Attendance Monitoring System based on Fingerprint Sensor

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Abstract— In this paper, the attendance monitoring system based on fingerprint sensor is presented. Among the salient aims of implementing a fingerprint feature into a portable attendance system is security and portability. The circuit of this device is strategically constructed to have an independent source of energy to be operated, as well as its miniature design which made it more efficient in term of its portable capability. Rather than recording the attendance in writing or queuing in front of class equipped with fixed fingerprint or smart card reader. This paper introduces a fingerprint based biometric attendance system which addresses the weaknesses of the existing paper based attendance method or long time queuing. In addition, our biometric fingerprint based system is encrypted which preserves data integrity.

Keywords: Fingerprint; Security; Portable; Encryption

I. INTRODUCTION

In every organization, one of the trusts that exist from the employers towards their employees is their attendance. Attendance is a symbolic representation that could be a benchmark to the higher authority to assess their staffs' commitment toward their job. This scenario is similar to any organization such as the as educational system. In this case, a lecture will play a role as the higher authority whereas the students will be his/her subordinates.

Most college in Nagpur have attendance systems that can be easily manipulated. As a proof to this fact, imagine if in each class, a lecturer has to pass the attendance list which is printed in a paper to the students to record their attendances. In this situation, the student only needs to fill the attendance with their signature. However, some of the students might imitate their friends' signatures even though they are absent. Most universities have barring procedures which exclude the students from taking the examination if their attendance record is less than 70%. One of the solutions is to call out the students' name to mark their attendance. Nevertheless, this approach is very time consuming. Hence, a new system to record the attendance should be implemented to replace the current method. Thus, by introducing a portable classroom attendance system based on fingerprint, the aforementioned problem would be solved.

The objective of this paper is to design a portable student attendance monitoring system used in educational institutions as well as to design a user-friendly attendance mechanism especially for the lecturer which incorporates security criteria for the stored data.

II. LITERATURE REVIEW

In higher learning institutions such as universities, attendance is made compulsory for every student in order for them to understand the subject matter taught in class. With the existence of the fingerprint scanner, it has been made easy for education such as lecturers to record student attendance. Furthermore,[1]In Our study of fingerprint scanner it comes with many advantages which includes ease of use, permanent, unique, good anti-fake mechanism and is increasingly recognized by many people. The technology behind this mechanism is fingerprint recognition.

Fingerprint is used to analyse biological data which is related to human characteristics and traits. Several biological characteristics are now used in attendance systems, for instance, iris, voice, face and fingerprints. It is more reliable to use biological characteristics to identify people that the traditional method such as pin numbers or passwords. As mentioned in [2] and [3], among all the biological characteristics, fingerprint is more widely used as personal identification technique.

In our research, enhancements have been made in terms of security, cost, and performance. We discuss and compare on the improvements that have been made as compared to the previous projects.

III. METHODOLOGY

Figure 1 describes the flow chart of the proposed fingerprint attendance system. First, the device will display the time and read the SD card as shown in Figure 2. Then, the process of scanning fingerprints is initiated for recording the attendance. If the fingerprint of the person is matched with the fingerprint in the database, the device will display student's id number and record the data in the SD card in encrypted format as shown in Figure 3. The device will tell the user if the fingerprint is not matched with the fingerprint in database system.
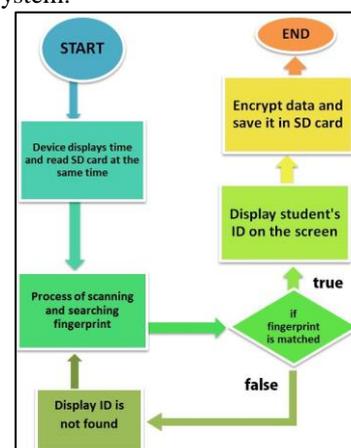

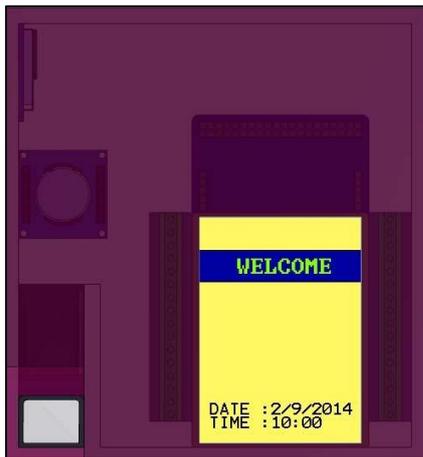Fig. 1: Flow Chart of the Proposed System
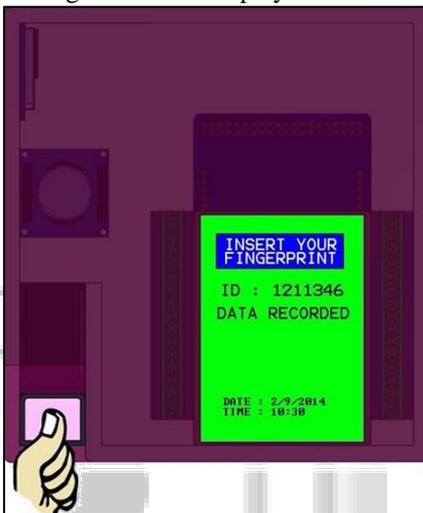
Fig. 2: Device Display the Time

Fig. 3: Device Scanning the Fingerprint and Display the Student's Matric Number

In order to achieve our objective, various steps have been conducted including information gathering, circuit and coding development. Before deciding on any further actions, we reviewed previous product that have been produced in order to make it more user-friendly. Since the attendance system must be carried around, our proposed system should be small and portable. Due to this factor, the recorded attendance will be saved in a memory card. Once we received our components, we start constructing our circuit and troubleshoot each component to verify it operates. When all of the components are in good condition, we upload the code by using Arduino. For testing purposes, we only use our members' fingerprints.

IV. SYSTEM DEVELOPMENT

Fig. 4: Block Diagram of the Portable Attendance System

In designing this project, we require both software and hardware implementations. Figure 4 shows the block diagram of the portable attendance system. Arduino Mega ADK is connected along with the SD card, TFT Touch Shield (LCD colour), RTC (real time clock), fingerprint scanner (ZFM20) and the battery. In the software implementation, Arduino compiler IDE is used to compile the code.

A. Hardware

Arduino Mega is a type of microcontroller board based on ATmega1280 operating at 5V voltage [4][5]. This microcontroller provides four hardware UARTs for TTL (5V) serial communication. It also includes a serial monitor that allows simple textual data to be sent to Arduino or from Arduino board. When data is being transmitted through FTDI chip and USB connection, RX and TX LEDs will flash up. A set of library (SoftwareSerial) allows serial communication on any of the Mega's digital pins.

Fingerprint scanner will generate image of the ridges and valleys on every human fingerprint. In this project, it has two functions; first to scan and retrieve information from student and second, it is used to match the student ID with the fingerprint matches [6-8]. ZFM20 fingerprint scanner has its own processor and memory [9], so that the identification process can be done on the device itself and not overloading the main processor (Arduino Mega).

TFT touch screen shield is developed for Arduino compatible board and has a user-friendly interface that have menu for user to make selection. In this project, TFT touch screen shield is used to display information (date, time and students' name).

SD card module is used as interface between SD card and the microcontroller Arduino. It consists of an SD card which is the type of storage used to store the student's record [10].

Real Time Clock (RTC) module is used to obtain the current time, date and day for the fingerprint reader. It can record the exact time that the student attends and leaves the class.
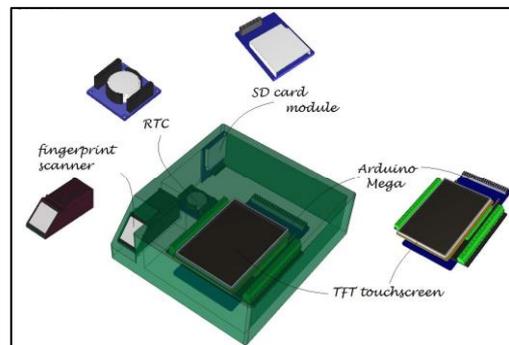

Fig. 5: Show the Sketch of the Design Work for the Electronic Devices used in this Project. The Dimension of the Assembly Project is 140mm x 130 mm x 45mm

B. Software

In order to take the attendance, student ID should be saved in the fingerprint scanner. The process of enrolling new IDs is began by uploading the program code in the Arduino

compiler. Then, the ID number is keyed in in the Serial Monitor.

C. Security Enhancement (Encryption)

The Portable Attendance System was added with a security mechanism to protect the data from being tampered by the student. It uses a cryptographic technique based on Ceaser Cipher method [11]. It involves substituting each letter of alphabet with the letter which is a number of places further from that alphabet as shown in Figure 6.
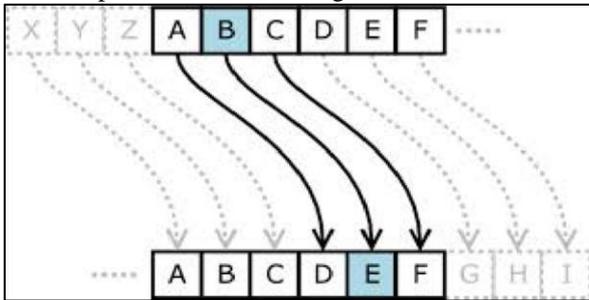

Fig. 6: Ceaser Cipher Shifting Technique

In this project the encryption takes place when the data is saved in the SD card. Then to read the data, the lecturers have to decrypt the data. The lecturer may be deciphered using Bloodshed Dev C++ software.

V. RESULTS & DISCUSSION

The portable attendance can save each student's fingerprint, hence makes the system more robust. During enrolment the student's fingerprints is assumed to be clean, not dry or damp, no scratches and not swollen.

Problems	Fingerprint Snapshot	Problems	Fingerprint Snapshot
Finger misplacement		Dirty finger	
Orientation		Skin problem	
Wet finger			

Table 1: Problem While Taking Attendance

Students are required to place their fingerprint. After the enrolment stage, the data will be saved in the fingerprint scanner and the verification system takes place by comparing the capture fingerprint characteristic with the previously enrolled data. Table I shows the types of issue that might occur when taking attendance system acquiring fingerprint for attendance purposes. Later, we designed a box for the product as shown in Figure 7. In the design stage, we considered all of these factors for the product which are user-friendliness, convenience, portability, and heat resistance.
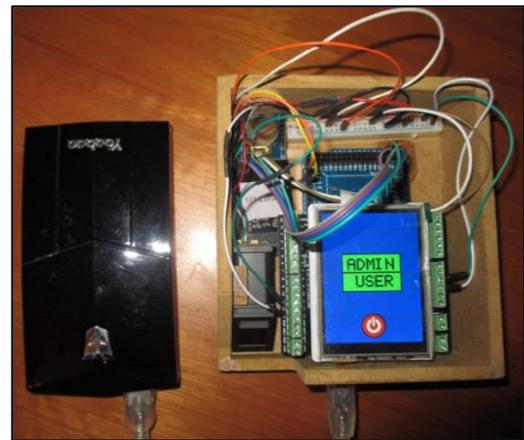

Fig. 7: Actual Portable Classroom Attendance System

In the recent time, most organizations such as colleges are using a sheet of paper to record the students' attendance. Students need to sign on the attendance sheet as an evidence for them to show that they attended the classes. When the attendance sheet is passed around in the class, each student needs to scan the name on the attendances sheet. We estimate the time for each student to sign the attendance sheet is about 1 to 2 minutes. If the total numbers of students in class is 40 the required time to sign the attendance is about 40 to 80 minutes.

Similarly for the fixed attendance system placed near the entrance to the class, the registration time for each student is around 20 seconds to 30 seconds. If the total number of students in class is 40, then the required time is about 13 to 20 minutes. Therefore, the last student to register will miss the class around 20 minutes.

An experiment has been conducted to know the time taken in recording students' attendance using our proposed Portable Attendance monitoring System. We record the time taken altogether starting from switching on the power until the verification of last student in the class. The results prove that utilizing the proposed system is more efficient and faster than using Attendance Sheet or Fixed Fingerprint Reader. The time require is around 10.21 seconds on average, while the time taken for each student to scan their finger is 4s. If a problem occurs which requires the students to use another fingerprint, the time taken is only 14 seconds. Therefore, the total time that was saved is around 56 seconds for each student. Some enhancement of the developed attendance system can be implemented, such as battery level indicator and security and backup system. A battery level indicator is a good way to display the remaining power for the device. When the battery is low, it will trigger a buzzer or light up an LED. Moreover, a wireless system that transmits the data wirelessly to a server as a backup can be developed to record the real time attendance system, just in case the SD card is damaged.

VI. CONCLUSIONS

This paper has presented the portable attendance monitoring system which is based on fingerprint identification. The system helped to reduce many issues such as, denying the possibilities of cheating in recording the attendance, helps to ease the lecturers to keep track of students' attendance, the encryption technique adds more security so there will be no

anonymous fingerprint which is able to tamper with the recorded data, and the portability saves time in taking attendance instead of queuing in a line. Future works will include battery life indicator and additional security enhancement and backup system.

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