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BIOMETRICS USING VEIN RECOGNITION

Vidhit Varma[1], Mansi Singh[2], Uzma Khan[3], Junaid Mandviwala[4]

[1-3]Dept.of Electronics & Telecommunications Engineering
[4]Assitant Professor, Dept. of Electronics & Telecommunications Engineering
Rizvi College of Engineering, Mumbai, Maharashtra, India.

Abstract - *Finger vein recognition is one of biometric authentication methods that analyzes finger vein patterns for accurate user authentication. The data for the finger is taken using the attester terminal and stored into the database. Vascular data of an individual's finger is matched against the record of the same individual from the database. This record is unique to that individual alone and thus makes for one of the strongest biometric techniques.*

Like in other Biometric techniques it is not possible to hack the system using high resolution images of a person. Aging or slight changes in the outer physical appearance does not affect this technique.

Key Words: **Arduino, OpenCV, ORB, Gabor Filter, Python, Infrared Led**

1. INTRODUCTION

Reliable user authorization is becoming a very high priority in the Web-enabled world. The consequences of an insecure access or an unauthorized user authentication in a corporate environment can be catastrophic to the user, and may include loss of information, data and compromised data integrity. There are various ways of user authentication. Biometric is considered one of the most secure ways of authentication. There are many different recognition systems in biometrics such as eye scanners, speech recognition, fingerprint, facial recognition and finger vein recognition. Out of these, eye scanners are very costly due to retina scanning technology. Facial recognition is very unreliable because a little change in face can make the system not recognize the user. Fingerprint scanners face similar problems where a little scratch on the skin or a little sweat can cause issues related to authentication. Finger vein system is considered to be one of the most robust systems in biometrics because the finger vein is hidden inside a finger unlike fingerprints and cannot be seen directly to the human eye therefore it cannot be forged or be stolen directly and easily. Finger vein is also unique to each individual so the false acceptance rate is close to zero. As there is an increase in breaching of securities using false credentials the use of finger vein systems can be an essential tool in limiting the increasing cases.

2. MATERIALS REQUIRED

There are many such open datasets available that contain finger vein images in lower qualities. These dataset templates are used to train the camera for accurate identification of finger vein when used practically.

A. Software Requirements:

- Arduino IDE: Arduino IDE is an application in which codes are written for arduino compatible boards. It supports C, C++ for programming as well.
- Python: Python is an object oriented programming language. It is free to install and easy to use programming software
- Tkinter: It is a python GUI toolkit which comes with basic installation of python. It is free software under python license.
- OpenCV: OpenCV is a library function mostly used for real time computer vision. Major applications of OpenCV consist of recognition and estimations using deep learning frameworks.
- MySQL: It is an open source Database management system (DBMS). XAMPP: It is a free open source web server pack.

B. Hardware Requirements:

- Arduino Uno: Developed by Arduino.cc is an open source microcontroller board. It has different sets of digital and analog pins to interface it with other devices or circuits. The camera is interfaced with the board to connect it with the computer system for transfer of data serially.
- OV7670: It is a VGA camera primarily used with arduino boards. It is a low voltage 0.3 megapixel CMOS camera with a resolution of 640 x 480 in 30 fps.
- Near Infrared (NIR) LEDs: Infrared Light has longer wavelength than visible light from the red range of visible spectrum at ~700nm to 1nm and NIR similarly has a larger spectrum range ~700nm to 2500nm.

3. METHODOLOGY

To build a system of creating and analyzing a biometric, a workflow of the procedure has to be followed. All the parts of the process are modularized. The process contains four key steps and they are described below:

A. *Storing the image:*

For a clear and distinct view of the veins of a finger, the index finger of the right hand and its middle phalanx is selected to give the optimum results. The camera used is the OV7670 camera module. The camera module is connected to the arduino Uno and the data is passed using serial communication. The image captured is saved in the MySQL database hosted locally using XAMPP Server integrated via Python code. The image is captured in the bmp file format.

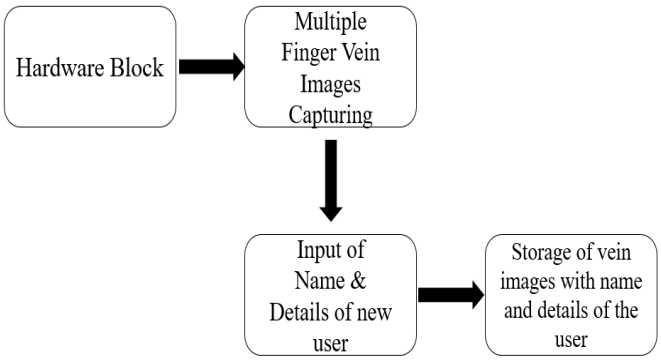

Figure 1- Input of images from the hardware to the software.

B. *Collecting User Data:*

The saved image will have an id and corresponding name and other details which will be provided by the user and will be stored in RDBMS fashion. Total of 6 images are taken considering different views and location for an input. All these images make a dataset that is used to authenticate data by the algorithm.

C. *Processing the image:*

The image will be converted using base64 encoding in a BLOB data type.

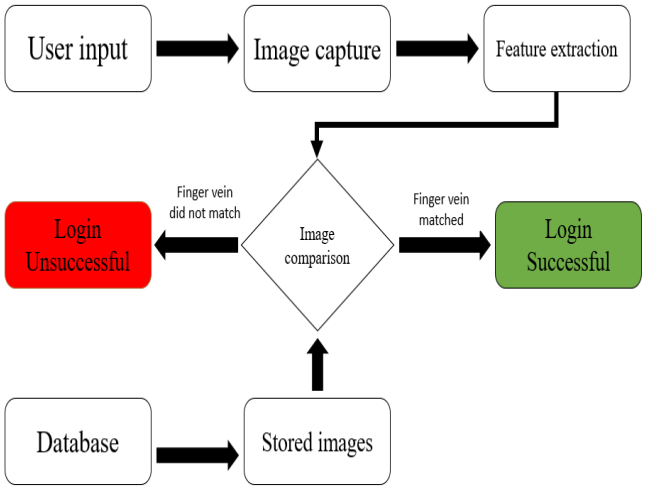

Figure 2 – Authentication process of the user trying to log in

D. *Finger vein recognition:*

Finger Vein Recognition can be implemented in many ways. The OpenCv Library provides various methods and attributes to process the image and apply various algorithms so as to compare and classify images. In this paper we will use image feature extraction using Gabor filter and OpenCv

ORB to extract image features in an integer matrix which then are compared for each image to derive similarity and matching the images.

4. IMPLEMENTATION

Feature extraction is the base of our finger vein recognition. Each Image is nothing but a set of pixel values which can be stored in a matrix. These values can be used to understand the image composition and can be altered to manipulate the image and image contrast. Matrix values of two images can be compared to obtain the similarity between them. Each Image whether derived from the dataset or the one used for recognition is first converted into a grayscale image. For any operation on the image, some features are to be enhanced and normalized to improve and enhance image attributes. For this normalization and enhancement of image is done. This image is then stored as a matrix of values.

1. Gabor filter method:

The images to be compared are passed through Gabor filter to extract image feature matrices of the two images to

be compared. These Matrix values are compared one by one. For each match a score value which is initially set to zero is incremented. A percentage value of score is calculated with respect to the size of the image.

Size=Height of the image * Width of the image.

Scores = 100 * round ((score / size), 4)

A minimum Threshold value of choice is considered for matching. We assume a threshold score of 80 % for the match.

2. Flann based matching:

The key points and descriptors of the images are obtained via OpenCv Kaze detect and compute method. The descriptors are then applied as a parameter for the knn match method used to calculate the nearest distance.

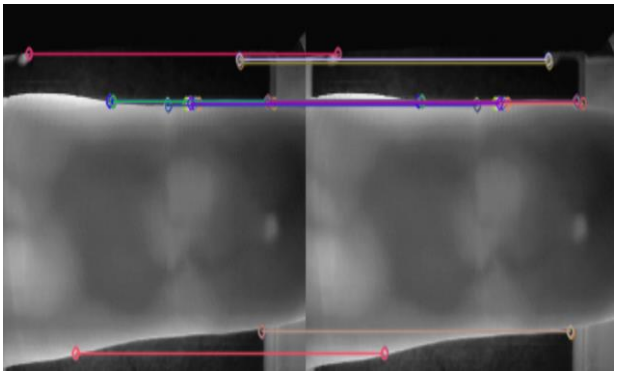

Figure 3- Flann based matching samples

The resultant is stored in a matrix. Each value of this matrix is iterated and a ratio test is applied on the values of the matrix as per Lowe's Paper.

Matches = flann.knnMatch (des1,des2,k=2)

If m.distance < 0.8*n.distance:

matchesMask[i] = [1,0]

match_keypoints_count += 1

A Percentage Score is generated accordingly

Score = 100 * round (match_keypoints_count / len (matchesMask), 4)

We assume a threshold of 60 %.

5. RESULTS

CASE 1:

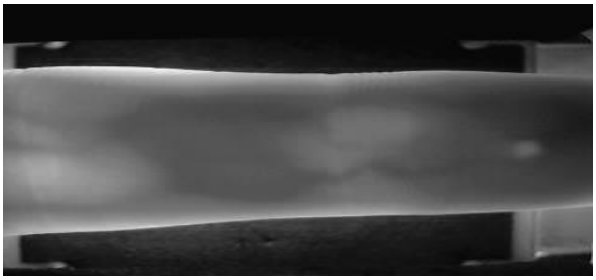

Figure 4- Finger vein sample index finger.

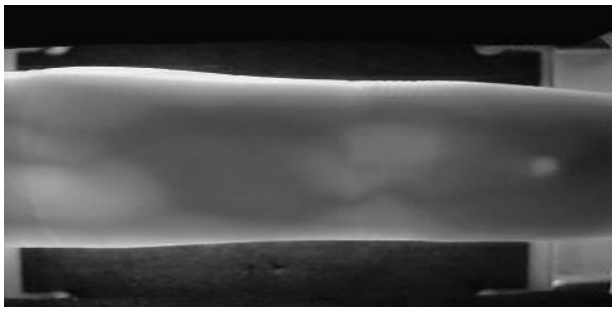

Figure 5- Finger vein sample index finger.

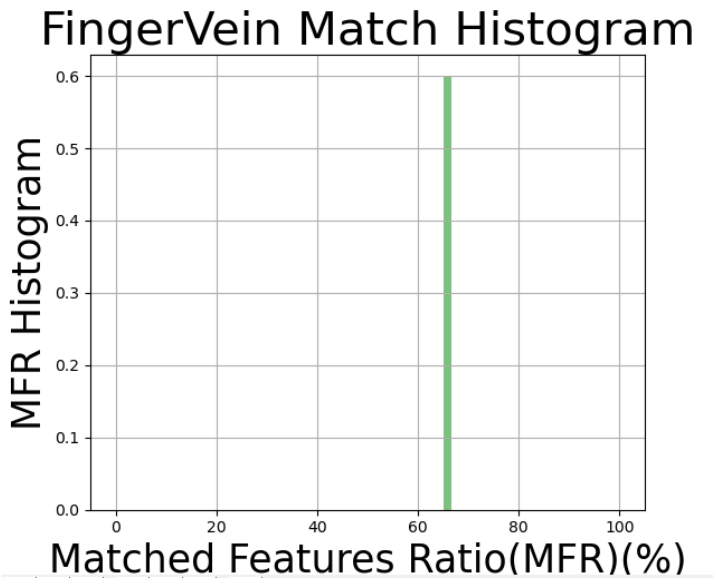

Figure 6- Histogram of matching samples (Figure 4 & figure 5)

A Percentage score of 89.75 % by Gabor Filter method and 66.67% by Flann based matching.

The two Finger veins match.

CASE 2:

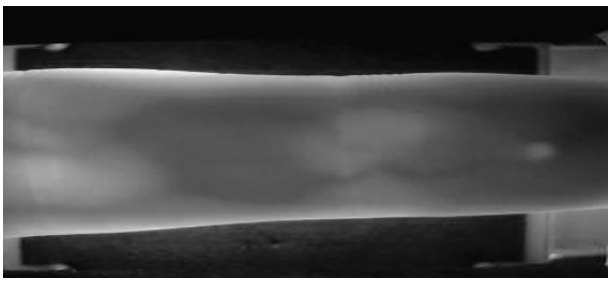

Figure 7- Finger vein sample index finger.

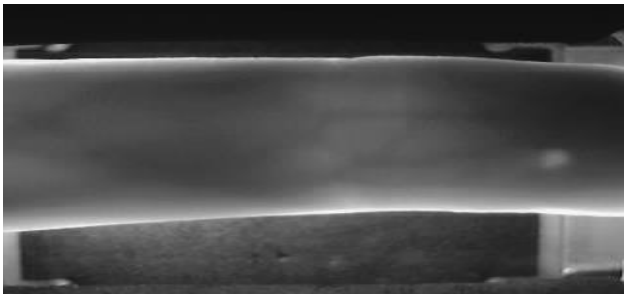

Figure 8- Finger vein sample ring finger.

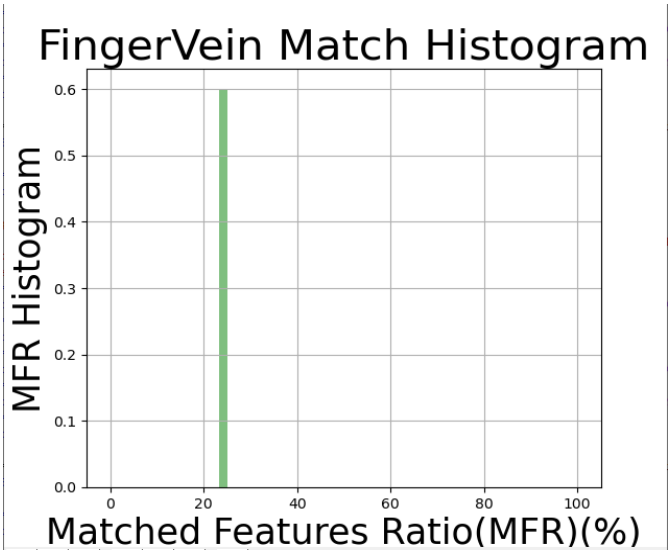

Figure 9- Histogram of non matching samples (Figure 7 & figure 8)

A Percentage score of 44 % by Gabor Filter method and 23.33% by Flann based matching.

The two Finger veins do not match.

6. CONCLUSION

Finger vein recognition systems in biometric security have been proved robust for safety in digital access. The system can easily detect differences between stored finger vein images of the person and the person may try to access the account in a secure manner. The recognition system has a high accuracy for detection of the images. In the current scenario where everything is digital it is easy to bypass security and gain confidential information of another person. Due to this, secure access is must for maintaining privacy of information. The simplicity of finger vein detection has made this security process a hassle free procedure as the vein images cannot be morphed or modified. As a vein is hidden inside the illegal user can't copy or forge another vein signature in any way.

REFERENCES

[1]. John Thangavel.P, Abarna.M, Aruna.P, Anitha.S, "Finger Vein extraction and authentication for security purposes", IRJET, e-ISSN: 2395-0056, pp 1012-1015.

[2]. Soheil Varastehpour, Hamid Sharifzadeh, Iman Ardekani, Abdolhossein Sarrafzadeh, "A Review of Biometric Traits with Insight into Vein Pattern Recognition", 2018 IEEE, 978-1-5386-7493-2/18.

[3]. Savio Jose, Bini A.A, "Towards Building a Better Biometric System Based on Vein Patterns in Human Being"s, 978-1-5386-8158-9/19 2019IEEE.

[4]. Nurul Maisarah Kamaruddin, Bakhtiar Affendi Rosli, "A New Filter Generation Method in PCANet for Finger Vein Recognition", IEEE Access, 10.1109/ACCESS.2019.2941555.

[5].Kashif Shaheed, Hangang Liu, Gongping Yang, Imran Qureshi, Jie Gou and Yilong Yin , "A Systematic Review of Finger Vein Recognition Techniques", MDPI Information 2018, 9, 213; doi:10.3390/info9090213.

[6].Lowe, D.G. Distinctive Image Features from Scale-Invariant Keypoints. International Journal of Computer Vision 60, 91–110 (2004).

[7].Lu Yang, Gongping Yang, Yilong Yin ,Lizhen Zhou , "A Survey of Finger Vein Recognition ", CCBR 2014, LNCS 8833, pp. 234–243, 2014

[8].Zhang, Hong & Liu, Zhi & Zhao, Qijun & Zhang, Congcong & Fan, Dandan. (2013). Finger Vein Recognition Based on Gabor Filter. 8261. 827-834. 10.1007/978-3-642-42057-3_104.