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HUMAN IDENTIFICATION USING FINGER VEIN IMAGES

Bagban F.I.
Dept. Electronics & Telecommunication Engineering,V.V.P.I.E.T. Solapur, Maharashtra, India.
mdfaisalb50@gmail.com
Amale P.P.
Dept. Electronics & Telecommunication Engg.
V.V.P.I.E.T. Solapur, Maharashtra India.
amalepraju212@gmail.com

Shukla S.R.
Dept. Electronics & Telecommunication Engineering,V.V.P.I.E.T. Solapur, Maharashtra, India.
shukla.solapur@gmail.com
Mrs. Hiremath G.A.
Dept. Electronics & Telecommunication Engineering, V.V.P.I.E.T. Solapur, Maharashtra, India.
rachitahiremath@gmail.com

***Abstract* — Finger vein is a unique physiological biometric which is used for identification of individuals based on the physical characteristics and parameters of the vein patterns in the human body. This technology is at present in use or development for a wide range of applications, which includes credit card authentication, security in automobile, employee time and tracking attendance , computer and network authentication, security at end points and automated teller machines. The basic principle, different feature extraction techniques and performance measuring are analyzed. Mostly the existing work is functionally described and compared in three parts (i.e. Finger vein acquired image, pre-processing and feature extraction).**

Keywords---Finger vein, Gabor Filter, Repeated line Tracking.

1.1 Introduction

A biometric system is a computer system which is used to identify the person on their behavioral and physiological characteristic. Finger vein recognition is a method of biometric authentication that uses pattern-recognition techniques based on images of human finger vein patterns beneath the skin's surface.

Finger Vein ID is a biometric authentication system that matches the vascular pattern in an individual's finger to previously obtained. Personal identification technology is applied to a wide range of systems including area-access control, PC login, and e-commerce. Biometrics is the statistical measurement of human physiological or behavioral traits. Biometric techniques for personal identification have been attracting attention recently because conventional means such as keys, passwords, and PIN numbers have problems in terms of theft, loss, and reliance on the user's memory.

In the area of biometric identification, security and convenience of the system are important . In particular, the systems require high accuracy and fast response times. Biometric methods include those based on the pattern of fingerprints facial features the iris , the voice the hand geometry or the veins on the back of the hand However, these methods do not necessarily ensure confidentiality because the features used in the methods are exposed outside the human body. These methods can therefore be susceptible to forgery. To solve this problem, we proposed a biometric system using patterns of veins within a finger, that is, patterns inside the human body . In this system, an infrared light is transmitted from the backside of the hand. A finger is place between the infrared light source and camera. As hemoglobin in the blood absorbs the infrared light, the pattern of veins in the palm side of the hand is captured as a pattern of shadows.

1.2 Objective

1. To identify and authenticate humans using finger vein recognition system.
2. Highly accurate system for security purpose.

1.3 Software Requirements:

a) MATLAB 2012

1.4 Block Diagram:

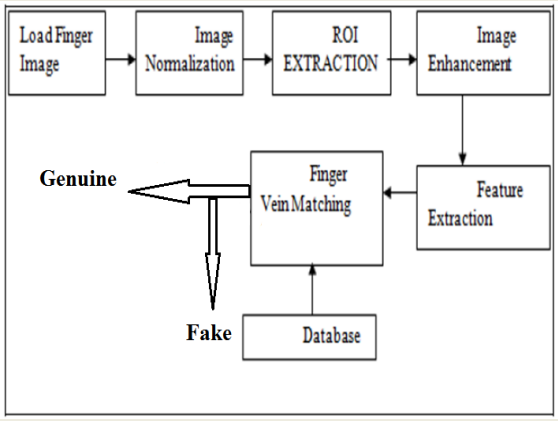

Figure a):- block diagram

1.5 Working:

Image Preprocessing:

Finger images are noisy with rotational and translational variations. To remove these variations, it is subjected to preprocessing steps.

- Image normalization
- ROI extractor
- Image enhancement

Image Normalization: Normalization is a process that changes the range of pixel intensity values. In this, the image is subjected to binarization with threshold value of 230.

Sobel edge detector is applied to the image to remove background portions connected to it. Eliminating the number of connected white pixels being less than a threshold, to obtain the binary mask.

Binarization is a method of transforming grayscale image pixels into either black or white pixels by selecting a threshold. The process can be fulfilled using a multitude of techniques. Binarization is relatively easy to achieve compared with other image processing techniques.

Fingerprint Image Binarization is to transform the 8-bit Gray fingerprint image to a 1-bit image with 0-value for ridges and 1-value for furrows. After the operation, ridges in the fingerprint are highlighted with black color while furrows are white. A locally adaptive binarization method is performed to binarize the fingerprint image.

ROI Extractor:

In the finger images, there are many unwanted regions (that cannot be taken for analysis) has been removed by choosing the interested area in that image. The useful area is said to be "Region of Interest".

The obtained binary mask is used to segment the ROI (Region of Interest) from the original finger-vein image. The orientation of the image is determined to remove the low quality images that present in finger vein image. This orientation is used for the rotational alignment of the ROI in vein image.

Image Segmentation:

In general, only a Region of Interest (ROI) is useful to be recognized for each fingerprint image. The image area without effective ridges and furrows is first discarded since it only holds background information. Then the bound of the remaining effective area is sketched out since the minutia in the bound region is confusing with that spurious minutia that is generated when the ridges are out of the sensor. To extract the ROI, a two-step method is used. The first step is block direction estimation and direction variety check, while the second is intrigued from some Morphological methods.

Image Enhancement:

The acquired image is thin and it is not clear. So the image is enhanced by using bicubic interpolation for better visualization.

Fingerprint Image enhancement is to make the image clearer for easy further operations. Since the fingerprint images acquired from sensors or other Medias are not assured with perfect quality, those enhancement methods, for increasing the contrast between ridges and furrows and for connecting the false broken points of ridges due to insufficient amount of ink, are very useful for keep a higher accuracy to fingerprint recognition. The Method adopted in fingerprint recognition system is Histogram Equalization

Histogram equalization is to expand the pixel value distribution of an image so as to increase the perceptional information. The original histogram of a fingerprint image has the bimodal type. The histogram after the histogram equalization occupies all the range from 0 to 255 and the visualization effect is enhanced.

Finger Vein Feature Extraction:

Gabor filter is used for finger vein and texture image feature extraction. Gabor filters optimally capture both local orientation and frequency information from a fingerprint image. By tuning a Gabor filter to specific frequency and direction, the local frequency and orientation information can be obtained.

We have creating the Gabor with specified orientations and these Gabor filter is convolved with the enhanced image to remove the unwanted regions other than the vein and texture regions.

In vein images, the extracted vein images are further processed into morphological top-hat operation for obtaining the clear vein patterns.

Vein Matching:

For matching, two steps has been done

- Extract features
- Match features

The features extracted from finger vein images are already stored in a database. The features of the input image are matched with all the extracted veins in the database to check whether the input image is matched with any one of the extracted veins.

- If the input image is matched with any one of the extracted veins, the message box will be opened and display "vein matched".

- If the input image is not matched with any one of the extracted veins, the message box will be opened and display "vein not matched".

1.6 System Design:

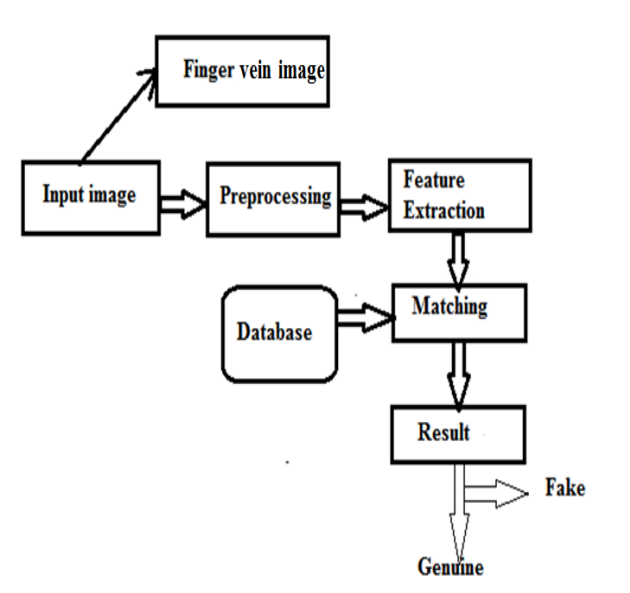

Figure b):-Flow chart

Conclusion:

We described a personal identification method based on patterns of veins in a finger. To extract the patterns from an unclear original image, line-tracking operations with randomly varied start points are repeatedly carried out. Evaluation of its robustness against image darkness showed that it is far superior to the conventional method based on a matched filter. Further experiments showed that the equal error rate was 0.145% and the response time was 460ms, which means the method is very effective as a means for personal identification.

Moreover, our method can be easily combined with other biometric techniques based on parts of the hand (fingerprints, finger/hand geometry, and so on).A multimodal identification system can thus be composed by using various methods while ensuring user convenience.

Future Scope:

This system could be further enhanced with future technologies to provide further more safety and security to the human identification systems.

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