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# Secured Authentication System by Recognizing the Finger-Vein

**C.Vinu, D.Silambarasan**

P.G. Student, Department of Electrical and Electronics Engineering, Anna University Regional Campus Coimbatore,Tamilnadu, India

Assistant Professor, Department of Electrical and Electronics Engineering, Anna University Regional Campus Coimbatore,Tamilnadu, India

**ABSTRACT:** In real world security is most important to protect our information and personals. Even much crucial to protect the confidential data's in an organization which place the important role in their business and feature. So there are many issues in the security. In this paper I proposed a secured authentication system by recognizing the finger –vein, which help to the person to access any kind of information in secured area. Here the system will take the finger-vein information by the sensor and it will react accordingly based on person authentication level which already predefined by the administrator. The system is implemented on a raspberry kit, sensors and actuators. The experimental results demonstrate that the finger –vein recognition system. the features used are lacunarity distance, blanket dimension distance .this has more accuracy when compared to conventional methods.

**KEYWORDS:** Bio metric,finger-vein,raspberry pi,IR sensor,usb camera.

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## I.INTRODUCTION

Finger –vein recognition system is a type of Biometric Authentication .biometric identifiers are often categorized as physiological versus behavioural characteristics. Physiological characteristics are related to the shape of the body. There is a long list of available biometric patterns, and many such systems have been developed and implemented, including those for the face, finger print, face recognition etc, illegal activities are happening in every place today. So government and corporate sections are concentrating mainly on the security levels with their inventions. To overcome the limitations of current hand based biometric system, finger vein recognition system had been stared. They proved that each finger has unique vein patterns in different formats. So that it can be used in personal verification .finger vein based biometric system has several benefits when compared with other hands based biometric methods.

We designed a special device for acquiring high quality finger vein images and propose raspberry pi based embedded systems to implement the finger vein recognition system in the present study to achieve better recognition performance and reduce computational cost.

There are two challenges for finger vein recognition :(1)the quality of the infrared images of finger vein affects the recognition performance significantly, and (2) the texture information of finger vein is limited and the pose variation of the finger may cause change of finger vein infrared image. To address these two problems, we proposed the novel framework on finger vein recognition which is based on unifying manifold learning and point-manifold distance function.

## II.METHODOLOGY OF THE SYSTEM

### A. **OVERVIEW**

The image capture module consisting of camera and LED's is used to collect finger vein images. the raspberry pi module is used to execute the algorithm and communication port is used to communicate with the peripheral devices.

There are five stages in finger vein authentication

 

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- Capture the finger vein image pattern
- Segmentation and alignment of the image
- Image enhancement
- Feature pattern extraction from the image
- Pattern matching and outcome decision

B. **OVERALL BLOCK DIAGRAM**

The data acquisition for finger identification the process that targets the processor that starts from the camera input to the final extracted information that the system requires. This data has to be representative of the individual finger and needs to be able to deliver similar results between captures in order to be able to define a proper identification system. The procedure, for which the information is captured, transformed, extracted information about the user and finally compared with a database Samples.

The human machine communicate module is used to display recognition results and receive the input from users. The proposed finger vein recognition system contains two stages enrolment stage and the verification stage. Both stages start with finger vein image pre-processing which includes detection of the region of interest.

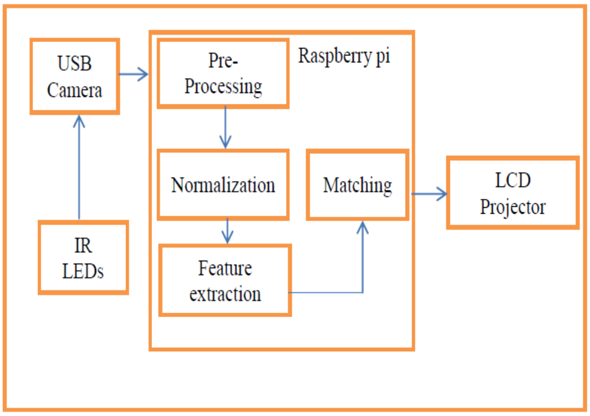


Fig 1.Block Diagram

## III .IMAGE ACQUISITION SYSTEM

The main body property used to acquire the images required for finger vein identification is the fact that blood vessels are opaque to Near-Infrared light and at the same time, bones and flesh aren't, delivering a different degree of shadowing at a picture taken in this wave length.

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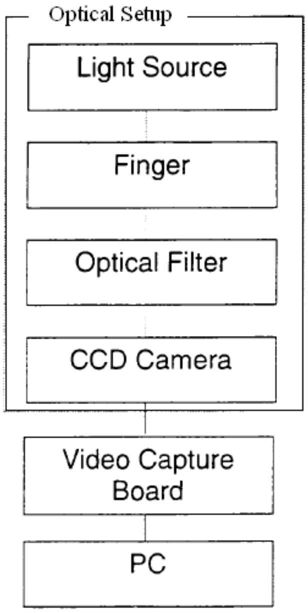


Fig 2.Image Acquisition System

A finger vein identification system will target such property through the use of a Near-Infrared (NIR) illumination system that targets to create the required lighting conditions to create an input frame for a Near-Infrared sensor from the light that pass through the user fingers and defines a pattern in the input image. The camera acquisition resolution is setup at 320x240 pixels. However, given the distance between the camera and the finger, the region of interest for the system has a resolution of 210x131 pixels, this count as the source picture resolution.

A(x,y)=(I1(x,y)3/4+12(x,y)3/4+.......+IN-1(x,y)3/4)/N (1)

Where x and y, are the coordinates of the pixel and N the number of images used for fusing. The results and the calculations were realized using 5 different pictures, improving the visibility of the veins and the stability of the extracted vein pattern and noise reduction. To achieve the desired result it's required to choose a non-balanced average that tries to reduce the score of highly illuminated areas, since the most common problem is to achieve some level of vein visibility into the area surrounding the illuminators.

$$M=\frac{1}{MXN}\sum_{i=0}^{M-1} 1 \sum_{j=0}^{N-1} 1 \qquad (2)$$

$$VAR=\frac{1}{MXN}\sum_{i=0}^{M-1} 1 \sum_{j=0}^{N-1} 1\,(I(i,j)-M(I))^2 \qquad (3)$$

$$G(i,j)=\begin{cases} M0+\sqrt{\frac{VAR0}{VAR}} \\ M0-\sqrt{\frac{VAR0}{VAR}} \end{cases} \times(\mathrm{I(i,j)}-\mathrm{M})^2, \mathrm{I(i,j)}\geq \mathrm{M} \qquad (4)$$

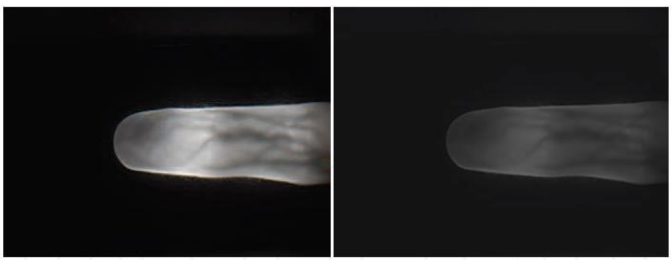

*Fig 3 Original Image And Normalized Image*

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### A. SEGMENTATION

Segmentation method is a commonly used simple and effective local dynamic threshold algorithm, so we choose this method to segment the image. The basic idea of this algorithm is that for every pixel in the input image; calculate their mean and variance of its $r \times r$ neighbourhood. Then as a result the image can be used for thresholding and also to segment image. Accurate extraction of finger vein pattern is a fundamental step in developing finger vein based biometric authentication systems. The finger vein pattern extraction method proposed and discussed above extends traditional image segmentation methods, by extracting vein object from the oriented filter enhanced image. The addition of oriented filter operation extracts smooth and continuous vein features from not only high quality vein images but also noisy low quality images and does not suffer from the over-segmentation problem.

### B. FEATURE EXTRACTION

Once the finger vein pattern is acquired the next step in an identification system is to choose, design the implementation of the pattern recognition algorithm and features that will be used for identification. Multiple kinds of data and pattern recognition algorithms can be used in a single final score. Those systems are usually known as multimodal systems since they use different features to perform a single identification.

In this paper three different kinds of data from the finger vein pattern were selected as feature points and the fusion between them in order to obtain a final result, such features are:

- The end and cross points of that can be found in the final picture after the image
- The finger vein pattern as it is will be recorded as a feature
- The maximum and minimum distance found between two finger veins in a cross-section scan of the finger vein pattern as geometric feature.

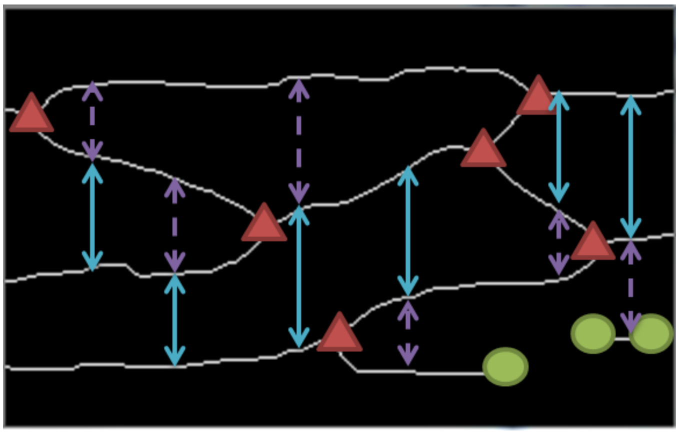

*Fig 4.example of feature points extracted.*

The distinguished finger images from other inanimate objects like ballpoint pen, pencil, chalk etc by calculating mean and skewness of the histogram of gray images. It has been observed that the same object show similar statistical behaviour even in different intensities.

**Mean:** It's the average gray level value in an image. Global mean represents the average intensity and local mean represents the characteristics of the image. **Skewness:** It measures the asymmetry of a distribution. It is positive if there is a long tail to the right (bright) and negative for a tail on the left (dark) Skewness is sensitive to outliers, removing pixels with gray levels far from the majority distribution.

All the parts of captured images do not carry meaningful information. Only the part that contains the veins is important for identification. Finger vein identification being a real time system should take as less time as possible. To speed up the entire recognition process a part of the image i.e. the region of interest is selected. It is chosen in such a way so as to maximize the vein area in it and that too without compromising the recognition rate. To subtract the

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background which can be misleading in identification, [3] have binaries the raw finger vein images using a manually selected threshold of 230. It locates the finger shape making the background black and finger region white. Evenly illuminated images produce a perfect binary outline representation of the finger. But in case of uneven illumination some portion of background turns white during binaries and remains connected to the white finger portion of the binary image. To produce a perfect finger mask from this kind of images the following steps are followed:

1. Sobel edge detector is applied to the entire image.
2. The resulting edge map is subtracted from the binary image.
3. The isolated blobs (if any) in the resulting images are eliminated by eliminating the white regions where the number of connected white pixels are less than a threshold. The resulting binary mask is used to segment the ROI from the original finger-vein image.

This proposed ROI segmentation method [6] is convenient for the database they have created. The finger is in the middle of the image and the background being much darker than the finger there's an obvious brightness jump in the vertical direction on the edge of the finger. A gradient operator as is moved to left and right of the image starting from the middle. An edge is detected if the gradient is greater than a threshold. Edges are obtained by repeating the same process for each row. One constraint is introduced to guarantee the continuity of the edge: the distance between two neighbour- points on the edge should be no larger than several pixels.

## IV.EXPERIMENTAL RESULTS

To verify the effectiveness of the proposed method, we test the algorithm using images from a custom finger vein image database. The database includes five images each of individuals' finger veins. Each image size is 320*240.

### A. PROCESSED OUTPUT

The finger vein is processed, and the processed images are displayed in the figure. Firstly the finger is captured, and then the finger region is detected. The Binarised veins extracted by maximum curvature method. Using the maximum curvature method, the binarised veins extracted by repeated line tracking method, and finally the image is captured.

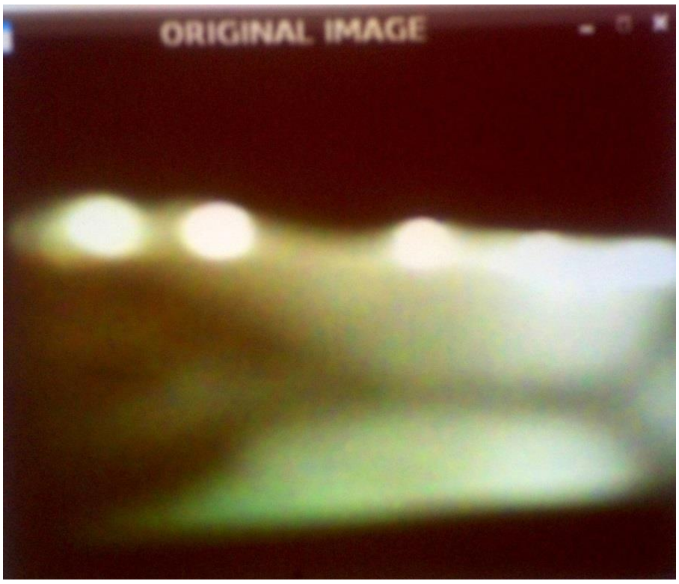


*Fig 5.Original finger image*

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*Fig 6.Camera Tested Image.*

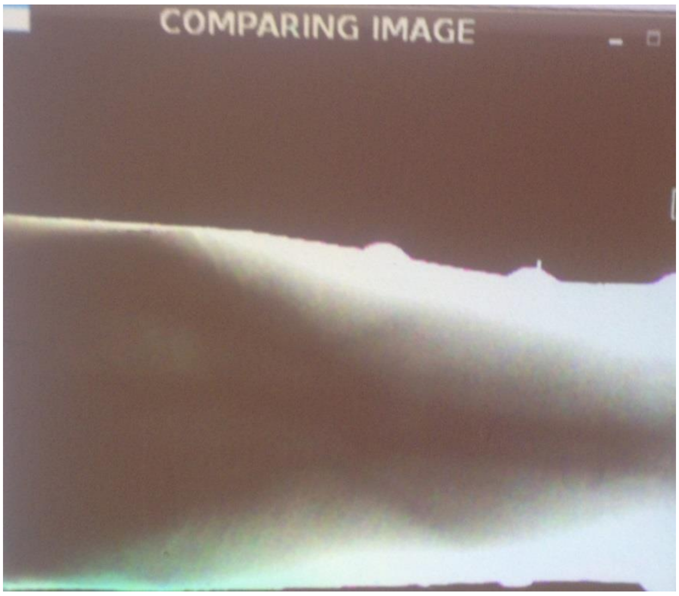


*Fig 7.Comparing Image*

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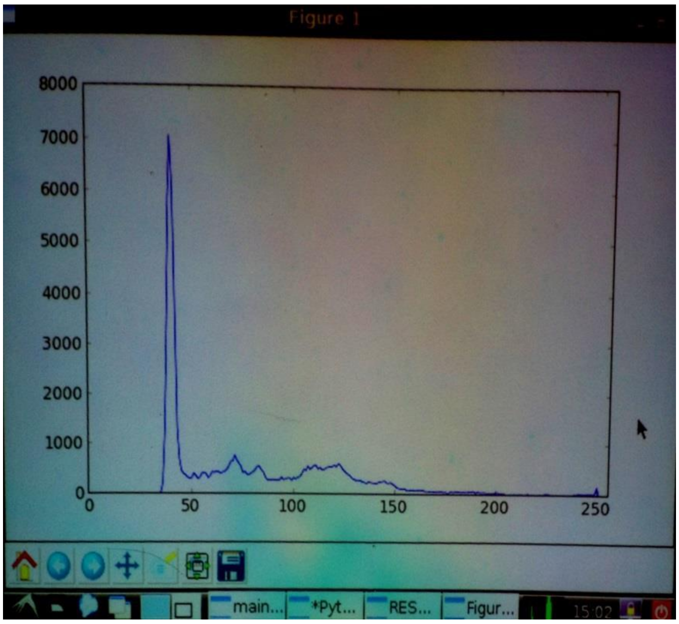


*Fig 8.Histogram Equalization*

Accurate extraction of finger vein pattern is a fundamental step in developing finger vein based biometric authentication systems. Finger veins have textured patterns, and the directional map of a finger vein image represents an intrinsic nature of the image. The finger vein pattern extraction method using oriented filtering technology. Our method extends traditional image segmentation methods, by extracting vein object from the oriented filter enhanced image. It is concerned with filtering the observed image to minimize the effect of degradations. Effectiveness of image restoration depends on the extent and accuracy of the knowledge of degradation process as well as on filter design. Image restoration differs from image enhancement in that the latter is concerned with more extraction or accentuation of image features.

## V. CONCLUSION

Finger-vein recognition is faced with some basic challenges, like positioning, the influence of image translation and rotation etc. To address these problems, essential topology attributes of individual finger veins are utilized in a novel method. Particularly, the relative distance and angles of vein intersection points are used to characterize a finger-vein for recognition, since the topology of finger-vein is invariant to image translation and rotation. The experimental results of the proposed system shows that the finger vein pattern is highly unique and is a better alternative for other personal authentication systems. Also, the use of low cost camera and open cv tools made the system cheaper than the conventional systems without risking accuracy.

For analysing resilience to rotation and translation, rotating the finger in different directions and axes will be much realistic moreover changing the distance between the finger and camera can be tested instead of artificially rotating and adding noise to the images.

And only one database is used for analysing the performance of the methods. However for better evaluation and analysis, other database, especially those with more images and more distortions should be used for better analysis of the parameters and performance of the methods software can be used as a future work.

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