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Biometric Authentication System with Hand Vein Features using Morphological Processing

K. Sujatha[1], S. Bala Krishnan[2], S. Sheeba Rani[3] and M. K. Bhuvana[4]

[1]Department of Computer Science and Engineering, Sri Krishna College of Engineering and Technology, Coimbatore – 641008, Tamil Nadu, India; Sujatha.ssps@gmail.com
[2]Department of Information Technology, Sri Krishna College of Engineering and Technology, Coimbatore – 641008, Tamil Nadu, India; balkiparu@gmail.com
[3]Department of Electrical and Electronics Engineering, Sri Krishna College of Engineering and Technology,Coimbatore – 641008, Tamil Nadu, India; sheebaranis@skcet.ac.in,
[4]Sri Krishna College of Engineering and Technology, Coimbatore – 641008, Tamil Nadu, India; 17EPCS003@skcet.ac.in

Abstract

Objective: In order to prevent the theft of authentication of the keywords and to preserve the biometric authentication a method is derived to secure the pattern. **Methods/Statistical analysis:** An efficient identification and authentication methods are implemented by using the dorsal vein recognition system which is very popular among the researchers of the world. By identifying the unique pattern of the hand vein, the features are extracted from the images and pattern is framed and dimension reduction is based on the system application. **Application:** This simple model can be used in reduction of dimensionality and the noise can be removed from the biometric pattern which helps to have high security. **Findings:** This paper contributes on image acquisition, preprocessing techniques, feature extraction in hand vein authentication system.

Keywords: Authentication System, Monochrome Camera, Morphological Process

1. Introduction

There is lot of advancement in the research of security against breaches and fraudulent activities. This leads to the need of efficient and intelligent method for securing the data. Though there are number of methods and technology available for securing the details of banking sectors, online financial transactions, law enforcement and health and social service, yet there is always a need for the new methods which may have high security. Generally, these methods may have different level of security for the database storage and average and acceptable range is calculated. When there are number of steps in the security measures there is a possibility of slow processing. Hence a new method with speedy technique can give accurate and excellent security. Hence the biometric system like face, fingerprint, iris, retinal scan can be used. Every system has own advantages and disadvantages. But the vein pattern recognition has advantage over the existing methods. As the vein does not change as the time changes the pattern can be very unique for every individual.

In the field of hand vein biometrics, a method with Holomorphic filter for extracting the region of interest was described[1]. The algorithm consists of four modules: image capturing, image pre-processing, and feature Extraction and the authentication module[2,3]. A thermal modified web camera with an array of Light Emitting Diode (LED) was used to capture the vein pattern. The proposed block diagram is given in the Figure 1.

The present work proposes an ease hand vein design acknowledgment framework utilizing a straightforward changed webcam. The framework presents a commotion evacuation calculation for upgrading the consequences of the division and utilizations an adjusted rendition of Hausdorff remove for highlight coordinating for the acknowledgment purposes. Framework can accomplish a zero false acknowledgment proportion while keeping the genuine acknowledgment rate in a worthy level[4] is the detailed study with hand vein pattern recognition, which consist of four stages: 1. “obtaining the image of back of hand vein 2. Image segmentation and extracting

*Author for correspondence

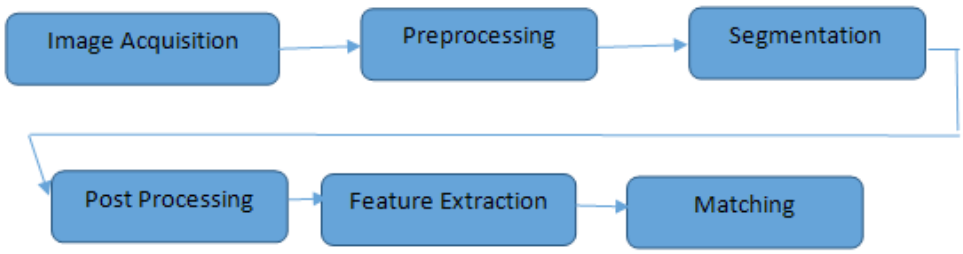

Figure 1. Block diagram Proposed by Pandey and Bisht.

the vein pattern from the vein images of back of hand; 3. Extraction of features for the vein recognition system 4. Pattern matching for authenticationto extracts the co-ordinate of vein pattern and image segmentation". In[5] local thresholding methods used for segmentation of hand vein pattern. In[5] proposed a first method using this biometric system. The recognizable proof will be done in view of the grouping of each piece of NCUT informational index and it comprising of 2040 dorsal hand vein pictures. The block diagram is given derived a method to work with large dataset. The data base includes different images of 100 to 200 persons. Since multiple features were extracted the box and branch point approach can be used for extracting the feature based on the ROI with Gabor filter[6]. Brach point technique is used with multiple feature extraction method with combined decision level feature extraction and or method is used for the fusion rules and the results found are a FAR of 0.1%, GAR was found to be 99.6%[6].

2. Proposed Architecture

In[7] used a data base created by a number of Tenancy University research members (Knoxville) such as which consists of one hundred dorsal hand patterns. These images were taken by a monochrome camera (CCD) that show the image of a fist in which thumb and other fingers are hidden. In order to equally distribute light an IR source applied in the hand area. The prepared images created only for computer processing. Two far infrared (FIR) and near infrared (NIR) methods were used to record dorsal hand veins images. In FIR the thermal radiation of veins in range of infrared waves are useful[8]. In NIR small lamps called Light Emitting Diodes (LED) are utilized which their wave length close to infrared wave. Since existing hemoglobin are sensitive to this wavelength and absorbs it from environment, therefore, it looks much darker than environment around. The Conventional Charged –Couple Device (CCD) camera equipped with LED lamps used to record veins images[9]. The vein pattern is given in the Figure 2.

Every image is taken by video-digital camera with 8-pixel resolution in gray scale[10,11] images are in 320 *240 pixels, width and height respectively. The following image shows one of obtained dorsal hand vein patterns. Figure 3 shows the sample of dorsal Hand vein pattern.

3. Pre-Processing and Features Extraction Stages

3.1 Pre-Processing Stages

Pre-processing stage of images is known to be the most primary and principle stage in identificationmethods. The

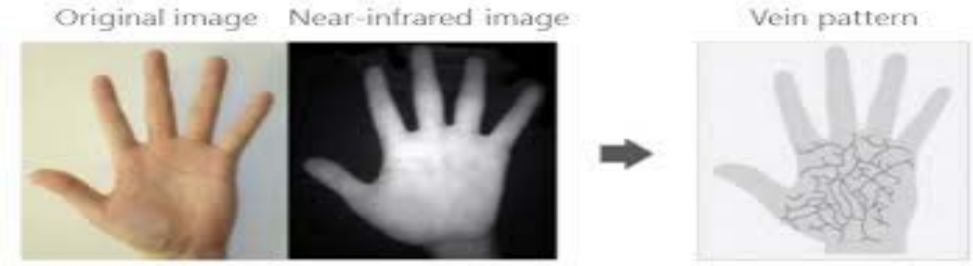

Figure 2. Vein Patterns.

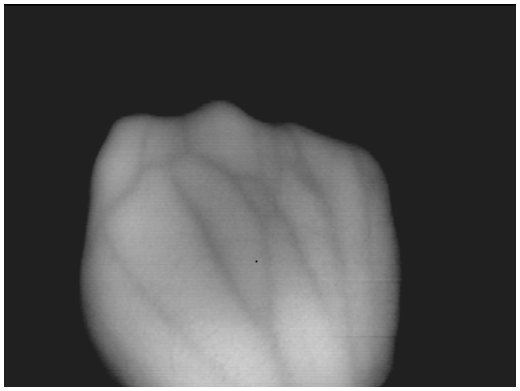

Figure 3. Sample of dorsal Hand vein pattern.

primary images of dorsal hand veins must be prepared for extraction of features during severalpre-processing stages. First and for most the input image is converted to JPEG to BMP.The result image contrast is enhanced by converting the with histogram equalization. With local Thresholding pixel conversion is made to extract the features. Morphological operation is performed to change the geometrical size. All preprocessing stages are given in the Figure 4(a) – (h).

3.1.1 Edge Detection

Edge detection is a principally important instrument in processing of an image which aims toidentify spots on a digital image in a way that light changes may be sharp or discontinuous. Using an edgedetector in an image contributes to establishment of a set of connected curves for specifying the object'sboundaries. In our algorithm, by use if Sobel edge detector and approximate calculation of image gradient theimage edges will be discrete.

3.1.2 Thinning

End–point, intersection point and image length are disadvantages of this method. Determination of intersection point of thin lines with large pixel width counts to

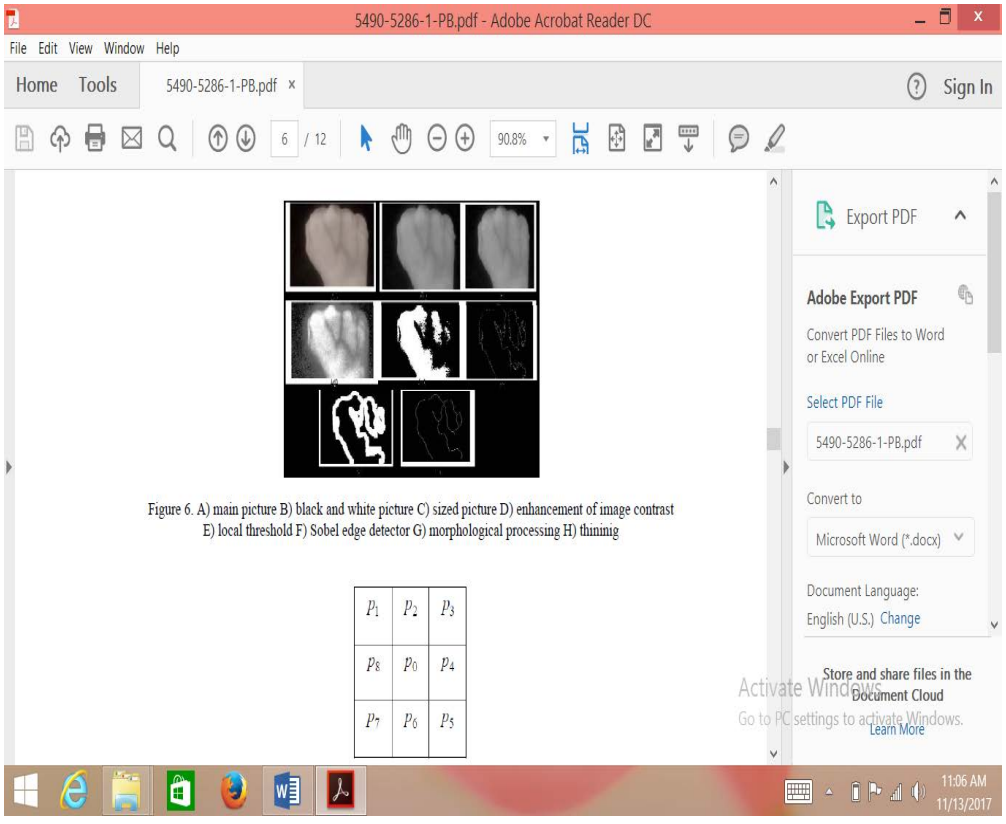

Figure 4. A) ain Picture, B) Black and white picture, C) sized picture, D) Enhancement of image contrast E)local Threshold, F) Sobel edge detector, G) Morphological processing H) thinning.

p_1	p_2	p_3
p_8	p_0	p_4
p_7	p_6	p_5

Figure 5. Procedure of finding veins intersection in images.

be challenging. Figure 5 shows the procedure of finding veins intersection in images.

By following formula the intersection will be found:

$$N_{trans} = \sum_{i=1}^{8} | pi+1 - pi \,|\, where p_9 = p_1$$

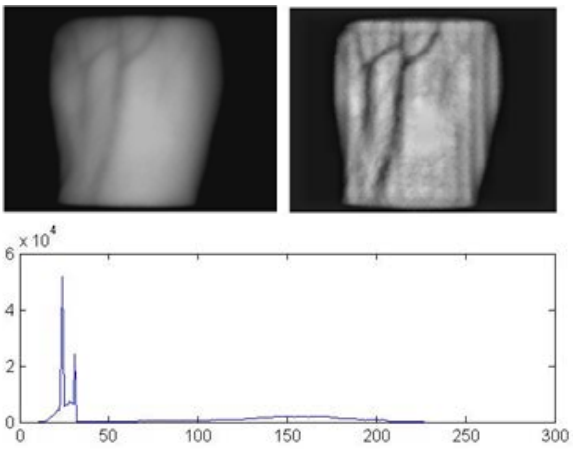

Figure 6. Order of arranging and extraction of images features a. input image, b. enhancement of contrast c. Diagram of contrast enhancement.

Order of arranging and extraction of images features are as Figure 6.

Local threshold and morphological processing is given in the Figure 7.

3.2 Stage of Feature Extraction in Veins Intersection

Features extraction from images of dorsal hand veins takes place after primary pre-processing stage.

So, four images per each person are given to the system as input then pre-processing stages performed on every single image. In next step, a unique and common feature allocated to all four images and a couple of random points will be selected for every individual separately[12,13]. After the primary pre-processing stage, per total number of input images of dorsal hand veins for each individual, value *I* is counted as a random value.

4. Experimental Results

Capturing of dorsal hand image is given in the Figure 8,9 which shows the results of a matched image along with the matching. As there is no reference image for this person, it has not been displayed.

5. Conclusion and Future Scope

This hand vein authentication technology is highly secured. Because of the required information is occupied inside the human body. The main feature is contactless with human body. In future this palm vein or hand vein authentication system will be used for high security purpose globally.

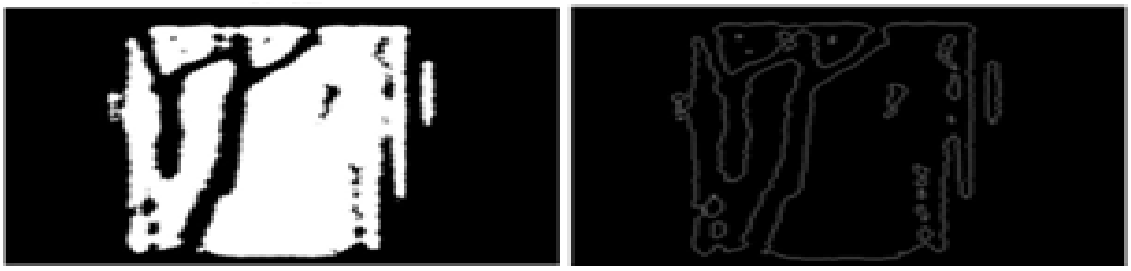

Figure 7. (a) local threshold (b) morphological processing.

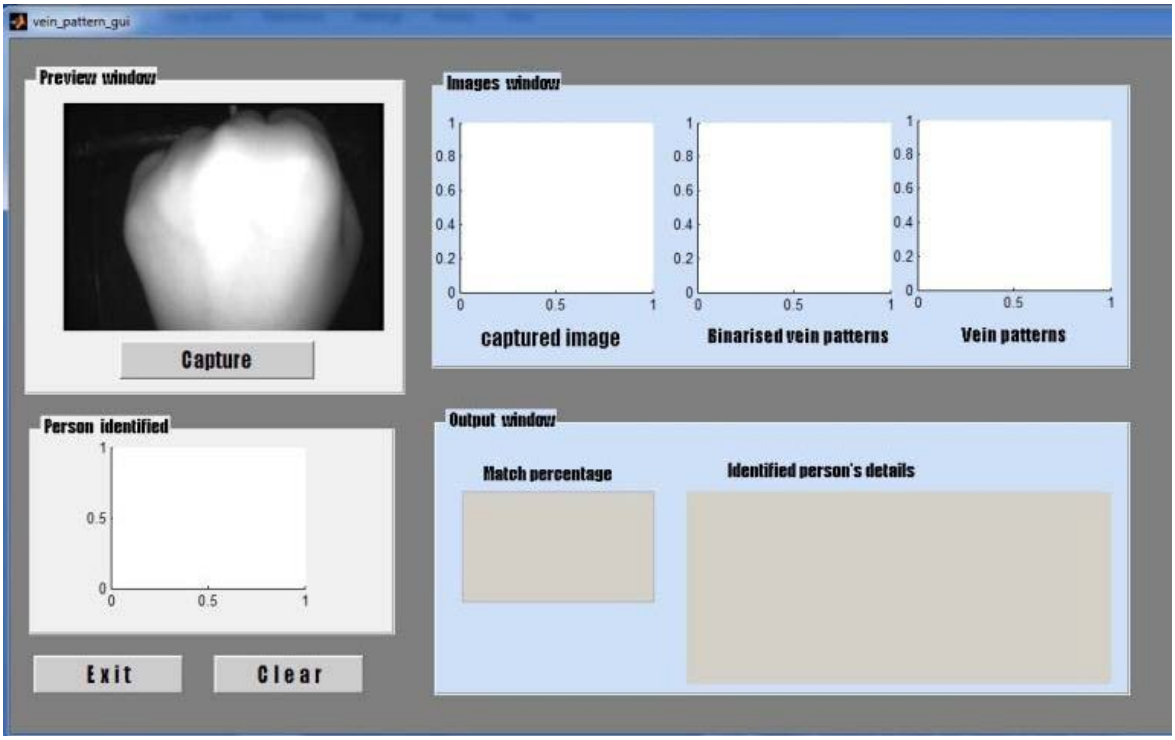

Figure 8. Capturing of dorsal hand image.

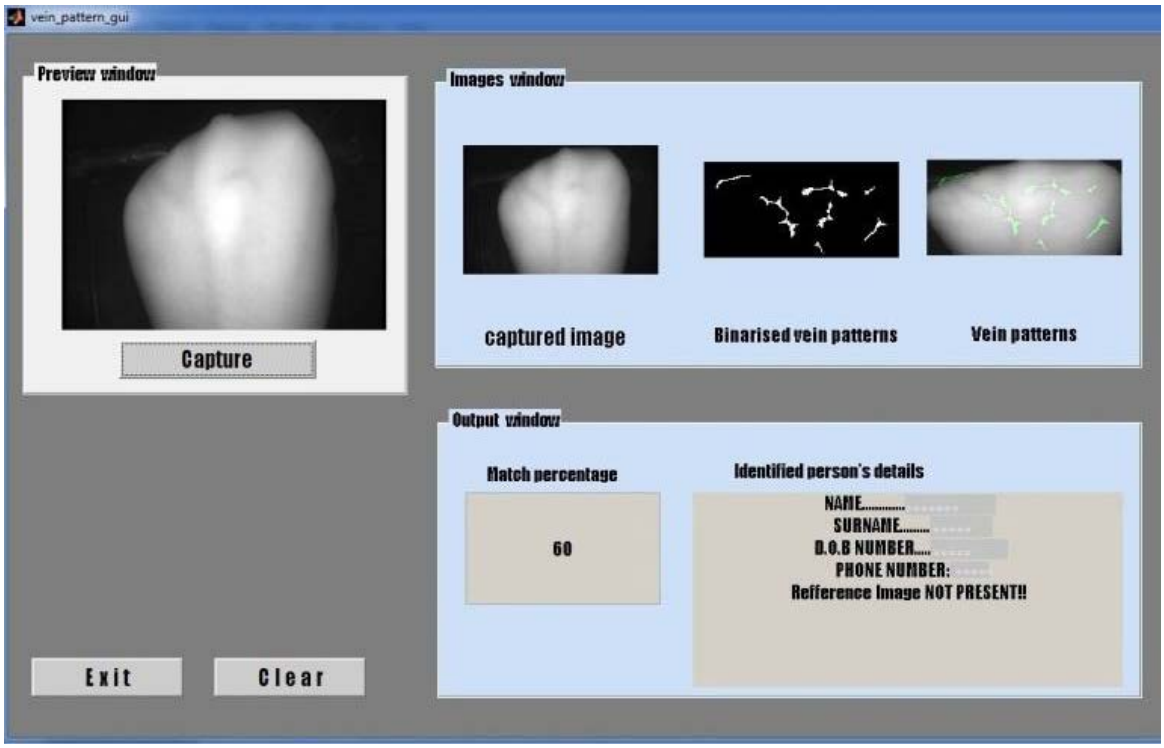

Figure 9. Results of matched image.

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