Volume 4, Issue 6, June 2014 ISSN: 2277 128X

International Journal of Advanced Research in Computer Science and Software Engineering

Research Paper

Available online at: www.ijarcsse.com

Palm vein authentication

Nirmal T M[1], Mathew Francis[2]

[1, 2] *Department of Electronics & Communication,*
Sahrdaya College of Engineering & Technology, Kodakara,
Kerala, India

Abstract— Palm Vein Authentication Technology is one of the newest biometric techniques researched today. Biometrics, such as with vein recognition, refers to methods for recognizing individual people based on unique physical and behavioural traits. Physiological biometrics is one class of biometrics that deals with physical characteristics and attributes that are unique to individuals. Vein recognition is a type of biometrics that can be used to identify individuals based on the vein patterns in the human finger. It is used in hospitals, law enforcement, military facilities and other applications that require very high levels of security. Vein recognition biometric devices can also be used for PC login, bank ATM identification verification, and many other applications such as opening car doors. The vein detection process consists of an easy to implement device that takes a snapshot of the subject's veins under a source of infrared radiation at a specific wavelength.

Keywords— Palm Vein, Biometric, Fingerprint, Fingerprint Scanner, Palm Scanner.

I. INTRODUCTION

A biometric system is essentially a pattern-recognition system that recognizes a person based on a feature vector derived from specific physiological or behavioural characteristic that the person possesses. A vein pattern detection has been proved to fully comply with this definition and it provides many important biometric features:

- Uniqueness and permanence of the pattern
- Non-contact detection procedure
- Almost impossible to forge or copy.
- The biometric parameter is hidden from general view

The vein pattern is intricate enough to allow sufficient criteria for position detecting various subjects' even identical twins. The vein detection process consists of an easy to implement device that takes a snapshot of the subject's veins under a source of infrared radiation at a specific wavelength. The system is able to detect veins but not arteries due to the specific absorption of infrared radiation in blood vessels. Almost any part of the body could be analyzed in order to extract an image of the vascular pattern but the hand and the fingers are preferred. The reason for this choice is the general availability of the hand.

The infrared radiation is absorbed in a different way in various types of tissue. In order to achieve visual penetration through the respective tissue, lighting should be performed under a very tight optical window namely 740nm up to 760nm (inside the near infrared part of the electromagnetic radiation spectrum). Because of the optical properties of the human tissue, a near-IR vein scanning device cannot penetrate very deep under the skin therefore the device will recognize the superficial veins and rarely the deep veins. Good candidates for the scanning procedure are the dorsal metacarpal veins and the general dorsal venous network. A statistical maximum penetration distance is 3mm and this poses some limitations on the quantity and quality of the extracted vein pattern.

II. LITERATURE SURVEY

Our project consists of an easy to implement device that takes a snapshot of the subject's veins under a source of infrared radiation at a specific wavelength and uses this unique feature for recognition systems. This biometric technique is more effective than the existing technologies that are discussed below:

A. Face Recognition Technology

Human individuality is often identified using faces, advancements in computing capability over the past few decades now enable similar recognitions. Recognition process has now matured into a science of sophisticated mathematical representations and matching processes from geometric model. Face recognition can be used for both verification and identification (open-set and closed-set).Facial recognition is achieved by means of comparing the rigid features of face, which do not change over a period of time.[1] It can also be achieved by comparing other parameters such as skin tone against the information that are stored in the facial database.

B. Finger Recognition Technology

Fingerprint identification is one of the most well-known and publicized biometrics. Because of their uniqueness and consistency over time, fingerprints have been used for identification for over a century, more recently becoming automated (i.e. a biometric) due to advancements in computing capabilities. Fingerprint identification is popular because

of the inherent ease in acquisition, the numerous sources (ten fingers) available for collection, and their established use and collections by law enforcement and immigration. The types of information that can be collected from a fingerprint's friction ridge impression include the flow of the friction ridges (Level 1 Detail), the presence or absence of features along the individual friction ridge paths and their sequence (Level 2 Detail), and the intricate detail of a single ridge (Level 3 Detail). Recognition is usually based on the first and second levels of detail or just the latter.

C. Iris recognition Technology

Iris is a muscle within the eye that regulates the size of the pupil, controlling the amount of light that enters the eye. It is the colored portion of the eye with coloring based on the amount of melatonin pigment within the muscle. Although the coloration and structure of the iris is genetically linked, the details of the patterns are not. The iris develops during prenatal growth through a process of tight forming and folding of the tissue membrane.[2] Prior to birth, degeneration occurs, resulting in the pupil opening and the random, unique patterns of the iris. Although genetically identical, an individual's irides are unique and structurally distinct,[11][12] which allows for it to be used for recognition purposes.

D. Voice Recognition Technology

Speaker, or voice, recognition is a biometric modality that uses an individual's voice for recognition purposes. The speaker recognition process relies on features influenced by both the physical structure of an individual's vocal tract and the behavioral characteristics of the individual.[4] A popular choice for remote authentication due to the availability of devices for collecting speech samples and its ease of integration, speaker recognition is different from some other biometric methods in that speech samples are captured dynamically or over a period of time, such as a few seconds. Analysis occurs on a model in which changes over time are monitored, which is similar to other behavioural biometrics such as dynamic signature, gait, and keystroke recognition.[10] The unique patterns of an individual's voice is then produced by the vocal tract. The vocal tract consists of the laryngeal pharynx, oral pharynx, oral cavity, nasal pharynx, and the nasal cavity. It is these unique patterns created by the vocal tract which is used by voice recognition systems. Even though people may sound alike to the human ear, everybody, to some degree, has a different or unique annunciation in their speech.

III. PALM VAIN

The vein information is hard to duplicate since veins are internal to the human body. The applications for this technology can be expanded by downsizing the sensor and improving the verification speed. Palm vein authentication uses the vascular patterns of an individual's palm as personal identification data.[3] Compared with a finger or the back of a hand, a palm has a broader and more complicated vascular pattern and thus contains a wealth of differentiating features for personal identification.[8][9] Palm vein authentication technology offers contactless authentication and provides a hygienic and non-invasive solution, thus promoting a high-level of user acceptance. We know that a vein print is extremely difficult to forge and therefore contributes to a high level of security, because the technology measures haemoglobin flow through veins internal to the body. The opportunities to implement palm vein technology span a wide range of applications.

IV. BLOCK DIAGRAM

The device arrangement mainly consist of camera, array of IR LED's, different types of filters, database for comparison etc. as shown in fig 1. The detection of a person is done with the help of the vein alignment of his palm. The deoxidized haemoglobin in the vein vessels absorb light having a wavelength of about 7.6 x 10-4 mm within the near-infrared area. When the infrared ray image is captured only the blood vessel pattern containing the deoxidized haemoglobin is visible as a series of dark lines. Based on this feature, the vein authentication device translates the black lines of the infrared ray image as the blood vessel pattern of the palm, and then matches it with the previously registered blood vessel pattern of the individual.

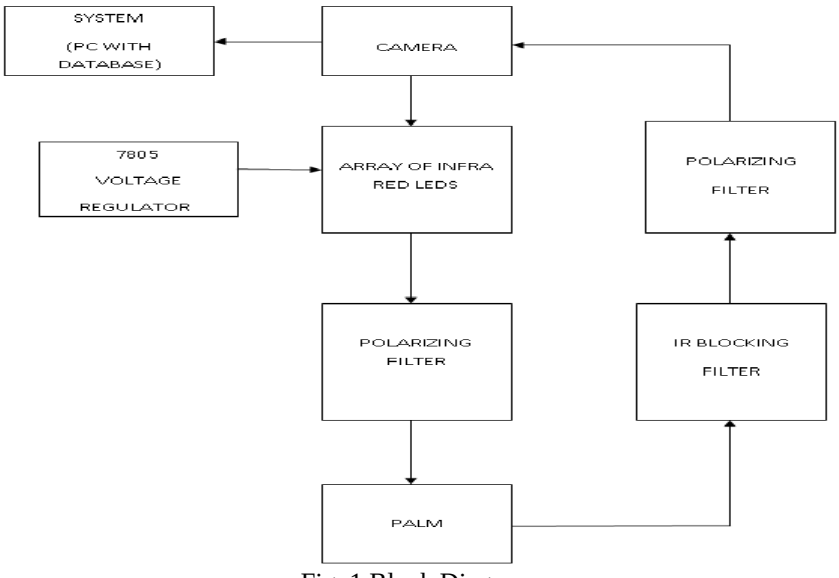

Fig. 1 Block Diagram

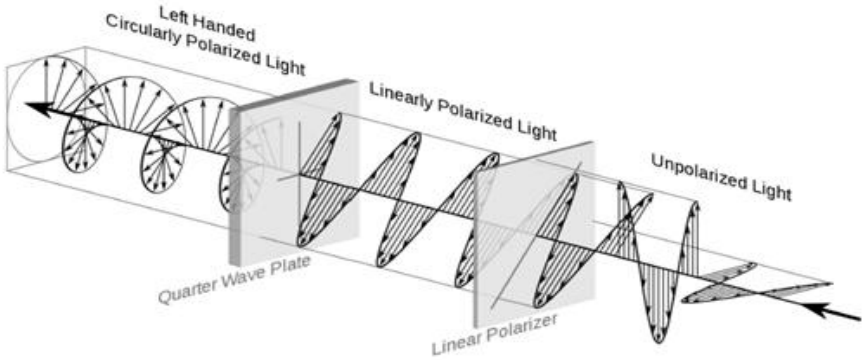

Fig. 2 Circular Polarisation

The first stage of the polarizer is a linear filter which filters out light that is linearly polarized in a specific direction. The second stage, for technical reasons related to the auto sensors within the camera, then circularly polarizes the light before it enters the camera.[6][7] The polarizing filter has two applications in both colour photography and black-and-white photography: it reduces reflections from some surfaces, and it can darken the sky.

Infrared cut-off filters, sometimes called IR filters or heat-absorbing filters, are designed to reflect or block mid-infrared wavelengths while passing visible light.[5] They are often used in devices with bright incandescent light bulbs (such as slide and overhead projectors) to prevent unwanted heating. There are also filters which are used in solid state (CCD or CMOS) video cameras to block IR due to the high sensitivity of many camera sensors to near-infrared light. These filters typically have a blue hue to them as they also sometimes block some of the light from the longer red wavelengths.

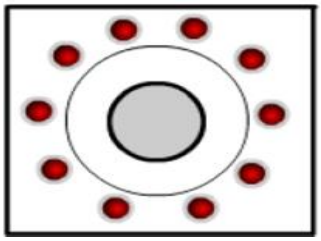

Fig. 3 Led Ring

The array of IR led is used to obtain the near IR rays. The wavelength is between 700nm to 900nm.In our research we have experimented with various lighting systems including natural sunlight, filtered tungsten lamps and near IR LED arrays fig 3. While sunlight and tungsten lamps offer a more constant illumination throughout the region of interest, a LED array is preferred due to the high contrast it provides. Near-infrared LED assemblies prove illuminating for day-night security cameras.

V. RESULTS AND DISCUSSION

The IR LED's will send out light which will pass through polarizing and diffusion filter and will then reach the hand. The veins will absorb the light and the camera will capture the image which will be compared with the image stored in the database. The diffusion filter is kept to increase the uniformity of light while the polarizing filters which is kept in front of the illumination source and camera will help with the reduction of specular reflection of the skin thus increasing even more the contrast of the resulting image.

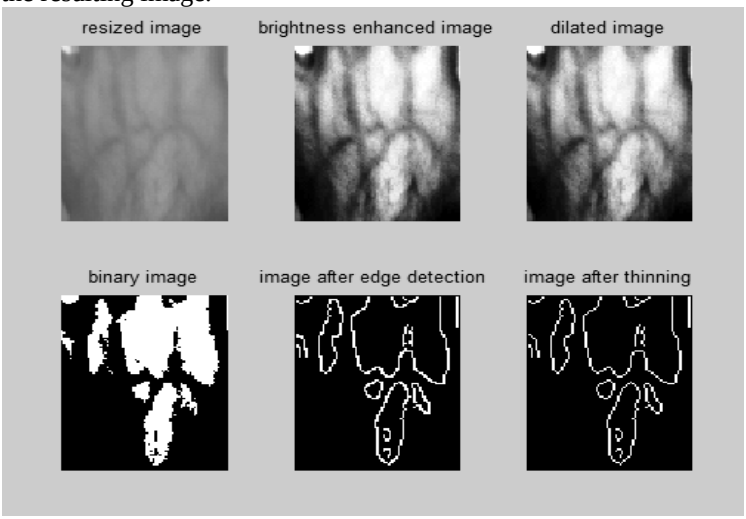

Fig. 4 MATLAB Simulated Result

VI. CONCLUSIONS

The palm vein authentication technology offers a high level of accuracy, and delivers the following results: a false rejection rate (FRR) of 0.01%, and a false acceptance rate (FAR) of 0.00008% or lower, based on Fujitsu research using the data of 140,000 palms. Several banks in Japan have used the palm vein authentication technology for customer identification since July 2004. The device arrangement could obtained the palm vein pattern with reasonable SNR, thus providing the platform for further work. The effectiveness can only be quantified by further investigation involving data set of match and non-match image set.

REFERENCES

[1] S. Prabhakar, S. Pankanti, A. K. Jain, "*Biometric Recognition : Security and Privacy Concerns*", IEEE Security & Privacy, March/April 2003 pp 33-42

[2] J. L. Wayman, "*Technical Testing and Evaluation of Biometric Identification Devices*", în Biometrics: Personal Identification în Networked Society. Kluwer Academic, December 1998

[3] Mansfield A.J., Kelly G., Chandler D. & Kane J. (2001) "*Biometric Product Testing*" Final Report, Issue 1.0, March 2001

[4] Thalheim L., Krissler J. & Ziegler P.-M. (2002) *"Body Check: Biometrics Defeated"* c't Magazine, June 3, 2002

[5] S. Erturk, "*Digital image processing*", University of Kocaeli, 2003

[6] A. D. Kim, "*Transport theory for light propagation in biological tissue*" Optical Society of America Journal A 21, pp. 820–827, May 2004.

[7] Vincent Paquit, Jeffery R. Price, "*Near-infrared imaging and structured light ranging for automatic catheter insertion, Medical imaging"* OAK RIDGE NATIONAL LABORATORY, Oak Ridge, Tennessee, 2006.

[8] "*Extraction of Finger-Vein Patterns Using Maximum Curvature Points in Image Profiles*," in Proceedings of the 9th IAPR Conf. on Machine Vision Applications, N. Miura, A. Nagasaka, and T. Miyatake, (MVA2005, Tsukuba Science City, Japan, 2005), pp. 347-350.

[9] *Bio-informatics Visualization Technology committee, Bio-informatics Visualization Technology* (Corona Publishing, 1997), p.83, Fig.3.2.

[10] A. K. Jain, S. Pankanti, S. Prabhakar, H. Lin, and A. Ross, "*Biometrics:a grand challenge*", Proceedings of the 17thInternational Conference onPattern Recognition (ICPR), vol. 2, pp. 935-942, 2004Z. Liu, Y. Yin, H. Wang, S. Song, and Q. Li.

[11] "*Finger vein recognition with manifold learning*", Journal of Network and ComputerApplications, vol.33, no.3, pp. 275-282, 2010.

[12] D. Wang , J. Li, and G. Memik, "*User identification based on fingervein patterns for consumer electronics devices*", IEEE Transactions onConsumer Electronics, vol. 56, no. 2, pp. 799-804, 2010.

