Study on Fingerprint Based Attendance System

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***Abstract*—Fingerprint identification is one of the most well known and common biometric identification systems. Because of their uniqueness & consistency over time, fingerprints have been used for identification over many years, more recently becoming automated due to its highly computing capabilities. So, here the fingerprint identification technique was used for maintaining the attendance record. The database of the fingerprints of various students is maintained. The PC and Module wireless communication is done using Bluetooth.**

***Keywords*—Attendance, Bluetooth, biometric, fingerprint;**

I. INTRODUCTION

Fingerprint identification is one of the most reliable and efficient biometrics. Because of their efficiency and consistency over time, fingerprints have been used for identification for over a century, more recently becoming automated (i.e. a biometric) due to its highly computing capabilities. Fingerprint identification is popular because of the inherent ease in acquisition, the numerous sources (ten fingers) available for collection, and their established use and collections by law enforcement and immigration.

A fingerprint usually appears as a series of dark lines that represent the high, peaking portion of the friction ridge skin, while the valleys between these ridges appears as white space and are the low, shallow portion of the friction ridge skin. Fingerprint identification is based primarily on the minutiae, or the location and direction of the ridge endings and bifurcations (splits) along a ridge path. The images below present examples of fingerprint features: (a) two types of minutiae and (b) examples of other detailed characteristics sometimes used during the automatic classification and minutiae extraction processes.

The types of information that can be collected from a fingerprint's friction ridge impression include the flow of the friction ridges (Level 1 Detail), the presence or absence of features along the individual friction ridge paths and their sequence (Level 2 Detail), and the intricate detail of a single ridge (Level 3 Detail). Recognition is usually based on the first and second levels of detail or just the latter.

(a) (b)

Fig 1. (a) Minutiae [31] (b) Fingerprint Characteristics [32]

Automated Fingerprint Identification Systems (AFIS) technology exploits some of these fingerprint features. Friction ridges do not always flow continuously throughout a pattern and often result in specific characteristics such as ending ridges, dividing ridges and dots, or other information. An AFIS is designed to interpret the flow of the overall ridges to assign a fingerprint classification and then extract the minutiae detail – a subset of the total amount of information available yet enough information to effectively search a large repository of fingerprints.

II. LITERATURE SURVEY

Basic Steps in Fingerprint recognition System: Fingerprint recognition can broadly be divided into four major steps as shown in figure 2 which is given below.

1. Image Acquisition
2. Pre-Processing
3. Feature Extraction
4. Template Creation and Matching

Firstly we take input image from the standard database. Secondly pre-processing is performed to improve the image quality and to reduce the noise in the taken images. In the next phase feature extractions is clearly taken after pre-processed input image to a very good level and relevant features are identified which can help in distinguishing that person to the other persons. In the last phase a template is generated for enrolment and matching purpose. Finally a matching is done at biometric matcher after that a matching score is given dependent on the features.

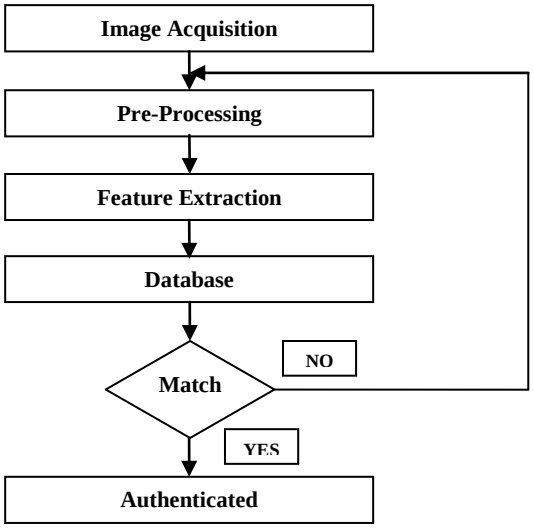

Fig 2.Block Diagram of Fingerprint Recognition

1. M. M. H. Ali [5], highlighted on previous studies on a basic fingerprint recognition system. In this paper, summaries of fingerprint databases with characteristics are given.
2. V. J. Rathod [7], proposed techniques like phase-based image matching in Fingerprint Recognition system designed in order to reduce the False Acceptance Rate (FAR) and False Rejection Rate (FRR) and to improve the performance of the system. In this paper gaps are also identified and an optimum approach is considered.
3. C. C. Liao and C. T. Chiu [8], proposed fingerprint matching method by combining different features like minutiae and ridge. By performing an experiment on FVC2002 database, the equal error rate (EER) is around 0.82
4. R. Oulhiq [9], proposed a use of number of bifurcations in an image localities and also use of Artificial Neural Network (ANN) for classification.
5. J. F. Lim and R. K. Y. Chin [12], proposed a hybrid method to improve the accuracy of low quality fingerprint matching by integrating specific features from image based techniques into minutiae based technique.
6. M. Kamaraju and P. A. Kumar [14], introduced a low power Digital Signal Processor (DSP) based embedded fingerprint recognition system. In this paper, for fingerprint image enhancement the algorithm of Gabor filter is used.
7. D. Kocharyan [18], proposed fusion scheme in which scores are transformed into common range, by assigning weights and combining the final fused score are generated.
8. N. Humaira [19], proposed a fingerprint image alignment by using core point based 'Poincare Index Value' method. Curvelet transformation is used for extraction of features set in different scale and orientation.

III. About Hardware

A. *Fingerprint Module GT-511C3*

The module does all the heavy work of reading, identifying, and storing the fingerprint data. It can be issued several commands for all the functionalities. The module can store up to 200 different fingerprints and is capable of 360o recognition. For working the fingerprint must be registered by sending appropriate commands. On successful execution of the command it sends acknowledgement for success and Error code otherwise. The database of the prints can even be downloaded from the unit and distributed to other modules. The raw images of the fingerprints can also be retrieved from the module.

B. *Arduino Mega 2560*

Arduino microcontroller acts as the link between the fingerprint module and the Bluetooth module. It converts the data received from the Fingerprint Sensor (FPS) to a string that can be sent over the Bluetooth. It also parses the data received from the PC and sends appropriate commands to the FPS. It was used since it has multiple serial ports available on the board. This makes it easy to communicate with both Bluetooth module and FPS.

Connections:

1. Serial Port 2 - Fingerprint Sensor

2. Serial Port 3 - Bluetooth Module

3. Serial Port 1 (Optional) - PC //Only for verifying if circuit is working

PC sends a 4 digit number as a command and parameter. The thousands digit is for command as described in the code. The rest of the 3 digits are used for passing the parameter. These 3digits are the ID which we want to delete using the delete command.

C. *Bluetooth Module*

It supports simple serial communication. It works at a baud rate of 9600 bps and hence is always in sync with the PC and the Arduino board. Its PIN is 0000. It was first paired with the PC. After that the connection with the Bluetooth module can be done with the serial library of Python. There is a difference in the connection here.

Arduino Tx - Module Tx
Arduino Rx - Module Rx
Power: 5V DC

IV. About Software

A. *Software tools used*

MySQL (For Database Management)

Python's GUI (Graphical User Interface) package- TkINTER

B. *Why MySQL*

- It's easy to use: Basic knowledge of SQL is required and most relational databases require the same knowledge. With only a few simple SQL statements, we can build and interact with MySQL.
- It's secure: MySQL provides solid data security layers that can protect sensitive data from intrusion. Rights can be set to allow some or all privileges to individuals. All Passwords are encrypted.
- It's scalable: MySQL handle any amount of data, up to 50 million rows or more. The default file size limit is approx. 4 GB. However, you can increase this number up to 8 TB of data.
- It runs on many operating systems: MySQL runs on many operating systems, like Novell NetWare,

Windows, Linux, many flavors of UNIX, FreeBSD and others.

C. *Why TkINTER*

The 'standard' toolkit is included in the base Python distribution such as Tkinter code should run on any system which has Python installed.

Since the Tk toolkit has been around for since 1991, it is more portable than any other GUI toolkit.

Many of the alternatives available don't even support all of X11, Windows, and Macintosh, let alone other, more uncertain window systems.

V. METHODOLOGY

A. *Enrolling*

To enroll the fingerprint the finger is to be pressed to the module three times. All the three times it creates a template for the finger that was sensed on the optical sensor, added to that, the third time it also merges the three templates to create the final template. On successful enrolling the device sends a unique ID related to the finger enrolled. This ID can be saved and later used for verification of the finger.

Enrolling Procedure:

.Enroll Start (ID); // Issue command to start enrolling over the passed ID as parameter.

Capture Finger; // Take snapshot of the finger

Enroll1; // Create template of the 1st Image

Remove and press finger again

Capture Finger;

Enroll2; // Create template of the 2nd Image

Remove and press finger again

Capture Finger;

Enroll3; // Create template of the 3rd image and merge all 3 templates.

Verifying Procedure:

Capture Finger;
Identify1_N;
If (ID < 200) □ Verified ID
Else Invalid Finger;

B. *Flowchart*

Figure3 shows flowchart of an attendance system.

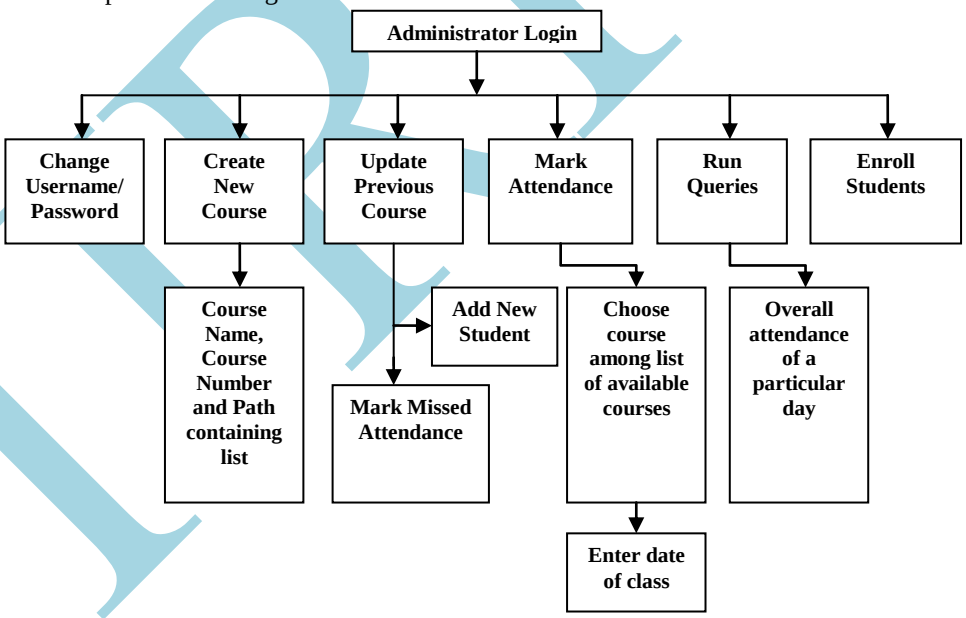

Fig 3. Block Diagram of Attendance System

VI. CONCLUSION

This Wireless fingerprint attendance system is elegant and efficient way to track the presence of students in the class during an entire semester for various courses enrolled. It also gives easy interface to get detailed information of relevant queries. Using this attendance system, Professor will get the attendance of whole class for a particular day and throughout the semester.

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