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Palm Vein based Authentication

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ABSTRACT

The palm vein authentication technology offers a high level of accuracy. Palm vein authentication uses the vascular patterns of an individual's palm as personal identification data. If we compare 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. The importance of biometrics in the current field of Security has been depicted in this work. We have processed the raw image from the dataset before implementing authentication algorithm. After getting the suitable image after pre- processing, we have used local binary pattern (LBP) for feature extraction purpose & then using a machine learning algorithm, with support vector machine (SVM), we tried to match the vascular vein pattern for authentication. Result of the matching algorithm is not only optimized as per the proposed approach but also quite efficient.

Keywords: Palm vein, biometrics, SVM, LBP.

I. INTRODUCTION

Palm vein authentication is one in every of the vascular pattern authentication technologies. Vein pattern authentication includes vein pattern authentication victimisation the vein patterns of the palm, back of the hand, or fingers as personal identification knowledge as personal identification. The vascular pattern utilized in this authentication technology refers to the image of vessels at intervals the body that may be seen as a random mesh at the surface of the body.

The biometric ways are often divided loosely into 2 classes, that area unit behaviourally primarily based and physiological-based ways. The common activity bioscience area unit identity verification, voice recognition, handwriting recognition, and gaits. The physiological ways use bioscience like fingerprint, iris, membrane scans, face, handshape, palm print, ear pure mathematics, deoxyribonucleic acid and vein pattern. The physiological ways area unit most well-liked because of individuation, permanence, and accuracy Physiological ways will any be separate looking on the appliance, defects and instrumentality prices. as an example, fingerprint recognition may be a wide used technique, however it uses a contact image acquisition methodology that is extremely unhealthful and thus not appropriate for clinical applications.

Palm vein biometric is contactless and thus is most well-liked for clinical applications. it's correct because the vein data lies to a lower place the palm skin surface and is strong because it depends on the blood flow within the vein, that prevents latency and create it tough to forge. The palm vein biometric system uses the vein pattern, that is stable over time and thought of as a sturdy feature.

II. RELATED WORK

In this section, few existing methods for palm vein recognition are discussed along with their advantages and disadvantages. The methods can be classified into line based, subspace-based learning, minutiae-points based, local point descriptors based and texture-based feature extraction methods.

The minutiae features extracted from the backhand images are used for recognition. The drawback of the result was that the identification was based on a small database of only 141 images. In Hausdorff distance, Line Edge Mapping (LEM) and Gabor wavelet were used for discriminative feature extraction. The results achieved were 58%, 66%, and 80% respectively for the accuracy in matching when using a dataset of 100 people.

In [1], image information is concentrated into high valued coefficients within the transform domain using Radon Transform. A driver identification system is created using Radial Basis Function and Probabilistic Neural Networks which provide results with an identification rate of approximately 99.2%. In feature extraction is performed using minutiae triangulation on the minutiae points. This is a poor method since most of the vein information is missed out and the results obtained do not have high accuracy.

In [2], negative mean curvature and mean curvature methods are used to find the valley like structures and the image geometry. The result is obtained by matching the pixel ratios.

In [3], a 2D Gabor filter is used to extract the local features from the image which is considered as a piece of texture. Further encoding is done using vein code which is a directional code technique that encodes the features into bit strings. Normalized Hamming Distance measures the similarities between the two vein codes.

III.SYSTEM IMPLEMENTATION

Three important stages involved in the process of palm vein recognition system are image acquisition, pre-processing and lastly registration, authentication, and identification of palm images.

A. Image Acquisition

Image acquisition is the first step, where the user places his/ her hand over a palm vein scanner. The user hovers the palm for a few seconds over the scanner without touching it. A typical representation of an image acquisition system that has been set up with the help of a Fujitsu Palm Secure scanner.

The setup consists of a palm vein scanner having the infrared lighting source within the hardware which provides even illumination of the palm, finger guides which assist the user to appropriately position the palm over the scanner and computer setup having the USB interface, software development kit, and system drivers. Palm vein scanner can record near-infrared images within the range of 760 nm wavelength. At 760 nm, infrared light penetrates through the skin and is absorbed differently by various types of tissues. The deoxygenated haemoglobin in blood flowing through veins absorbs the near infrared rays while the arteries and other tissues reflect the rays. Due to this phenomenon, a dark network of veins is observed which the camera within the scanner records as an image. This image is further processed and used as input to the subsequent stages in the matching system. The schematic representation of a palm vein scanner is shown in Figure 1.

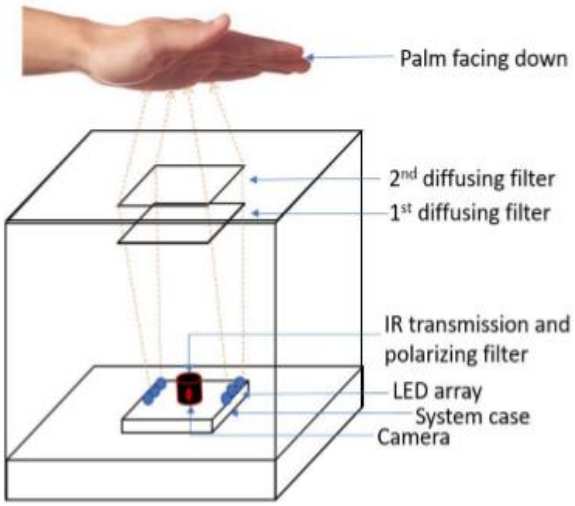

Figure 1: The main structure of a palm vein system

B. Pre-Processing

In the pre-processing stage, it is observed that the images obtained from the palm vein scanner are in poor contrast due to glare and also contain irregular shading caused by the various thickness of the skin and bones. Also, most matching algorithms use only a specific region of palm vein network for identification. So, a suitable region of interest (ROI) is selected from the image. Furthermore, the images are enhanced using traditional image processing techniques like filtering [4], denoising [5], histogram equalization, contrast enhancement, etc. Approaches using Affine-Invariant transform and Ridgelet transform are effective in the extraction of features as discussed in [6] and [7]. As per other existing literature, few more successful approaches for the pre-processing steps involve use of Gabor Filters [8] [9] [10], Fisher discriminated analysis [11], and Curvelet transforms [12] [13]. Feature extraction in the pre-processing stage is pivotal in palm vein biometrics because the final step of image comparison is completely dependent on the feature extracted image.

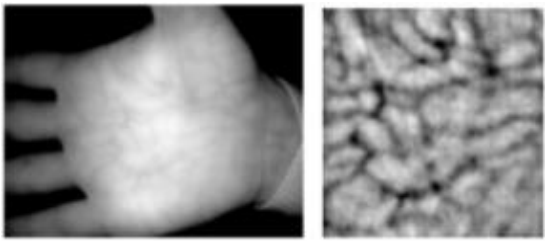

Figure 2: (left) NIR image of palm, (right) Image after pre-processing

Figure 2 shows an example of an output image obtained from the pre-processing step. The left image is the original image captured by the palm vein scanner, while the right image is the pre-processed image.

C. Registration, Authentication, and Identification of palm images.

The registration stage comprises of storage of vein images captured using the palm vein scanner. The pre-processed output image is stored in a database in a structured and organized manner. The authentication step is a one-to-one matching process for a specific user where the system compares the input pre-processed image obtained from the user to the database image previously stored in the system. Identification is the step where the input image is taken from the user and compared to the images which are already stored in the database using the registration process. Since these images have already gone through the registration and authentication steps, they will be pre-processed, simplified into the Region of Interest (ROI) format and enhanced. The image from the user will go through the pre-processing steps to be compared with the database images iteratively until a match is found. The general framework of the palm vein recognition system is represented in Figure 3.

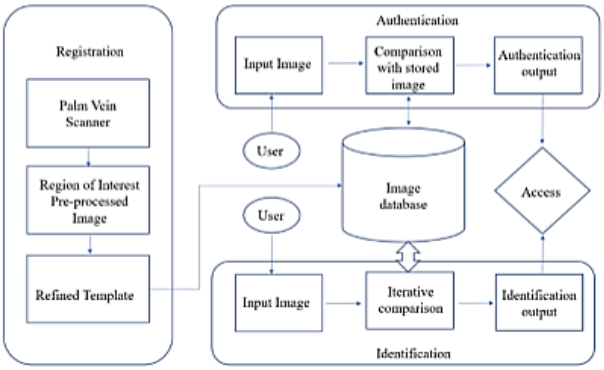

Figure 3: A general framework of a palm vein recognition system

IV. RESULTS

The processed image results from the input dataset & accuracy assessment result is shown below in Figure 4 which we have evaluated from the program code as an output from our implementation.

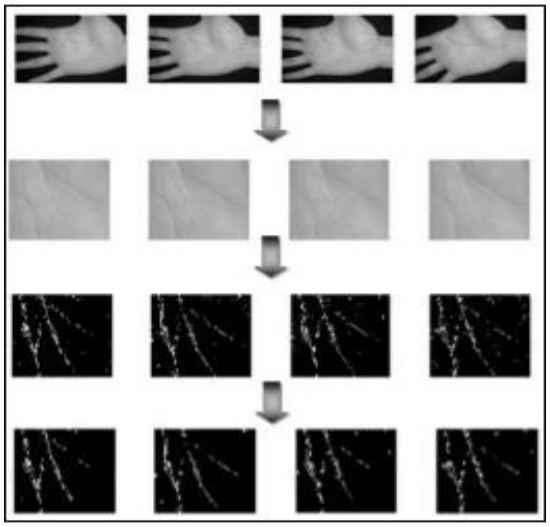

Figure 4: Results are shown based on Proposed Algorithm

V. CONCLUSION

Palm vein authentication technology is secure as a result of it uses information contained within the body and is additionally highly correct as a result of the pattern of veins within the palm is advanced and distinctive to every individual. Moreover, its contactless feature offers it a healthful advantage over different identity verification technologies. We have processed the authentication system as projected in our project which provides an optimized output as an identical result from the given information & this can be quite a terribly economical system for authentication. Besides, the entire identification process is controlled by a trained neural network which improves its accuracy. Studies suggest that this approach has significantly improved all the performance parameters and hence promising for future application.

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