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A Review On : PALM VEIN TECHNOLOGY

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ABSTACT- Biometric Authentication is a system which deals with the physiological as well as behavioral traits of a person. Palm vein structure is unique for every human being even for the twins also. Palm vein authentication has a high level of authentication accuracy due to the uniqueness and complexity of vein patterns of the palm. Because the vein patterns of palm are internal to the body, they are a impossible to forge. Also, the system is non-intrusive and hygienic for use in public areas. It is more accurate than other biometric authentication such as face, iris, and retinal authentication system. In this paper we study the palm vein technology, various approaches for different kinds of palm vein features extraction ,various palm vein segmentation schemes, accuracy and processing speed of various approaches

Keywords:- Palm vein, CASIA, Biometric , Authentication, Wavelength, Obstacles, Ridges

INTRODUCTION

According to Fujitsu in the ubiquitous network society, any person can easily access their information anytime and anywhere, people are also facing the problem that others can easily access their information like password anytime and anywhere. Because of this problem, personal authentication technology, which can distinguish between registered legitimate users and forged user, is now generating interest. Now a days, passwords, Personal Identification Numbers (4-digit PIN numbers) or identification cards are used for personal authentication. However, identification cards can be lost somewhere, and passwords and numbers can be forged or forgot. To solve these problems, biometric identification technology, which identifies people by their unique biological characteristics, is attracting people attention. According to Fujitsu in biometric authentication, legitimate user body characteristics, behavior or body part image are registered in a database and then compared with the person traits who may try to access that account. characteristics are compared to check that if the access is by the same or legitimate person or not.

In biometric authentication system Characteristics or traits of a person that must be checked in order to have access to the system purposes are

• Uniqueness - The same trait does not appear in two different people.

• Measurability - The trait can be measured with some technical or physical instruments.

• User friendliness - The trait can be easily Captured and compared with minimal discomfort.

Vein Authentication

In this field, "vein authentication" which uses image recognition and optical technology to scan the normally invisible palm vein pattern, hand from back, fingers, etc. has the properties of being highly accurate and highly efficient to recognize, impersonation and other forged actions.

Palm vein authentication uses an infrared beam to penetrate in the users hand and scan veins as it is held over the sensor; the veins within the palm of the user hand are viewed as black lines. Palm vein authentication system has a high level of efficiency due to the uniqueness and complexity of vein patterns of the palm. Because the palm vein patterns are internal to the body, this is impossible to forge. Also, the system is non-intrusive and hygienic for use in public areas[1]. The palm vein pattern is an ideal part of the body for

this technology; as their does not have hair which can be an obstacle for scanning the blood vessel pattern, and its susceptibility is less to a skin color, opposition to finger or the back of a hand [2].

Vascular pattern authentication principle

Infrared rays (IR) are electromagnetic radiation whose wavelength is longer than that of the visible light, and Infrared light has a range of wavelength that lies between 750nm and 1mm, similar to visible light having wavelengths ranging from red light to violet. Infrared light is commonly divided into 3 spectral regions: near infrared, mid infrared and far infrared light, but the boundaries ranges are very closer to separate. [3].

Vein patterns of palm cannot be seen using normal, visible rays of light since they are under the skin's surface. There are two choices that focuses on imaging or scanning of vein patterns in the palm by the infrared light

1. The far-infrared (FIR) imaging
2. The near-infrared (NIR) imaging

They are suitable to capture images of human parts in a non-hygienic way [4].

Acc to fujitsu hemoglobin contain in the blood is oxygenated in the lungs and carries oxygen to the tissues of the body through arteries. After it releases the carried oxygen to the tissues, the deoxidized hemoglobin go back to the heart through the veins. The hemoglobin have two types that have different rates of absorbency1. Deoxidized hemoglobin absorbs light at a wavelength of about 760 nm in the near-infrared region. When the hand is illuminated with near infrared light, unlike the pattern seen by the human eye [Figure 1(a)], the deoxidized hemoglobin in the palm veins absorbs this light, thereby minimizing the reflecting rate and causing the veins to appear as a black pattern [Figure 1(b)]. In vein authentication system based on this principle, the region used for authentication is scanned and photographed with near-infrared light rays, and the vein pattern is extracted by image processing [Figure 1(c)] and gets registered in the system. The vein pattern of the person being want to access system is then verified against the preregistered legitimate user pattern.

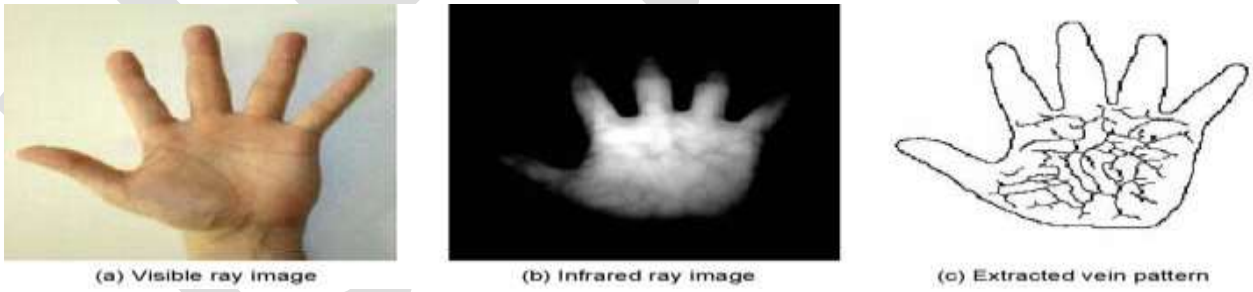

Figure1: Extracting palm vein pattern

The still image captured by the camera, which photographs in the near-infrared range, appears as a black network, reflecting the palm's vein pattern against the lighter background of the palm.

An individual's palm vein image is converted by algorithms into data points, and then compressed, encrypted, and stored in the software and get registered along with other details in his profile as a reference for future. Then, each time a person want access his account by a palm in a securely manner, the person palm newly captured image is again processed and compared with the registered

one for verification, all in a micro seconds. Numbers, orientation and positions of veins and their crossing points are all compared with the registered image and, depending on verification; the person is either granted or denied access to the system.

Reason for considering palm vein for authentication:

1. Vein patterns are unique to each individual; even identical twins have different vein patterns.
2. The palm has no hair; it is easier to photograph its vascular pattern.
3. **Secure:-** It is difficult to forge for intruders because blood vessels are hidden within the body.
4. **Non-Intrusive:-** It does not involve any physical contact between the user and the system.
5. Palms have a broad and complicated vascular pattern and thus contain a significant amount of differentiating features for personal biometric identification.

Related Work:

A number of studies showing the advantages of palm vein authentication system have appeared in the literature.

Palm vein model

Palm vein technology works by identifying the unique vein patterns in an individual's hand. When a user's palm is held over a scanner, a near-infrared light finds the location of the veins. The red blood cells or deoxidized blood present in the veins absorb the light and reflect on the map as black lines, whereas the remaining hand structure visible as white. This vein pattern is then verified against a preregistered legitimate pattern to authenticate the person. As veins are internal in the body and have a millions of differentiating traits, attempts to forge an identity are impossible, thereby enabling a high level of security [5].

Steps involved in processing a palm vein images are:

1. Image Acquisition

The CASIA database that contains 7200 multi spectral palm vein images is considered as base of palm vein images. The image is verified using a palm vein image in the CASIA database as reference.

2. ROI Selection

ROI segmentation of palm vein is to automatically and reliably segment a small region from the captured palm vein image and palm vein extraction is to extract the palm vein from a ROI. This is considered one of important stages in these four stages because it greatly influences the overall identification accuracy and processing speed of the whole system [9].

Kai-Wen Chuang et.al In this paper, presented a palm vein ROI extraction algorithm which combines

1. Otsu thresholding scheme,
2. Morphological opening operation
3. Sobel edge detector
4. Reference points
5. Line construction
6. Palm vein image alignment.

The performance of the proposed palm vein ROI segmentation scheme is verified using a palm vein image database, Poly U database (version 2). The experimental results show that the proposed algorithm is effective and efficient in palm vein ROI segmentation and is robust for noises surrounding palm vein images [9].

Yingbo Zhou et. al in this paper presented a palm vein ROI extraction technique:

The acquired palm vein images are firstly normalized to minimize the rotational changes, translational changes and scale changes.

1.The co-ordinate system is constructed through those variations.

2. The web between index finger and middle finger together with the web between ring finger and little finger were utilized as the reference points line to build up the coordinate system (figure 2).

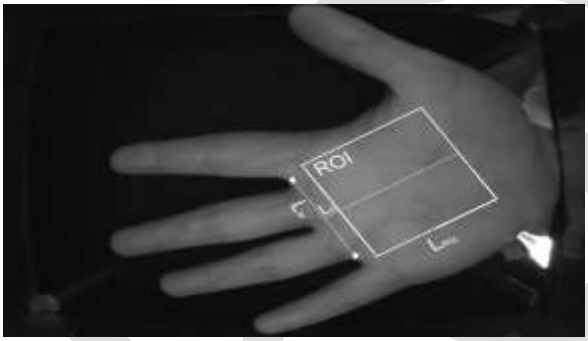

Figure 2: Palm vein ROI from contactless images

3. The location as well as the size of region of interest (ROI) is selected based on the distance between the two webs (*LW*) [10].

3 .Vein Pattern Extraction

Yingbo Zhou et.al in this paper investigates new approaches, which extract different kinds of palm vein features and illustrate good performance. **The localized Radon transform** based approach achieves best performance and also offers computationally simpler alternative to existing palm vein identification approaches. The idea of this approach is that curved/straight lines can be estimated by small piecewise joint integrated segments and it integrates the intensity value in the local region in all defined orientations, but instead of integrating all the pixel values inside the local region, only the pixel that fall in the confined line width area is integrated, and the orientation gives the minimum or maximum integration value [10].

Mohit Soni et. al presents a technique which extracts the forking from the skeleton image by examining the local neighborhood of each ridge pixel using a 3X3 window. It can be seen from the preprocessing image that an ROI contains some thinned lines/ridges. These ridges representing vein patterns can be used to extract features. Features like ridge forking are determined by computing the number of arms originating from a pixel. This can be represented as *A*. A given pixel P is termed as a ridge forking for a vein pattern if the value of A for the pixel is 3 or more. This ridge forking pixel is considered as a feature point which can be defined by (x, y, θ) where x and y are coordinates and θ is the orientation with respect to a reference point [11].

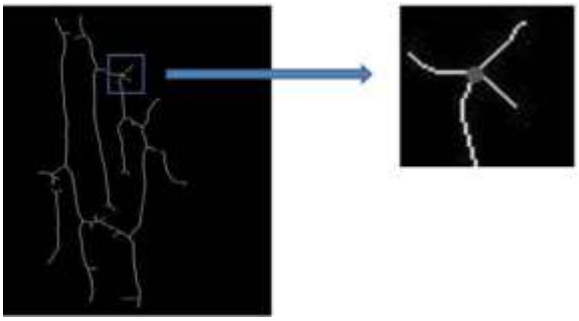

Figure 3: Four Arms emitting from a forking point

4. Skeletonization

As human beings grow the size of veins in palm also grow, only the shape of the vein pattern is used as the sole feature to recognize each person. A good representation of the vein pattern's shape is via extracting its skeleton. Figure 4 shows the skeleton of the vein pattern after applying the thinning algorithm proposed by Zhang and Suen [12] . It can be seen that after the pruning process, the skeletons of the vein pattern are successfully extracted and the shape of the vein pattern is well preserved [6].

Figure 4: After Skeletonization

5. Vein Pattern Matching

Sunita Aeri et.al proposed a new approach for biometric authentication system using infrared thermal hand vein patterns. The proposed work presents a Euclidean distance based vein's pattern based biometric authentication that can be used for matching the biometric identity of person under scanner. The vein patterns are grabbed using the infra red (IR) thermal cameras and after applying some image pre-processing operations, a binary image is obtained consisting of veins crossings and intersections. The binary image is thinned using the morphological operations and a single line thinned image pattern is obtained. The thinned image pattern is now examined for intersections extractions and inter-distance between intersections. The inter-distance among intersections of vein patterns are stored in a data base. Further, when a test vein pattern is brought under test, the data base information is compared to that of the test pattern using Euclidean distances. Minimum the Euclidean distance, more is the equivalency of the test pattern to data base pattern [13].

Lingyu Wang et.al Vein pattern matching is done by measuring the line segment Hausdorff distance between a pair of vein patterns. Hausdorff distance is a natural measure for comparing similarity of shapes. It is a distance measure between two point sets.

Hausdorff distance uses the spatial information of an image, but lacks local structure representation such as orientation when it comes to comparing the shapes of curves. To overcome this weakness, in this paper, the line segment Hausdorff distance (LHD) is calculated to match the shapes of vein patterns. It incorporates the structural information of line segment orientation and line-point association, and hence is effective to compare two shapes made up of a number of curve segments [6].

Conclusion

Biometric refers to automatic recognition of an individual based on her behavior or traits. However the palm vein authentication system uses the vein's patterns of one's palm for making access to the system. This technology is highly secure because it uses information contained within the body and is also highly accurate because the pattern of veins in the palm is complex and unique to each individual. Moreover, its non-intrusive feature gives it a hygienic advantage over other biometric authentication technologies.

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