multiple Access (TDMA) technique for transmitting signals [6]. TDMA is a technique in which several different calls may share the same carrier. Each call is assigned a particular time slot. A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone.

GSM Modem allows the capability to send and receive SMS to and from the system. The communication with the system takes place via RS232 serial port [7]. In this system SIM 300 GSM module is used shown in Figure 5. It is an industrial GSM module which provides four transmission modes including voice, data, short message, and FAX. It works in frequency band 900MHZ or I800 MHZ, power voltage 3.4V to 4.5V and baud rate is 300 bps to 115 kbps, where between 1200 to 115 kbps is automatically configured [8]. With a tiny configuration of 40mm x 33mm x 2.85 mm, SIM300 can fit almost all the space requirement in your application, such as Smart phone, PDA phone and other mobile device. The SIM300 is designed with power saving technique, the current consumption to as low as 2.5mA in SLEEP mode.

Figure 5: GSM modem

The GSM standard is the most widely accepted standard and is implemented globally.

3.4 Microcontroller

Microcontroller forms the backbone of the system. In this system P89V51RD2 microcontroller is used. It is an 80C51 microcontroller with 64 kB Flash and 1024 bytes of data RAM. It is also In-Application Programmable (IAP), allowing the Flash program memory to be reconfigured even while the application is running. It drives the control logic behind every functionality, some of which are mentioned below:

- Power up and initialize it and dependent modules.
- Check for interrupts, faults while the modules get initialized.
- Command the fingerprint module to function as requested by the software interface.
- Enable data transfer through the wireless module.

4. System Software Design

4.1 Database GUI

Hyper Terminal V1.5 is used for making the database of the system. Hyper Terminal presents the user with a basic graphical user interface (GUI) which highlights the core functions of Hyper Terminal: message box for displaying connection activity and status, several menus, associated buttons and icons for several functions at the user's disposal. Microsoft Hyper Terminal is a small program that comes with Microsoft Windows. We use it to send AT commands to the mobile phone or GSM/GPRS modem.

5. Result of Project

The proposed system scanned the fingerprints placed on the device sensor and compared them against those stored in the database successfully. The performance of the system was acceptable and would be considered for full implementation especially because of its short execution time and reports generation. This system takes the attendance of the student and sends this attendance to their parent's mobile through GSM. Figure 6 shows the SMS received by the parents.

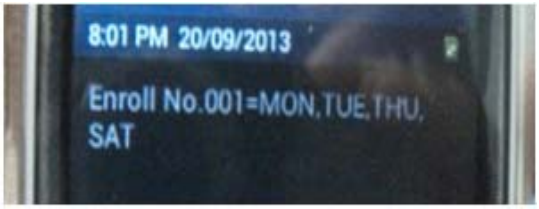

Figure 6: SMS received in parents mobile

Reports can be easily generated in the proposed system so user can generate the report as per the requirement (monthly/weekly) or in the middle of the session. User can give the notice to the students so he/she become regular.

6. Conclusion

The main purpose of this project is to monitor the student attendance in lecture, tutorial and laboratory sessions in more efficient way and send this attendance to their parents. This system resists students from bunking classes through SMS sending feature to parents. Biometrics has been used effectively for more than a decade for time and attendance system. Fingerprint attendance system is a cost effective simplified system that uses fingerprints for identification. The fingerprint is unique to each individual and cannot be shared.

7. Future Scope

- Student is regularly absent within four day or six days free voice call to call the parents mobile number by using GSM technology.
- The system could be modified into a web based system so that reports could be generated anywhere.

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