



Biometric Recognition System Based On Dorsal Hand Veins

K. Sravan Kumar Reddy*, A. Rudra Prasad, P.Sravani, S. Mohammad Shahid,
S. Rohith Venkat, S. Sameeruddin

Department of Electronics and Communication Engineering, Siddharth Institute of Engineering and
Technology, Puttur, Andhra Pradesh, India.

Abstract

The 'Biometric Recognition System Based on Dorsal Hand Veins' is one of the biometric techniques which introduces the design and implementation of a system for identifying which introduces the design palm vein pattern. The main aim has been to build a unique, cheap and reliable system as an alternative to Contact Based systems. Near Infrared camera images have been used since this leads to clear production of veins required for the ideal working of the system. The first step is to process the image and find the knuckle profile using grayscale thresholding and image inversion. Image segmentation is performed on the image to get the significant edges. The image is then processed to remove noise, and using morphological operations the vein pattern is signified. The region of interest is then cropped and a 1-pixel thick skeleton pattern is obtained using image thinning which is used as a feature for matching and recognition. Triangulation method using local thresholding. Finally, triplets are matched and used as a parameter to compare image stored in database and input image.

Keywords: Digital Image Processing, Biometric, Dorsal hand Veins, Vein recognition.

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I. INTRODUCTION

The term biometric is originated from the union of two Greek terms "bio" means "life" and "metrics" means "measure". Biometric systems are of two types, one is behavioural that deals with the behavioural patterns or traits of human body like gait, typing style, handwriting, speaking, and movement of body whereas second one is Physiological that deals with the physical appearance of the human body parts doesn't matter either these part are external or internal. For example, hand veins, retina, iris, palm, finger, foot, face etc. As security has become more valuable in different fields especially in highly protocol cases, that's why these biometrics systems are taken into account because they are unique from human to human and provide far greater security and reliability than other systems. The biometric systems are of two types. They are,

Unimodal: For authentication process, it depends on the proof of a single source of information. But these systems are not having enough performance and reliability.

Multimodal: It integrates, the multiple modalities information which arrives at decision. It overcomes the environmental variations and imposter attacks by elevating the performance and robustness of the system.

There are many methods that are designed in order to fulfill the security, reliability, and high performance criteria by using human biometrics. The oldest technique among these systems is "Facial Recognition System" that was designed to identify a person in a crowd. Other Biometrics systems used for authentication are handwriting, fingerprint, voice and so on. System that uses fingerprint for authentication and identification is used mostly due to low price and ease of use and identification. People brought implementation closer to eye like Iris and Retina scan because they have better results than voice, handwriting, facial and fingerprint. One step forward to this implementation people used human hand veins for identification process and so do we.

Human vein patterns are unique to every individual and provide a good constraint to differentiate a person from others, even in twins. The vein structure's view depends on many factors such as: skin thickness, person's age, surrounding temperature and a physical activity done by the person and other surface conditions like warts, moles, injury scars, hairs, etc. Imaging technologies that are used to acquire images of hand veins are

of two types: first one is Far-Infrared (FIR) technology that has spectrum ranges between 8-14 micrometer and is effective in capturing the large veins on the back side of hand but it is very sensitive to surrounding conditions due to which it cannot result a good and information enriched image. Second technology is Near Infrared (NIR) technology that has a spectrum ranges from 700-1000 nanometer yielding better and information enriched and stable images of veins present in a palm, hands, and wrist. NIR provides good images even in surrounding temperature and body condition changes.

II. RELATED WORKS

Ajay Kumar, K. Venkata Prathyusha (2009) presents a new approach to authenticate individuals using triangulation of hand vein images and simultaneous extraction of knuckle shape information. The proposed method is fully automated and employs palm dorsal hand vein images acquired from the low-cost, near infrared, contactless imaging. The knuckle tips are used as key points for the image normalization and extraction of region of interest. The matching scores are generated in two parallel stages: (i) hierarchical matching score from the four topologies of triangulation in the binarized vein structures and (ii) from the geometrical features consisting of knuckle point perimeter distances in the acquired images. The weighted score level combination from these two matching scores are used to authenticate the individuals.

C. Nandini, Ashwini C, Medha Aparna, Nivedita Ramani, Pragnya Kini, Sheeba k (2012) Vein pattern is the network of blood vessels beneath a person's skin. This vein pattern can be used to authenticate the identity of an individual. In this paper, a new approach is proposed to extract features from the dorsal hand vein pattern. The length of the main vein and the angle at the bifurcation points were used as the key features for this system. We mainly used the concepts of Hough transform and K-nearest neighbor matching algorithm. The proposed methodology has been tested on a self generated dataset of 20 persons dorsal hand vein images and the achieved experimental results are found to be promising, with an accuracy of 90%.

Li Xueyan and Guo Shuxu (2009) A reliable biometric system, which is essentially a pattern-recognition that recognizes a person based on physiological or behavioral characteristic [1], is an indispensable element in several areas, including e-commerce (e.g. online banking), various forms of access control security (e.g. PC login), and so on. Nowadays, security has been important for privacy protection and country in many situations, and the biometric technology is becoming the base approach to solve the increasing crime.

D. Raghavendra, Dr. P. Venkataramana (2018) The desire of economy, reliable and alternate to contact based biometric systems led to invention of many Biometric recognition options. Among the most operated options are fingerprint recognition, iris recognition, face recognition, voice recognition, etc. However, based on convenience and performance of these standard methods have some issues. Every human hand has specific vein patterns. Dorsal hand veins based recognition is more suitable than all other standard methods because the vein patterns are difficult to forge and its acquisition process is easy. The proposed system is one of the biometric technique which introduces the design and implementation of a system using multiple algorithms for selecting ROI and to estimate the image ROI, edge and morphological filtering for feature extraction. These algorithms give good accuracy for the specified region of interest. The proposed results have been improved when compared to the existing results. The entire system will be developed in MATLAB.

Ricardo Janes, Augusto Ferreira Brand (2014)—Biometric identification systems based on the recognition of the hands vein pattern are better than the other systems such as fingerprint identification, face, iris, retina, and hand geometry features for using not visible images to the eye, having high acceptability to users and do not require physical contact. This paper presents an identification system based on the dorsal hand vein pattern recognition, using a low cost camera to capture images with near-infrared (NIR), curvelet transforms for feature detection of images and random forest classification method. The proposed method was tested on a database of 1240 images captured by the authors and the system results presented classification about recognition with low Equal Error Rate (EER).

N. V. Krishnaveni, K. Sivasankari, Veena Vijayan (2014) Biometric identification with the vein patterns is a more recent technique. The vein patterns in the hands are assumed to be unique to each individual and they do not change over time except in size. As veins are under the skin and have a wealth of differentiating features, an attempt to copy an identity is extremely difficult. BOSPHOROUS hand vein database was utilized in this project work. Image was initially normalized, followed by feature extraction. Based on the angles and length between minutiae, the invariant triangles were formed. From this, triplet score were assigned using score assignment process. Finally matching was done between the hand vein database and the extracted hand vein image and the person is identified.

III. MATERIALS AND METHODS

3.1. Requirements

Hardware :

The proposed system requires the following hardware:

Operating Systems : Windows 10

Processors : Any Intel or Amd x86-64

RAM : 4GB

Software :

MATLAB 2013a Version

3.2 Proposed Model

The existing system is on image processing like Acquisition of a database, Storage of database, Live Acquisition of image and comparing these images with database. Initially required users are authorized by training images by knuckle profile extraction, ROI extraction and feature extraction. Then the user is allowed to scan his dorsal hand from which the image is acquired using an NIR camera.

Then the image is changed to grayscale and then binarized using Otsu's Thresholding method. After this, final knuckle profile is extracted by performing the edge detection method on the image and then Region of Interest (ROI) Extraction is done. After necessary cropping is done for ROI, Adaptive Histogram Equalization (AHE) is performed to get a contrast stretched image. The noise reduction techniques used are Median Filtering or LOG Filtering. This image is then morphologically thinned to get the vein patterns, which reveal the necessary bifurcation points and end points. From these minute points, the Delaunay's triangulation is performed. Now after the Delaunay's triangulation, the image is matched with existing database of user's data and the decision of authorized or unauthorized user is taken based on the matching of matrices.

The proposed method is a combination, as well as addition of new and latest available toolboxes and commands as available in the latest versions of softwares. This system, being a new one, has several advantages over the prevailing older systems. As identified generally, this methodology is based on the Triangulation method, and the subsequent block diagram gives an outline of the steps to be followed while implementing the methodology. It can be seen that the two most important and basic steps that govern the working of the methodology used for this system, or any system based on image processing are:

- 1) Acquisition of a database
- 2) Storage of database
- 3) Live Acquisition of image and comparing with Database, or comparing existing image in database with images in database.

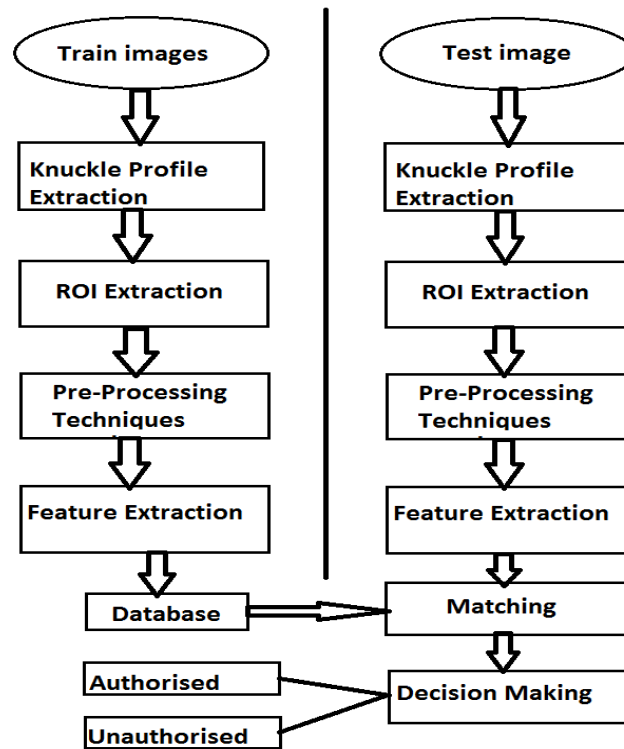


Fig. 1 Block Diagram of the System

IV. EXPERIMENTAL RESULTS

Matching algorithm: As we apply the Delaunay’s Triangulation on every image we get the no. of triplets or triangles in the image. Thus we create a ‘Trained set’ by training every image we have to store the Endpoint triplets and Bifurcation point triplets of each and every image in a matrix. Thus as a new image or Test image is taken as input from the NIR camera or the database. This test image goes through the same process till the Delaunay’s Triangulation. Once we get the no. of Endpoint and Bifurcation point triplets of the test image, they are compared with the matrix in which we have stored the BPs and EPs of the trained images.

The least Difference or Threshold is decided (Ideally should be ‘0’), and if an image within that threshold is found in comparison to the test image, then the test image is said to be an Authorized User , else if no image is found within the threshold , then the comparison fails and the test image is said to be an Un-Authorized user. A specific GUI is built in MATLAB for the convenience of the user the specific program components are linked to the repective buttons.

This GUI thus contains simple buttons mainly useful for the system. The pushbuttons are Train System- which is used to train the system of the database, i.e to feature out the triplets and count them.

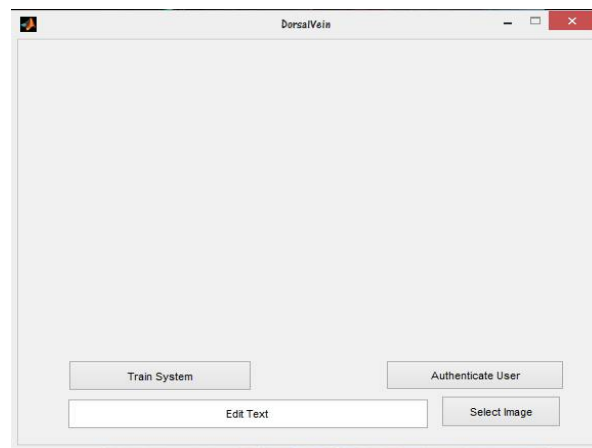


Fig 2. GUI (Graphical User Interface)

Then there is a Select Image pushbutton which is used to select the image from the memory or from the live scan. An then there is Pushbutton to Authenticate the user.

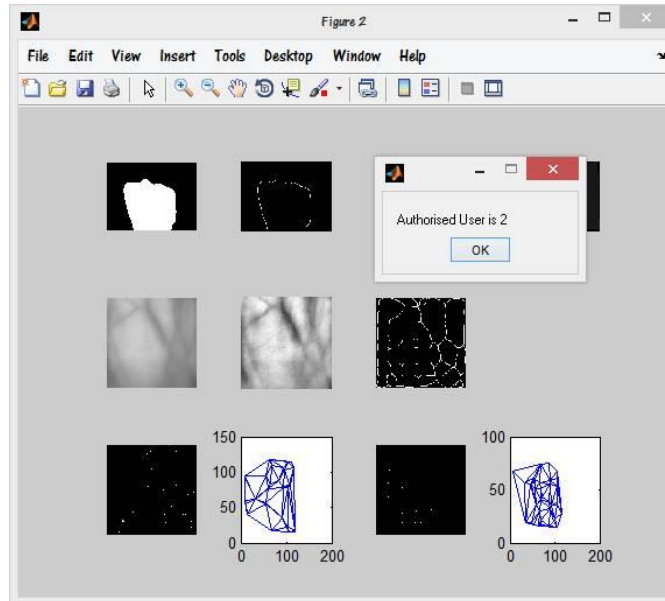


Fig.3. Authorized User

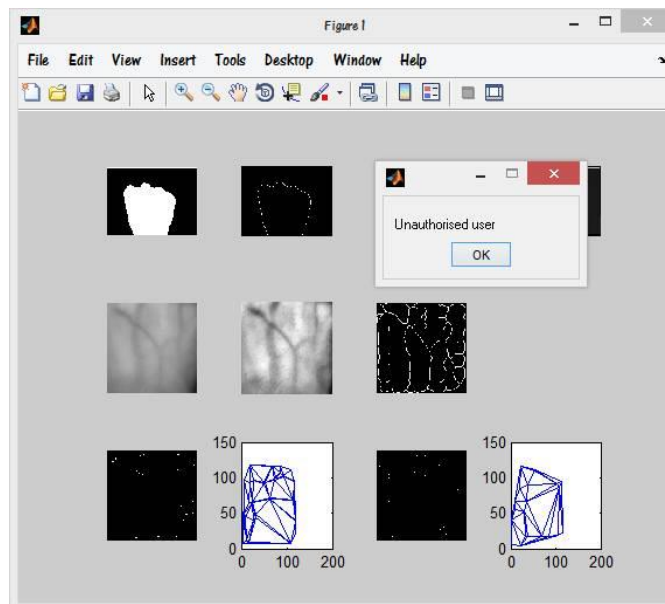


Fig. 4 Unauthorized User

Thus we have two possible results as shown above, the first one is where the user is authorized, i.e. an image pattern or a template similar to his is found in the database, and the other result is the one that is unauthorized which means that his template is not found in the database.

V. CONCLUSION & FUTURE SCOPE

After studying many research articles, we came to know about the overall description of dorsal hand Vein Authentication and its corresponding method. Further in literature, each technique is summarized with the advantages and shortcomings. Besides a number of Dorsal hand vein recognition techniques are already been developed, there is still a scope of further improvements. Many authors obtained Global and Local feature by using different methods like PCA, LBP and many more, In future we are try to use Global feature for research. Dorsal hand vein pattern offers high security and is reliable for identification, hence advantageous over other biometric systems. Accuracy, Non-contact as well as low maintenance system is achieved. Permanent Database as well as a system suitable for use in day to day applications is achieved.

Dorsal hand vein pattern offers more security, Accuracy, and Non-contact as well as low maintenance system is achieved, so it is more advantageous over other biometric systems. By applying Hybrid processing algorithms, we are getting better result & accuracy than existed method. So, the better performance and more security can be achieved by multimodal biometric system than unimodal system. The biometrics future can perhaps be a Multimodal biometric system than unimodal systems because as they overcome few of the problems observed in unimodal biometric systems.

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