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# Biometric Student Attendance System based on Image Processing and RaspberryPi

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**Abstract:** The attendance system is on paper in colleges which is traditional method. In this old system attendance sheet is provided to all students for marking attendance in form of signature for uniquely identification. In this current system chances of making proxies are more i.e. if any student is absent but his/her friend whom knows the signature of absent one, can easily make his/her signature. Due to which our system causes problem if any wrong happens with anyone who's absent. The system is blamed for any problems occurred. Hence the attendance system must be advanced accordingly. Time waste over responses of students, waste of paper etc. is the disadvantages of manual attendance system. The system we are going to design is based on biometric authentication using Raspberry 3, python and open CV platform. In this system fingerprint authentication is being used. Every students fingerprint will be collected in a database. The kit will be provided to students for giving their thumb impression on the fingerprint sensor. This sensor will take an image of the thumb and then with help of open CV platform & python scripts, image processing will be done. If the image gets matched with the previously stored database then the attendance will be marked before his/her name.

**Keywords:** Fingerprint sensor, biometric, Raspberry Pi, Power supply, open CV.

## I. INTRODUCTION

The 'Biometric students attendance system's project consists of the development of low-cost and competitive security environment of fingerprint recognition. It is based on a GT (511C1R) device, and embedded into a Raspberry Pi B+ with Raspbian Linux. The system we are going to design is based on biometric authentication using Raspberry 3, python and open CV platform. In this system fingerprint authentication is being used. Every students fingerprint will be collected in a database. The kit will be provided to students for giving their thumb impression on the fingerprint sensor. This sensor will take an image of the thumb and then with help of open CV platform & python scripts, image processing will be done. We used the image processing methods such as Thresholding, Thinning etc. If the image gets matched with the previously stored database then the attendance will be marked before his/her name.

## II. RELATED WORK

In this system we used raspberry pi hardware module which attaches a fingerprint scanner to get fingerprints which is used for authentication. This system provides security in authenticating a student attendance and doesn't allow to make proxies. The system will scan the fingerprint with the help of the fingerprint scanner which will be attach to hardware device, after scanning the processed image will be matched with the stored database.

### A. What is fingerprints?

A fingerprint is the pattern of ridges and valleys on the outer of a fingertip. The endpoints and crossing points of ridges are called minutiae. It is a mostly accepted theory that the minutiae pattern of each finger is unique and never change during one's life. Figure 1. Clarify an example of a ridge ending and a bifurcation. In this example, the black pixels correspond to the ridges, and the white pixels correspond to the valleys.

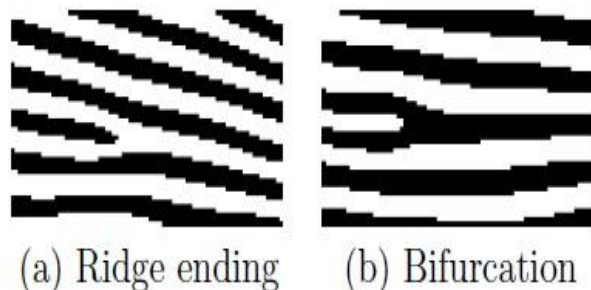


Fig.1 Example of a ridge ending and a bifurcation

### B. Why use Fingerprints?

Fingerprints are considered to be the best and fastest method for biometric identification. They are safe to use, unique for every person and never change for lifetime. These implementation of fingerprint recognition system is cheap, easy and accurate up to satisfiability. Fingerprint recognition has been widely used in both forensic and civilian applications. Compared with other biometrics features, fingerprint-based biometrics is the most proven technique and has the largest market shares. Not only it is useful than other techniques but also the energy consumption by such systems is very less.

### C. Aims and Objectives

- 1) High level security is noted because of thumb impression.
- 2) System is based on open source.

## III. PROPOSED SYSTEM

The 'Biometric student attendance system' project consists of the development of low-cost and competitive security environment of fingerprint recognition. It is based on a GT (511C1R) device, and embedded into a Raspberry Pi B+ with Raspbian Linux. The system we are going to design is based on biometric authentication using Raspberry 3, python and open CV platform. In this system fingerprint authentication is being used. Every students fingerprint will be collected in a database. The kit will be provided to students for giving their thumb impression on the fingerprint sensor. This sensor will take an image of the thumb and then with help of open CV platform & python scripts, image processing will be done. We used the image processing methods such as Thresholding, Thinning etc. If the image gets matched with the previously stored database then the attendance will be marked before his/her name.

### A. Advantages of System

- 1) High level security is noted because of thumb impression.
- 2) System is based on open source format.
- 3) No proxies can be done.

### B. Disadvantages of The System

- 1) If any of the hardware fails it can affect whole system.
- 2) We are considering only one thumb of each student.

## IV. SYSTEM DETAILS OF SOFTWARE AND HARDWARE

### A. Hardware Requirement

This project requires some hardware components such as Raspberry pi, Fingerprint sensor and power supply.

- 1) *Raspberry pi*: The design of this project uses Raspberry pi 3 B. Raspberry Pi is a single board computer with Linux or other small operating systems. It was created by Raspberry Pi foundation in UK for the use of computer science education. The second version of the Raspberry Pie used in this project. Raspberry pi consists of an ARM 1176JZF-S processor, which runs at 700MHz clock speed, 512MB SDRAM shared with GPU, a Video Core IV GPU, 2 USB port, 1 100 M bit/s Ethernet port, one video and audio output, one HDMI output. It also has 26 pins including 8 General purpose Input/output(GPIO), one SPI bus, one I2C bus, one UART bus and 3.3V, GND and 5V. The Raspberry Pi needs an external Secure Digital(SD) card to store its operating system and also all the user data. So, it can be used as a really powerful microcontroller which can accomplish almost any functions, and also it can act as a normal use computer with keyboard, mouse and monitor connected.



Fig.2 Raspberry pi

- 2) *Fingerprint sensor*: This device uses 4-pin connector to communicate with the Raspberry. We chose the Fingerprint Scanner Device GT 511C1R as it is very cheap and provides a well-documented manual, a Linux compatible module as well as a low cost relation. GT511C1R which has a more memory capacity. The module can backlog up to 200 definite fingerprints and is now have the ability of 360° recognition. The on board JST-SH connector has 4 signals are Vcc, GND, TX, Rx.



Fig.3.Fingerprint sensor

- 3) *Power supply*: The power supply on Raspberry pi is easy. This uses a Micro USB connection to power itself and the micro USB connection ability of supplying at least 700mA at 5v. Apparently normal mobile phone charges are applicable and do not efforts to power of Raspberry pi from a USB port of another computer or hub because they are frequently incapable of supplying the required current.

#### B. Software Requirement

- 1) *Python*: Python is a extensively used high-level, general-purpose, interpreted, dynamic programming language. Its design conception accent code readability, and its syntax allows programmers to express concepts. In less lines of code than possible in languages such as C++ or Java. The language provides advice to enable clear programs on both a small and large scale. Python supports various programming criterion, including object-oriented, compulsory and functional programming procedural styles. It features a dynamic type system and automatic memory management and has a large and absolute standard library.
- 2) *Open Cv*: Open CV (Open Source Computer Vision) is a functions library of programming largely defined at real-time computer vision. The library is free and cross-platform for utilize under the open-source, Open CV supports a many algorithms related to Computer Vision and Machine Learning and it is enlarging day-by-day. Open CV supports multiple programming languages like C++, Java, Python etc. and various platforms are convenient including Windows, OSX, Android, Linux, iOS etc. Open CV-Python is the Python API of Open CV. It integrates the best qualities of Open CV C++ API and Python language.
- 3) *Open cv python*: Python is a general purpose and very popular programming language in short time because of its code readability and simplicity. Programmer is express his ideas in limited lines of code without reducing any readability using this language. Python is slower than other languages like C/C++,. But it can be easily extended with C/C++ is another feature of python language. This feature helps programmer to write intensive codes in C/C++ and create a Python wrapper for it so it uses these wrappers as Python modules.

This gives us two advantages: inA, rst,~ our code is as fast as original C/C++ and second, it is very simple and easy to code in Python. This is how Open CVPython works, it is a implementation of Python wrapper around original C++ . And the support of Numpy makes the task more easier. For the numerical operations numpy is a highly optimized library. It gives a MATLAB-style syntax. It converts all the OpenCV array structures. So every operations we can do in Numpy, this operation is combine it with OpenCV, which increases number of weapons in your arsenal. SciPy and Matplotlib libraries are supports Numpy which can be used with this. So OpenCV-Python is fast prototyping tool for appropriate computer vision problems.

## V. TECHNOLOGIES USED

#### A. Thresholding

In this project we used image processing technique Thresholding. For partitioning of an image into a foreground and background effective way is used which is thresholding. This image analysis technique is a type of image segmentation that separate objects by converting grayscale images into binary images. Thresholding is applied on fingerprint image and gave the following result:

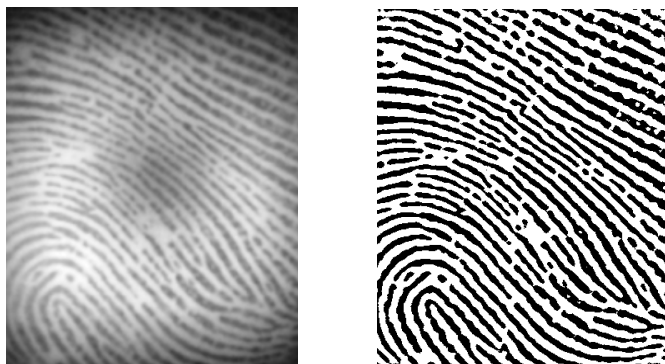


Fig.4. original image and after thresholding

### B. Thinning

To transform of a digital image into a topologically equivalent image, technique used is thinning. It is calculated using mathematical morphology operators. Thinning is also used to extract a simple representation of regions in combination with other morphological operators. Automated recognition of hand-written characters is a common example of this. To obtain the shapes of the characters morphological operators are used as pre-processing which then can be used for the recognition. Here we used this technique for fingerprint recognition.



Fig.5. After Thinning

### C. Image Inversion

Image inversion is black and white inversion which is refers to an image processing technique in that light areas are mapped to dark, and dark areas are mapped to light. In other words, after image inversion black becomes white and white becomes black. An inverted black and white image can be thought of as a digital negative of the native image. Here we have implemented this technique because in next technique we need to detect black ridges in the image but our thinned image was having a black background hence the minutiae points were unable to detect. So we have implemented inversion method to make the image as per the algorithms need.



Fig.6 After Image inversion

#### D. Minutiae Recognition (Crossing Number Method)

Crossing number methods is very simple way to recognize ridge and ridge bifurcations.

First, we'll need thinned (skeleton) image. Then the crossing number algorithm will look at 3x3 pixel blocks: if middle pixel is black (represents ridge):

- 1) if pixel on boundary are crossed with the ridge once, then we've found ridge ending.
- 2) if boundary pixel are crossed with the ridge three times, then we've found ridge bifurcation.

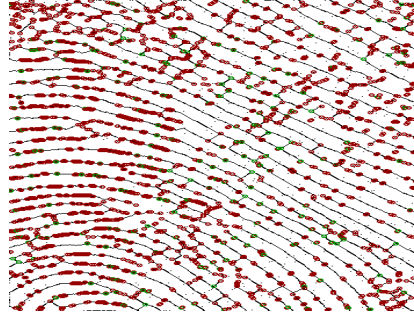


Fig.7 After Minutia recognition

#### E. Matching

In this method, captured fingerprint image is compared with every image in the stored database and when the match is found, it display the matching points. As shown in the fig.7. But in this method we get 30% success rate.

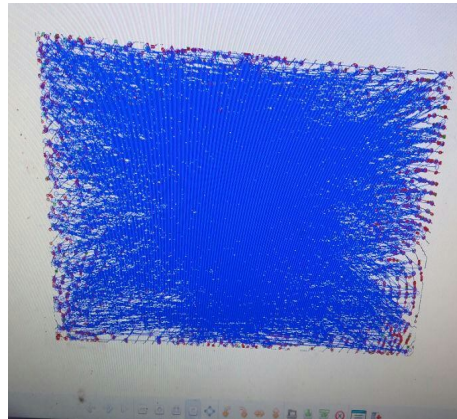


Fig.8 Matching points

### VI. FUTURE ENHANCEMENT AND CONCLUSION

The main intention of this project is developing an algorithm which can be detect the fingerprint and compare it with the stored database our main objective will be to make the system portable.

Future scope will be-

- A. We can broadcast the attendance through network.
- B. When student is regularly absent for 4 to 6 days, a free email will be send on parents and HODs email.

### VII. ACKNOWLEDGMENT

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