

Review on Vein Pattern Based Biometric Systems

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ABSTRACT: Identification of individuals among one another has forever been a tricky and difficult task for the researchers. There are several techniques that are used for characterization of an individual. However biometric technique is the standard one that permits us for on-line identification of people on the basis of their physiological and behavioral characteristics. The veins pattern based systems include finger veins, face veins, palm veins, head veins, heart veins, iris, palatal veins of the rascal etc. The multi-veins based systems use the veins of various physiological traits for characteristic an individual. This paper illustrates an outline of veins pattern based personal identification systems. It begins with summary of vein detection and also the benefits of vein as biometric modal. Next, the vein capturing technology to extract the vein pattern is discussed. Finally, preceding works associated with improvement in vein pattern based system is mentioned and reviewed.

KEYWORDS: Biometric, vein, vein detection, vein enhancement, vein pattern.

I. INTRODUCTION

The identification of an individual is an extremely advanced task as a result of which it becomes difficult to determine the distinctiveness of an individual simply. In earlier days, a number of techniques were utilized for the identification regarding the distinctiveness of an individual. The International Normal Organization (INO) has outlined the meaning of "biometric". The term biometric is a combination of greek words: one is 'bio' which means 'life' and the other is 'metric' which means 'measurement'. Therefore, biometric technique permits us to identify people by just examining their physiological and behavioral features. Many styles of techniques are used for locating the distinctive of people. The techniques like finger print based, palm print based, finger vein, hand vein, face vein, palm vein, face vein, palates, iris, DNA recognition, face expression, gait signature, voice recognition, visual communication, heart beat and foot vein based. Fingerprint techniques were employed by Babylonians since five hundred B.C for business transactions. The first fingerprint pattern ridge primarily based biometric system was developed in India by "AzizulHaque" for "Edward Henry" and this technique was referred to as "Henry's system". The fingerprint technique uses the finger ridge and minutiae points for distinguishing people because each "ridge" and "minutiae points" are totally different for every person.

The "iris" and "heartbeat" based biometric systems are used for distinguishing the individuality of persons as every iris and heartbeat of a person is totally different from another person. The hand vein based techniques are used for distinguishing the individuality of persons primarily based upon form of palm length and dimension of finger and palm. The shape of hand, finger and palm is employed for distinguishing the individuality of persons. The face vein based technique is employed for distinguishing the distinctiveness of someone. This system cannot be changed simply in any circumstances. Each individual has a unique facial vein pattern. The face vein patterns are captured by MWIR (Mid Wave Infra-Red) thermal camera. Some extraction features are used for locating the face veins from the facial image of persons. The face veins pattern of one person remains identical at totally different angles of rotation however the vertices change. Similarly hand vein based system is also unique. The range of the spectrum of Infrared (NIR)

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technology lies between 700-1000 nanometer for capturing a good quality image of palm veins and hand veins. The infra-red light passes through the tissues of physical body. The deoxygenated blood absorbs the infra-red light and so the vein patterns may be captured with the assistance of infra-red camera. There are two forms of palm print resolutions; one is high resolution image that is employed in forensic applications for identification of the criminals and second is low resolution image that is employed for identifying an individual. The high-resolution image may be 400dpi or additional and low resolution image may be 150dpi or less. There are five main points of consideration for biometric systems that are: value, user acceptance, surroundings constraints, accuracy, computation speed and security. Fusion based techniques are better for locating the individuality of persons. There are three types of categories of fusion based techniques; these are: pixel level fusion, feature level fusion and score level fusion.

The veins pattern based recognition technique is highly efficient technique compared to alternative techniques for identifying people. The veins exist beneath the skin of a person, accountable for carrying blood within the whole body of an individual. Human veins are unique and distinctive for each person, thus vein based techniques are utilized these days. The Near Field Communication ID (NFCID) and Finger Vein Authentication System (FVAS) technologies are used to determine the identity of people for security reasons. The FVAS technique performs based on physical behavior of humans and then identifies the person. The finger vein classification algorithms also are used for verifying identity of persons. In the field of vein based identification system, embedded hardware systems are used for locating the individuality in complicated situation. The FPGA technology implementation is predicated on the biometric and image process formula for distinguishing the person.

II. LITERATURE REVIEW

Many researchers have contributed to the field of hand vein biometric systems. Research on the new techniques for the various steps involved in this have been analyzed. A brief review of some techniques is presented below:

In year 1995, JM Cross Smith presented thermographic imaging of the subcutaneous vascular network of the back of hand for biometric identification. He used low cost automatic thermographic imaging system prototype for obtaining the vein patterns. FRR of 7.5% and FAR of 0% was obtained. Later in the year 2004, a new concept by Toshiyuki Tanaka was introduced. He correlation and template matching and obtained FAR of 5.818% and FRR of 16% which proved to be less efficient. In year 2008, Mohamed Shahin put forth his idea which was based on the spatial correlation of hand vein pattern. He reduced the FAR to 0.02% and FRR to 3.00%. Ajay Kumar, K. Venkata also presented their methodology which included the extraction of the knuckle tips as a part of the analysis region. Error rate of 1.14% was obtained. In 2013, Ahmed et al presented hand vein biometric system based on the vein tree detection and obtained FAR of 0.03% and FRR of 7.84%. Later in the year 2014, V.KrishnaSree and P.Sudhakar Rao presented their idea of the dorsal hand vein pattern authentication by using the hough transform for the feature extraction.

III. DISCRPTION OF TECHNIQUE

Modes of operation

Biometric system operates in several modes: that includes Verification and Identification. Verification includes the comparison of acquired data with a stored database to verify the individuality of a person. All biometric systems need every approved user to be listed. It involves the user to represent the characteristic attribute to the system one or number of times. A library guide is created from the sample. This guide holds on information of every registered user. It can be encoded on a smart card. Whenever the user requires access, he/she should present the desired attribute to the system which then compares this with the database.

Factors affecting the performance

The various factors affecting the performance of the vain based biometric systems include:

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1. Client population is open or closed; e.g. a population of manufactory staff as opposed to the population of potential ATM users,
2. False Rejection Rate (FAR) and False Acceptance Rate (FRR)
3. Some people involved in the criminal cases may have a legal rejection to their finger prints.
4. Whether it is harmful to the body as in case of retinal scan where the back of an eye is put under laser scan.
5. User friendly behavior
6. Whether it is hygienic or not

Uniqueness of the vein patterns

A good biometric system should have certain qualities like universality, distinctiveness, collectability and permanence. In reference to these qualities, the following can be concluded:

1. The hand vein patterns are unique to every individual. Even the twin's posses different vein patterns.
2. Vein patterns are distinguishable.
3. The samples can be collected by using an NIR camera.
4. The vein patterns are permanent and don't change with time.

Methodology

For the analysis and setup of the hand vein based biometric system, certain steps are to be considered. These include the image acquisition, pre-processing, feature extraction and then the matching of features.

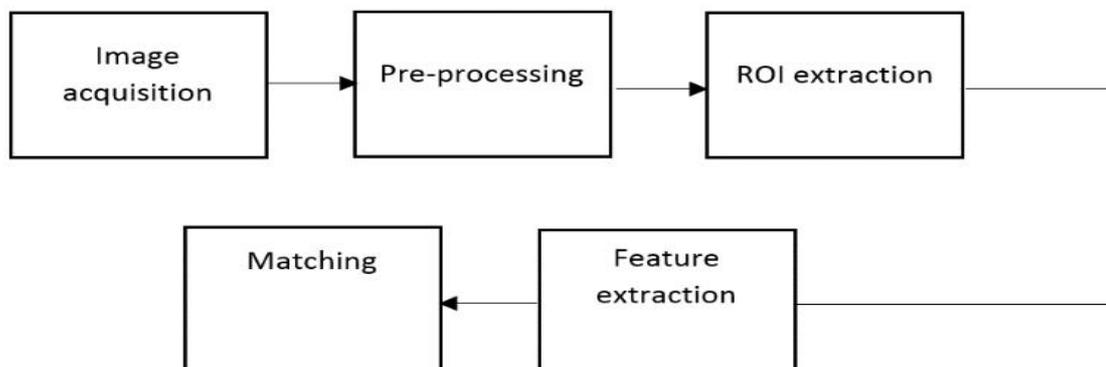


Image acquisition: The images of hand vein pattern are acquired from a database available online. The database consists of images taken from a Near Infrared Camera (NIR). NIR light having wavelength of 700nm – 900nm can transmit through the skin upto 3mm depth. The veins have deoxygenated blood in them and the NIR light is completely absorbed by the blood. Due to this, the veins appear to be darker than the rest of the region in the image.

Pre-processing: Pre-processing is an important step for the analysis of the hand vein system. It includes the processing to improve the quality of the image. Various filters for removal of noise are employed. Histogram equalization can also be included in this step.

Region Of Interest (ROI): This is done by extracting a specific region from the image which is actually useful for our analysis. The ROI should include that area where the vein are clearly detected. This can be done by number of techniques like extracting the centroid and then selecting an area around it. Also we can use the knuckle tips to extract ROI.

Feature extraction: This includes the extraction of various features which can then be used for the matching purpose. Features can be in the form of various points, line segments, etc. Various algorithms can be used for the feature extraction. We can use hough transform, triangulation method or any other method. Thinning can also be applied to extract the exact skeleton of the veins.

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Matching: Matching or the authentication of the correct individual is the important step in the whole process. It works by matching the features of the input image and the image saved in the database. By comparing the two images, a decision is taken for the authenticity of the individual that whether the user is registered one or not.

IV. CONCLUSION

This review paper presents the basic idea about the biometric techniques. The main focus is on the hand vein based biometric systems. It presents the various methods used, the techniques and the algorithms that can be used for the analysis. The various steps used in the analysis of the system have also been discussed. The advantages and disadvantages are also discussed.

V. FUTURE SCOPE

The proposed system can be further extended to include the neural network. The neural network can be used for training and the authentication for the users can be verified. This can result in high accuracy and efficiency of the system. The False Acceptance Rate and False Rejection Rate for the system can improve.

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