Biometric Approach For Personal Recognition of Finger Vein Images Using Charged Coupled Device

Shaik Aman[1], Dr. Devraj Varma[2], Aditya CA[4], Dr. Rajapraveen[3]
[1, 2, 3, 4]Dept of Computer Science Engineering (Specialisation)
[1, 2, 3, 4] Jain University

Abstract- *We propose a system in which the human recognition and identification can be done based on the features extracted from the finger vein images. We examine the previously proposed fingerprint identification approaches and develop a new approach that illustrates it superiority over prior published efforts. The utility of low-resolution finger vein images acquired from CCD camera is examined to ascertain the matching performance from such images. We enhance the low resolution images by combining the enhancement technique such as Contrast Limited Adaptive Histogram Equalization (CLAHE) and median filter. The segmentation of Region of Interest (ROI) using the combination of Thresholding and Sobel Edge Detector and the orientation and rotation translations (invariant to rotations) make the system highly efficient. We propose Gabor filter for feature extraction process. The Speeded up Robust Features (SURF) Algorithm is used to detect and extract the key-points in the Vein pattern image which is previously extracted using Gabor Filter. The minute internal features of the finger vein images are extracted for all the images present in the database and finally the matching was done based on the comparison of extracted vein pattern image of testing with trained vein pattern image. The experimental results indicate that the system is highly accurate.*

Keywords- Finger vein, Gabor filter, identification, recognition.

I. INTRODUCTION

Finger vein recognition is a method of biometric authentication. It uses pattern matching 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 data.

The objective of the paper is to propose a finger vein recognition system which can be used for human identification and it is also on the development of new approaches for the finger-vein identification, which achieves significantly improved performance over previously proposed approaches.

This method of biometrics has more advantage than the existing system in term of security purpose because since the vein pattern is not visible to human vision without any special device and it will not produce any trace in any object. Hence it has taken more advantage than the normal fingerprint pattern system.

i) Advantages of finger vein are:

1) Finger vein biometrics is much more reliable and secure with the advantage of robustness against malicious attacks.
2) It is more convenient to operate this biometric than the face and iris recognition system.
3) The finger veins are hidden structures. It is extremely difficult to steal the finger vein patterns. It is a high degree of privacy.
4) It is much secure as vein pattern is not visible to human vision without any special device and it will not produce any trace in any object. Hence it has taken more advantage than the normal fingerprint pattern system.

ii) Techniques used in the proposed paper are:

1) Thresholding
2) Sobel Edge Detector
3) 3) Contrast Limited Adaptive Histogram Equalization (CLAHE)
4) Orientation and Direction estimation
5) Gabor Filter
6) Morphological Operations
7) Speeded up Robust Features (SURF)

The contribution of this paper will highlight the necessity of finger vein in evolving to a more secured technology which will help in detecting many malicious activities.

II. REVIEW OF LITERATURE

Finger vein technology is implemented by many users. Biometrics like fingerprint recognition, finger-texture

recognition, and palm print recognition, face recognition are found less accurate when compared to finger vein recognition. The drawbacks are of these biometrics are that the key details of the existing implementation are missing , not robust and not secure, image quality is low. Hitachi developed and patented a finger vein ID system in 2005. The technology is currently in use or development for a wide variety of applications, including credit card authentication, automobile security, employee time and attendance tracking, computer and network authentication, end point security and automated teller machines. The acquired finger vein images are noisy with rotational and translational variations resulting from unconstrained imaging. Therefore, the acquired images are first subjected to pre-processing steps that include: 1) segmentation of ROI, 2) translation and orientation alignment, and 3) image enhancement to extract stable/reliable vascular patterns. For achieving a successful finger vein biometrics, there are a variety of factors taken into consideration in this biometric system, such as the number of intersections in the vein pattern, and the pattern around the intersection point. This intersection spot will be taken by the system itself, taking the intersecting point as the mid-point. Thus finger vein authentication by means of this new method will ensure high level of security. The reduced feature set method proposed has high accuracy and improved performance.

III. MATERIALS & METHODS

In finger vein authentication technique, to obtain the pattern for the database record, an individual inserts a finger into an attester terminal containing a near infrared light emitting diode (LED) light and a monochrome charge coupled device (CCD) camera. The hemoglobin in the blood absorbs near-infrared LED light, which makes the vein system appear as a dark pattern of lines. The camera records the image and the raw data is digitized, certified and sent to a database of registered images. For authentication purposes, the finger is scanned as before and the data is sent to the database of registered images for comparison. The authentication process takes less than two seconds. Blood vessel patterns are unique to each individual, as are other biometric data such as fingerprints or the patterns of the iris. Unlike some biometric systems, blood vessel patterns are almost impossible to counterfeit because they are located beneath the skin's surface. Biometric systems based on fingerprints can be fooled with a dummy finger fitted with a copied fingerprint; voice and facial characteristic-based systems can be fooled by recordings and high-resolution images. The finger vein ID system is much harder to fool because it can only authenticate the finger of a living person.

i) My research contribution:

By this proposed technology, authentication will be accurate and faster. This technology will help in preventing malicious activities as it will detect any minute change in the images of the input human finger. This method of biometrics is much more secure than any other physiological biometrics. This method will overcome the drawbacks of the previous biometrics such as fingerprinting, face recognition.

IV. RESULT & DISCUSION

The acquired finger-vein images are first subjected to binarization, using a fixed threshold value, to coarsely localize the finger shape in the images. Some portions of background still appear as connected to the bright finger regions, predominantly due to uneven illumination. The isolated and loosely connected regions in the binarized images are eliminated in two steps: First, the Sobel edge detector is applied to the entire image, and the resulting edge map is subtracted from the binarized image. Subsequently, the isolated blobs (if any) in the resulting images are eliminated from the area thresholding, i.e., the eliminating number of connected white pixels being less than a threshold. The resulting binary mask is used to segment the ROI from the original finger vein image. The orientation of finger-vein images is estimated from the orientation of binarized mask, which is generated from the localization of ROI. The estimated orientation of the image is used for the rotational alignment of the ROI in vein image. The images with low contrast and uneven illumination are subjected to nonlinear image enhancement. We implement Gabor Filter for feature extraction. The morphological operations are further employed to enhance the extracted vein structures. The Speeded up Robust Features (SURF) Algorithm is used to detect and extract the key-points in the Vein pattern image which is previously extracted using Gabor Filter. The minute internal features of the finger vein images are extracted for all the images present in the database and finally the matching was done based on the comparison of extracted vein pattern image of testing with trained vein pattern image. The experimental results indicate that the system is highly secured.

V. CONCLUSION

The technique of finger vein comes along with many factors which should be checked for not letting the unauthorised people to get access to any private resource or place. First the image of the input finger should be digitalised and also checked for edge. Then, it should be checked if the digitalized images are in alignment then the image enhancement and features extraction is considered. At last these features from the input finger is compared to the features in the database, when matched means that the input user is

authorised .So all these factors should be considered very important when it comes to authentication as any minute feature difference can be very helpful in detection. The advantages of the process will help the technique in protection of duplication; the technique will be easy to use and also reliable.

VI. FUTURE SCOPE

Further improvement of this paper is, we can implement LBP for feature extraction and we can compare the feature results which are extracted using LBP as well as extracted using Gabor Filter.

VII. ACKNOWLEDGEMENT

The company that motivated in writing this paper are:

HITACHI:

The company offers finger vein authentication technology for logical access and physical access applications. Its vein recognition product portfolio for the BFSI sector includes:

- USB finger vein biometric scanner, which is mainly implemented by PC users to safeguard their systems against unauthorized access and information loss
- Access control finger vein reader: A finger vein authentication system that prevents loss of corporate information and entry of unauthorized persons into home and office premises.

FUJITSU:

Palm Secure bio lock: A contactless recognition technology that uses biometric patterns to identify human palm veins to ensure the safety of a customer’s information.

REFERENCES

[1] US Patent no. 7,526,111 "Personal Identification Device and Method".
[2] "Barclays - Hitachi Digital Security". Retrieved 17 May 2018.
[3] "Archived copy" (PDF). Archived from the original (PDF) on 2012-03-19. Retrieved 2011-07-0
[4] N. Miura, A. Nagasaka, T. Miyatake,"Feature extraction of finger-vein patterns based on repeated line tracking and its application to personal identification," Machine Vision and Applications, Vol. 15, pp. 194-203, 2004.
[5] H. Vallabh,"Authentication using finger-vein recognition," University of Johannesburg, 2012.
[6] R. M. Haralick, K. Shanmugam, I. H. Dinstein,"Textural features for image classification," Systems, Man and Cybernetics, IEEE Transactions on, pp. 610-621, 1973.