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Fingerprint and finger vein technique to overcome the challenges in person identification: A review

[1] Er. Ritika Chopra, [2] Er. Sukhpreet Kaur

[1] Lecturar, CSE Department, Gian Jyoti Group of Institutions, Mohali, Punjab, India
[2] HOD, CSE Department, SUSCET, Tangori, Punjab, India

Abstract
Finger vein system improves the performance of identification of system. Finger print sensor is used in biometric systems to make the system highly secure. In this paper a review of Fingerprint and Finger vein image processing is done. The purpose of finger vein system is to recognize the person's identity by mathematical analysis of the patterns of finger prints which are visible from some distance. The block diagram describes the working of finger vein system. The Finger vein image processing makes our system more secure and overcome the threatens.

Keywords: fingerprint, finger vein image processing

1. Introduction
With the progress toward a globalize information society, the average person's life at the same time become vulnerable by crime occurrences. To overcome such threatened biometrics systems, which are highly accurate and use a part of one's body is good to overcome these threatened [1]. Vein recognition refers to the biometric technology which exploits the vein patterns in the person finger to recognize individuals. Over the several years, there have been some efforts devoted to segmentation of FV imagery [2]. Due to the veins inside of the finger, the visible lights are often incapable of imaging them. So, the near infrared (NIR) lights are usually used in imaging the finger-veins since the NIR lights are able to penetrate through a finger and be absorbed greatly by the deoxyhemoglobin [3].
Several biometrics technologies are susceptible to spoof attacks in which fake fingerprints, static palmprints, and static face images can be effectively engaged as biometric samples to impersonate the identification. So, several liveness countermeasures to detect such sensor-level spoof attacks have been proposed e.g., finger reaction to electrical impulse, finger temperature and electrocardiographic signals, time-varying perspiration patterns from fingertips, and a percentage of oxygen-saturated hemoglobin in the blood [4].

2. Fingerprint
A fingerprint is an impression left by the friction ridges of a human finger. These are the traces of an impression from the friction ridges of any part of a human or other primate hand. The combination of numerous ridges forms a fingerprint pattern. Minutiae are major features of a fingerprint, using which comparisons of one print with another can be made. Minutiae include Ridge ending – the abrupt end of a ridge and Ridge bifurcation – a single ridge that divides into two ridges. In this method the location & angle of the feature are taken to represent the fingerprint & used in the matching process [5].

3. Uniqueness of the fingerprint
The "fingerprint" which is produced on the tip of the finger by the visible pattern, the skin takes it absolutely distinctive to its owner. Every individual living on the earth has a diverse set of fingerprints. All people who have lived throughout history also had different fingerprints. These prints remain unaffected throughout one's lifetime unless a great injury occurs. That is why the fingerprint is accepted as a very important identity card and used for this purpose around the world [5].

4. Finger Vein
Finger vein is a powerful biometric pattern for personalized identification in terms of their advantages over existing biometrics. Based on the spatial pyramid representation and the combination of more effective information such as gray, texture and shape, this paper proposes a simple but powerful feature, called Pyramid Histograms of Gray, Texture and Orientation Gradients (PHGTOG) [7]. To obtain finger-vein images, we have designed a homemade finger-vein imaging system, which can automatically capture a finger-vein imagery when a finger is available. According to diaphanography in modern medicine, finger vein imaging is a kind of optical trans-illumination modality. In this manner, the NIR light penetrating a human finger can be refracted, absorbed and scattered by the biological tissue. Since the biological tissue can be viewed as a complex heterogeneous optical medium, the NIR light suffer from significant scattering in addition to absorption when they propagate into this medium [7].

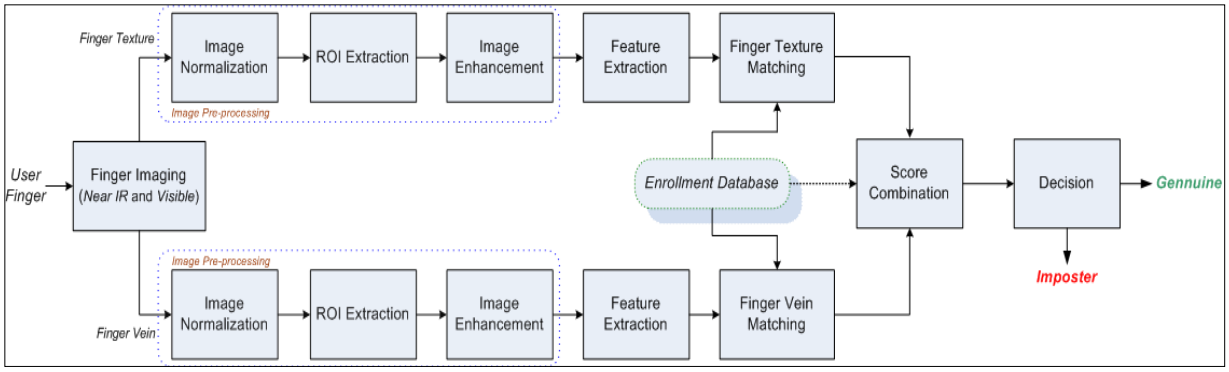

Fig 1: Block diagram for personal identification using simultaneous finger vein and finger texture imaging.

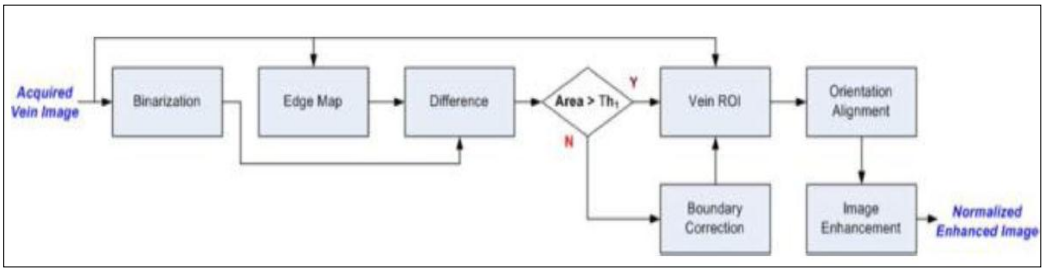

Fig 2: Block diagram illustrating key steps employed for the preprocessing of acquired finger-vein images.

5. Review of literature

1. Shi-Jinn Horng [2008], In this paper. A preliminary process was initiated to intensify the quality of an image which was degraded by light and noise being produced by the web camera. Adaptive threshold method was used to segment the vein pattern and then by using improved template matching, patterns were matched. The experimental result showed that veins should be clear for better quality of an image. As a result, still 100% identification accuracy could be achieved.
2. Jinfeng Yang and Xu Li [2010], In this paper, finger vein localization and vein feature extraction related problems were addressed. An intrinsic physical property of human finger was used to focus the region of interest (ROI) of vein images by eliminating uninformative vein imagery based on the inter-phalangeal joint prior. Also steerable filters were used to characterize the vein images as a chain of energy. Experimental results depict that the proposed algorithm for human vein identification showed the appropriate performance.
3. Jinfeng Yang and Junjie Wang [2011], In this paper, finger –vein images were restored which were deteriorated by lens of camera using Gaussian-PSF model and then to further restore the images, two depth- PSF models was designed by taking into the consideration, the optical properties of skin layers. After that, depth-depended restored images were combined to generate the fused finger vein image. Lastly, experimental results depicted that the proposed method exhibits a thrilling performance in finger-vein image quality enhancement.
4. Naoto Miura, Akio Nagasaka and Takafumi Miyatake [2004], In this paper, finger vein pattern was extracted from the image which was not clear by using line tracking which would start from different positions. Results showed that robust pattern were extracted and 0.0145% was the equal error rate found in personal identification.
5. G. Ramaswamy, Vuda Sreenivasarao, P. Ramesh and D. Ravi Kiran [2010], In this paper, fingerprints or inked impression of fingerprints were the metric used for identification techniques. In order to have a better accuracy, matching of different decomposed images were performed. Resultant fingerprints were compared based on these parameters. This system exhibit faster and more correct to examine the fingerprints matching process when tested on database images.
6. Hui Ma, Oluwatoyin P. Popoola and Shuli Sun [2015], This paper proposed a system based on multi-route detection by combining the fingerprint and finger vein techniques. First of all, two classifiers were constructed for fingerprint image and finger vein image respectively. Then the third classifier was made by concatenating the feature vectors extracted from the first stage. Finally the three classifiers recognition results were fused to get the throughput at decision level. Experiment results depicted that this algorithm not only enhances the performance of the recognition system but also overcomes the imperfections of single-modal biometrics.
7. Jinfeng Yang and Yihua Shi [2012], In this paper, a novel method was introduced to enhance the finger vein images by the removal of scattering, directional filtering and suppression of false vein information. Then the matting based segmentation approach was given in order to get the high-fidelity extraction of finger-vein networks in an automated manner. Proposed method was validated by performing the extensive experiments.
8. Diptanu Bhowmik [2013], In this paper, the proposed system would simultaneously obtained the finger-vein and low-resolution fingerprint images and then using a novel score-level combination strategy, two evidences were combined. Earlier proposed finger-vein identification approaches were examined and a new approached was introduced ensuring the superiority over previous published efforts. Holistic and nonlinear fusion which was called two new score-level combinations, were developed

to improve the performance of finger-vein identification systems.

6. Finger-Vein image preprocessing

The acquired finger images are noisy with rotational and translational variations resulting from unconstrained (peg-free) imaging. Therefore, the acquired images are first subjected to preprocessing steps (see Fig. 2) that include: 1) segmentation of ROI, 2) translation and orientation alignment, and 3) image enhancement to extract stable/reliable vascular patterns [8].

The finger vein authentication technique contact between the finger and sensor is not necessary. In finger vein identification technique the main idea is infrared rays of light passes through most of the human body parts. Since the main and central part of image is captured. The previous and available techniques for finger vein authentication have same feature obtaining steps. Due to blur and image scatter problem, the acquired finger vein or raw image contain irregular shadow of shadings.

When image is divided into parts or segments errors can occur at feature extraction process because the quality of finger vein image is low. When the networks are not segmented, the recognition process degraded recognition technology. Then it shows solution of previous challenges due the features. According to the user point of view, the low quality finger-vein images are mainly created due to inappropriate behaviors during the image acquisition process. The vein authentication technique is innovative and sophisticated identification technology of biometrics but at acquisition phase some factors affect its performance.

When blur and skin scattering occurs, then obtained finger vein image is not clear and shadings occurs due to blurring. Based on above observations, low quality finger-vein images created due to inappropriate user behaviors. The inappropriate user behaviors generate problems for authentication process [9].

The three main factors create chances which make an image distortion or blurred. These are as followings:

- Incorrect placement of the finger.
- High pressure or forcefully stretch of the finger.
- Movement of the finger.

7. Automatic Finger image Authentication System (AFAS)

AFAS identity is provided inform of input and a finger image, the result of this identity is true for matched and false for not matched. This process shows that whether the input image is matched with the particular person whose finger image is given in form of identity. As figure 1.7 shows, after acquiring image feature extractor extract features, compare with database and matcher matches features with database's stored image [11].

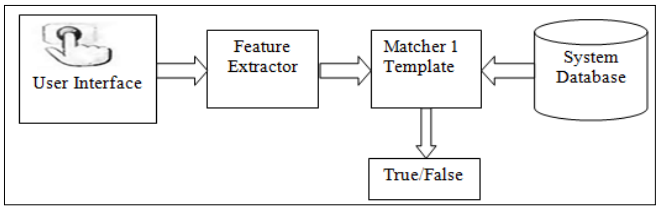

Fig 3: Verification of identity in AFAS

8. Automatic Finger image Identification System (AFIS)

In AFIS fingerprint is given as input and then result shows list of identities of persons that can have the given finger image and a score for each identity indicating the similarity between the two finger image. Matcher matches multiple templates with database stored images [11]. By using N template matching technique, it saves time. This technique makes identification easy and gives partial identity detail to low the search space. The above figure 1.8 shows that this technique compares the acquired image with those images which are stored in the database in both verification and identification for recognition purpose.

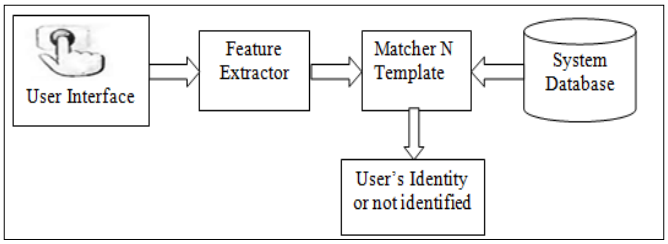

Fig 4: Identification in AFIS matches multiple templates

Recognition technique is a process which contains perception and associating the obtained detail information with combination some internal memory or database contents. For example, an attacker can manufacture a fake finger according to a stolen finger vein template. When system scans the fake finger, the fake user may be capable to split into some finger vein recognition systems which store the original finger vein.

9. Finger Vein Classification

Finger vein technique which is further in AFIS. The main reason of this finger vein technique is clustering a database of finger vein into some dusters. The previous identification or classification technique that is further used in manual finger vein identification is comes under Henry classification technique. A novel method is applied for authentication and classification. In finger vein image, the image contains various features in form of veins of finger. According to classification every finger vein image is used for authentication by its distinction and uniqueness [12]. Finger vein identification technique comes under hand biometric authentication technique that identifies a person from veins of fingers. The finger vein is a network of veins under finger skin or texture. This veins network has distinct pattern of every person and not effected by age.

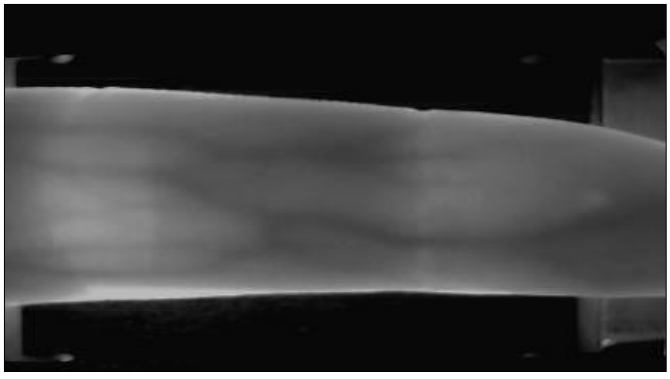

Fig 5: Finger vein image [11]

In figure 5, it is clearly seen that after acquiring finger image then image shows the internal veins which are used for further authentication and to make it more clearly visible many type of operations are performed. Finger vein image is thin one. For further authentication preprocessing operations are performed on acquired vein image [9, 10, 11].

10. Conclusion

From this paper it is concluded that finger vein recognition technique if high level correctness and privacy for the identification of person. The proper working of finer vein system is described in paper which helps us to assure the system is fully protected with this technique. This finger vein recognition technique is widely accepted biometric in most applications. Fingerprint is recognized by using convenient methods which are less complex and has faster algorithms than previous algorithms and it eliminates image noises and reflections. In future we will propose a method which will overcome the limitations of Finger vein recognition and make the system more secure.

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