IDENTIFICATION OF FINGER IMAGES USING SCORE-LEVEL FUSION.

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ABSTRACT: *This paper presents a new approach to improve the performance of finger-vein identification systems presented in the literature. The proposed system simultaneously acquires the finger-vein and low-resolution fingerprint images and combines these two evidences using a novel score-level combination strategy. We examine the previously proposed finger-vein identification approaches and develop a new approach that illustrates it superiority over prior published efforts. The utility of low-resolution fingerprint images acquired from a webcam is examined to ascertain the matching performance from such images. We develop and investigate two new score-level combinations, holistic and nonlinear fusion, and comparatively evaluate them with more popular score-level fusion approaches to ascertain their effectiveness in the proposed system.*

I. OBJECTIVE

In this paper, they have proposed an alternate novel method of finger vein and finger texture recognition system this system has taken 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.

II. EXISTING SYSTEM

We propose a method of personal identification based on finger-vein patterns. An image of a finger captured under infrared light contains not only the vein pattern but also irregular shading produced by the various thicknesses of the finger bones and muscles. The proposed method extracts the finger-vein pattern from the unclear image by using line tracking that starts from various positions. Experimental results show that it achieves robust pattern extraction, and the equal error rate was 0.145% in personal identification.

III. DISADVANTAGES OF EXISTING SYSTEM

➢ The database employed in this paper is too small to generate a reliable conclusion on the stability of such features in the noisy vein patterns.
➢ The performance from this approach is shown to be very high, but the key details of their implementation are missing.

IV. PROPOSED METHOD

A new approach for personal identification that utilizes simultaneously acquired finger-vein and finger surface (texture) images is presented. Our experimental results illustrate significantly improved performance that cannot be achieved by any of these images employed individually. The experimental results on 6264 images from a 156-subject database acquired over a period of 11 months suggest that the proposed approach outperforms previously proposed approaches considered in this paper.

Another related contribution of this paper is on the development of new approaches for both the finger-vein and finger texture identification, which achieves significantly Improve d performance over previously proposed approaches. Our finger-vein identification approach utilizes peg-free and more user-friendly unconstrained imaging. Therefore, the steps for the acquired finger-vein image normalization, rotational alignment, and suiting interclass variations.

In the finger images are also developed. The unconstrained finger texture imaging with a low-resolution webcam presents high rotational and translational variations. A robust image normalization scheme is developed; rotational and translational variations are also accommodated in our matching strategy, which results in significantly improved performance.
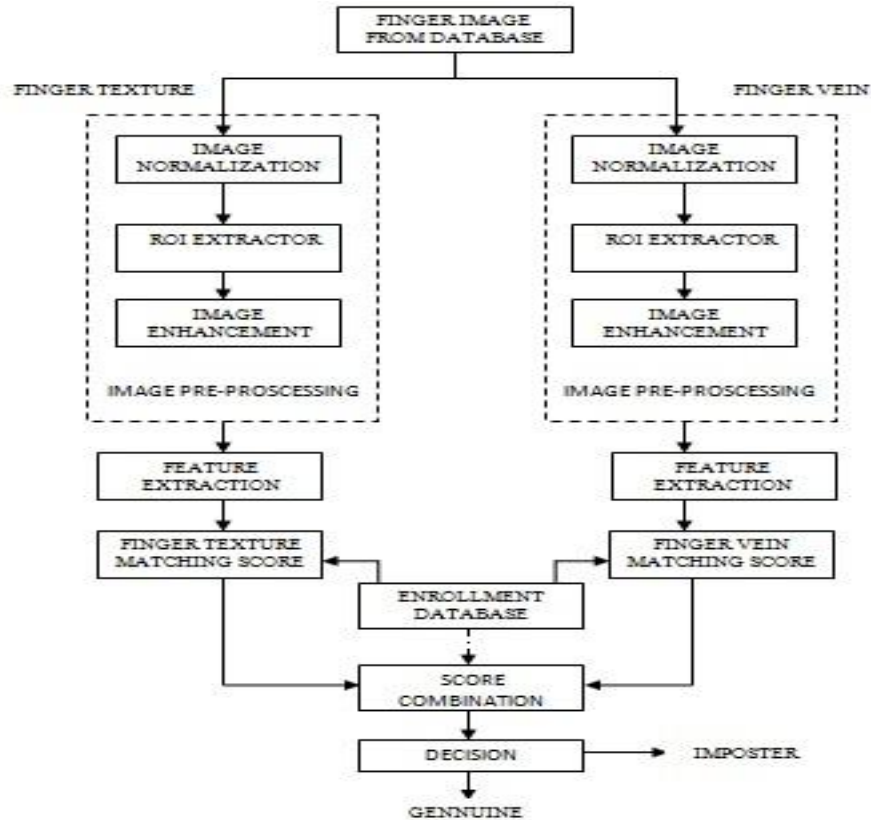
Fig: Block Diagram

V. PROPOSED SYSTEM ADVANTAGES

The finger veins are hidden structures; it is extremely difficult to steal the finger-vein patterns of an individual without their knowledge, therefore offering a high degree of privacy.

Second, the use of finger-vein biometrics offers strong ant spoofing capabilities as it can also ensure liveness in the presented fingers during the imaging.

VI. PAPER DESCRIPTION

GENERAL

In this PAPER, the finger images obtained from the database are separated into finger vein and finger texture images. These two images are processed separately as per the concept represented in paper. The process involved is image preprocessing, image enhancement, feature extraction and matching. For feature extraction we have use Gabor filter and for matching we implement score level combination as holistic and nonlinear fusion. This system has taken 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.

V. FINGERPRINT ENHANCEMENT TECHNIQUES:

BINARIZATION

Binarization is a method of transforming grayscale image pixels into either black or white pixels by selecting a threshold. The process can be fulfilled using a multitude of techniques. Binarization is relatively easy to achieve compared with other image processing techniques.

A binary image is a digital image that has only two possible values for each pixel. Typically the two colors used for a binary image are black and white though any two colors can be used. The color used for the object(s) in the image is the foreground color while the rest of the image is the background color. In the document scanning industry this is often referred to as bi-tonal.

Median Filtering

Median filters calculate the average of pixel values in a pre-specified window size. The central pixel is then assigned that value.

The Simple Median Filter has an advantage over the Mean filter since median of the data is taken instead of the mean of an image. The pixel with the median magnitude is then used to replace the pixel studied. The median of a set is more robust with respect to the presence of noise. The median filter is given by

Median filter(x1…xN)=Median(‖x1‖2……‖xN‖2)

Image Enhancement

Image enhancement operation improves the quality of the image, it can be used to improve the image contrast, and brightness characteristics, reduce its noise content, and/or sharpen its details. Image enhancement techniques may be grouped as either subjective enhancement or objective enhancement. Subjective enhancement technique may be repeatedly applied in various forms until the observer feels that the image yields the details necessary for particular application.

Feature Extraction

Many features had extracted from each print. The co-ordinates of each minutia and the type of the minutiae can be determined. The number of total minutiae had also recorded. A fingerprint can have up to 80 minutiae. It had generally accepted as the same Print if 8 to 17 points match. Some translation of the fingerprint will be acceptable, however the rotation had to minimized since no techniques have been implemented which specifically counteracts rotation.

GABOR FILTER

A Gabor filter is a linear filter whose impulse response is defined by a harmonic function multiplied by a Gaussian function. Because of the multiplication-convolution property (Convolution theorem), the Fourier transform of a Gabor filter's impulse response is the convolution of the Fourier transform of the harmonic function and the Fourier transform of the Gaussian function.

The Gabor Filters have received considerable attention because the characteristics of certain cells in the visual cortex of some mammals can be approximated by these filters. In addition these filters have been shown to posses optimal localization properties in both spatial and frequency domain and thus are well suited for texture segmentation problems. Gabor filters have been used in many applications, such as texture segmentation, target detection, fractal dimension management, document analysis, edge detection, retina identification, image coding and image representation. A Gabor filter can be viewed as a sinusoidal plane of particular frequency and orientation, modulated by a Gaussian envelope.

$$\mathbf{G(x,y)} = s(x,y)\, g(x,y)$$

where $s(x,y)$ is complex sinusoid and $g(x,y)$ is 2D gaussian envelope

$$s(\mathbf{x,y}) = \exp\left[-j2\pi\left(\mu_0 x + v_0 y\right)\right].$$

$$g(\mathrm{x,y}) = \frac{1}{\sqrt{2\pi}\sigma_x\sigma_y}\exp\left[-\frac{1}{2}\left(\frac{x^2}{\sigma_x^2} + \frac{y^2}{\sigma_y^2}\right)\right]$$

σ_x and σ_y characterize the spatial extent and bandwidth of along the respective axes, u_o and v_o are the shifting frequency parameters in the frequency domain. Using $G(x,y)$ as the mother wavelet, the Gabor wavelets, a class of self-similar functions can be obtained by appropriate dilations and rotations of $G(x,y)$ through: $G_{m,n}(x,y) = a^{-m}G(x',y')$, where $x' = a^{-m}(x\cos\theta + y\sin\theta) = a^{-m}(x\sin\theta + y\cos\theta)$, $y' = a^{-m}(x\sin\theta + y\cos\theta)$, a>1, $\theta = \frac{n\pi}{0}, m = 1\ldots S\ n = 1\ldots 0. 0$ indicates the number of orientations, S the number of scales in the multi resolution decomposition and a is the scaling factor between different scales.

METHODOLOGIES

MODULE NAMES
➢ Finger vein identification
➢ Finger texture identification
➢ Finger vein and texture matching
➢ Score combination

MODULE DESCRIPTIONS

MODULE 1: FINGER VEIN IDENTIFICATION

Image preprocessing:
Finger images are noisy with rotational and translational variations. To remove these variations, it is subjected to preprocessing steps.
➢ Image normalization
➢ ROI extractor
➢ Image enhancement

Image normalization:
Normalization is a process that changes the range of pixel intensity values. In this, the image had subjected to binarization with threshold value of 230. Sobel edge detector had applied to the image to the remove background portions connected to it, eliminating the number of connected white pixels being less than a threshold, to obtain the binary mask.
Binarization is a method of transforming grayscale image pixels into either black or white
pixels by selecting a threshold. The process can be fulfilled using a multitude of techniques. Binarization is relatively easy to achieve compared with other image processing techniques.

ROI extractor:
In the finger images, there are many unwanted regions (that cannot be taken for analysis) has been removed by choosing the interested area in that image. The useful area is said to be "Region of Interest".
The obtained binary mask is used to segment the ROI (Region of Interest) from the original finger-vein image. The orientation of the image is determined to remove the low quality images that present in finger vein image. This orientation is used for the rotational alignment of the ROI in vein image.

ROI extraction by Morphological operations
Two Morphological operations called 'OPEN' and 'CLOSE' are adopted. The 'OPEN' operation can expand images and remove peaks introduced by background noise . The 'CLOSE' operation can shrink images and eliminate small cavities. The bound is the subtraction of the closed area from the opened area. Then the algorithm throws away those leftmost, rightmost, uppermost and bottommost blocks out of the bound so as to get the tightly bounded region just containing the bound and inner area.

Image enhancement:
The acquired image is thin and it is not clear. So the image is enhanced by using bicubic interpolation for better visualization.
The Method adopted in fingerprint recognition system is Histogram Equalization
Histogram equalization is to expand the pixel value distribution of an image so as to increase the perceptional information. The original histogram of a fingerprint image has the bimodal type. The histogram after the histogram equalization occupies all the range from 0 to 255 and the visualization effect is enhanced.

MODULE 2
FINGER TEXTURE IMAGE PREPROCESSING

➢ Localization and Normalization
➢ Image Enhancement

Localization and Normalization:
In texture preprocessing, Sobel edge detector is used to obtain the edge map and localize the finger boundaries. This edge map is isolated with noise and it can be removed from the area threshold. Such noise is eliminated from the area Thresholding, i.e., if the number of consecutive connected pixels is less than the threshold. The slope of the resulting upper finger boundary is then estimated.

This slope is used for automatically localize a fixed rectangular area, which begins at a distance of 20 pixels from the upper finger boundary and is aligned along its estimated slope. We extract a fixed 400 160 pixel area, at a distance of 85 and 50 pixels, respectively, from the lower and right boundaries, from this rectangular region. This 400 160 pixel image is then used as the finger texture image for the identification.

Image Enhancement:
In image enhancement, finger texture image had subjected to median filtering to eliminate the impulsive noise. The resulting images have low contrast and uneven illumination. Therefore, obtain the

background illumination image from the average of pixels in 10×10 pixel sub blocks and bi-cubic interpolation. The resulting image is subtracted from the median-filtered finger texture image and then subjected to histogram equalization

VII.   FINGER VEIN AND TEXTURE IMAGE FEATURE EXTRACTION

Gabor filter had used for finger vein and texture image feature extraction. Gabor filters optimally capture both local orientation and frequency information from a fingerprint image. By tuning a Gabor filter to specific frequency and direction, the local frequency and orientation information can be obtained.

We have creating the Gabor with specified orientations and these Gabor filter is convolved with the enhanced image to remove the unwanted regions other than the vein and texture regions.

MODULE 3
FINGER VEIN AND TEXTURE MATCHING:
The general block diagram for matching is given below
In that, the matcher block predicts that the vein and texture image is matched with the database. The database contains the features of all vein and texture images.
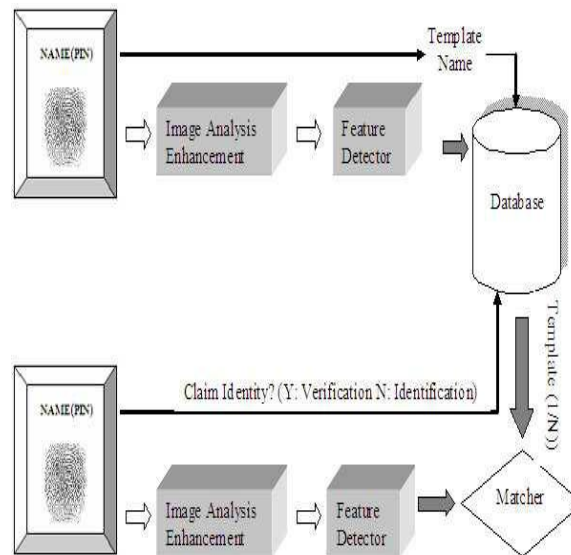
Fig: Block Diagram for Matching

For matching, two steps has been done

➢   Extract features
➢   Match features
These two steps had done by using mat lab in built commands.

Vein matching:
The features extracted from finger vein images are already stored in a database. The features of the input image matched with all the extracted veins in the database to check whether the input image is matched with any one of the extracted veins.
➢   If the input image is matched with any one of the extracted veins, the message box will be opened and display "vein matched".

➢   If the input image is not matched with any one of the extracted veins, the message box will be opened and display "vein not matched".

Texture matching:
The features extracted from finger texture images are stored in the same database. The features of the input image had matched with all the extracted texture in the database to check whether the input image matched with any one of the extracted textures.

> ➢ If the input image is matched with any one of the extracted textures, the message box will be opened and display "texture matched".

> ➢ If the input image is not matched with any one of the extracted textures, the message box will be opened and display "texture not matched".

Notation, there are a few extensions that will likely cause you some problems at first.
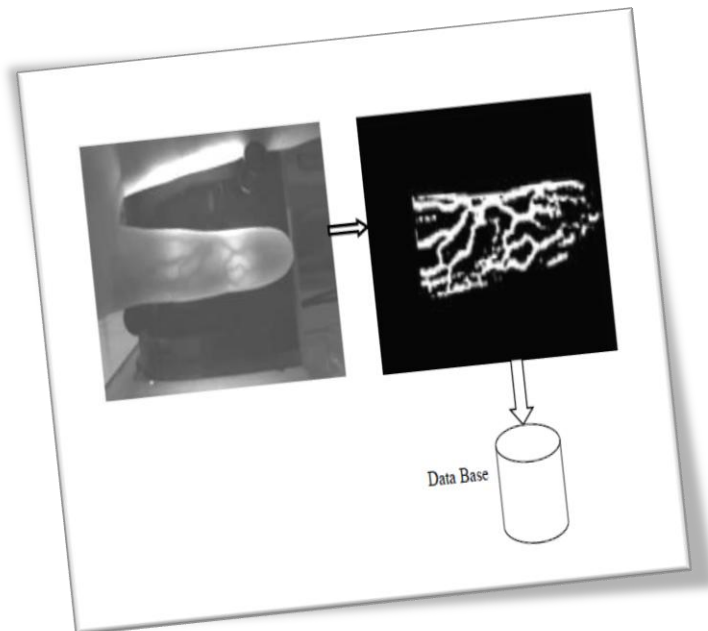
Fig: Database

Vein regions extracted from the image are stored in database.

CODE IMPLEMENTATION:

The code had implemented and stored in my web site. If anyone is interested in implementing my code then it is freely available in the below web address: http://gowthamethicalhacker.wordpress.com

SIMULATION OUT PUTS:

The below are the simulation outputs for my code implementation the below figures illustrate a clear view of my idea where I am have used the MATLAB in built commands for execution.

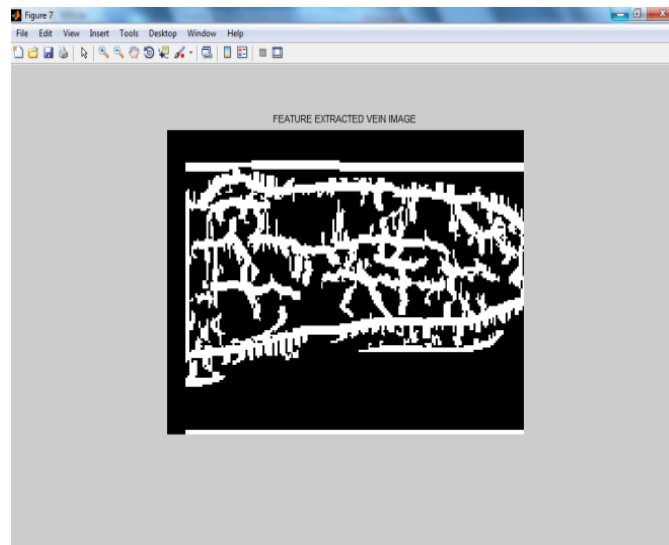**1. Input Image or Original Image:**
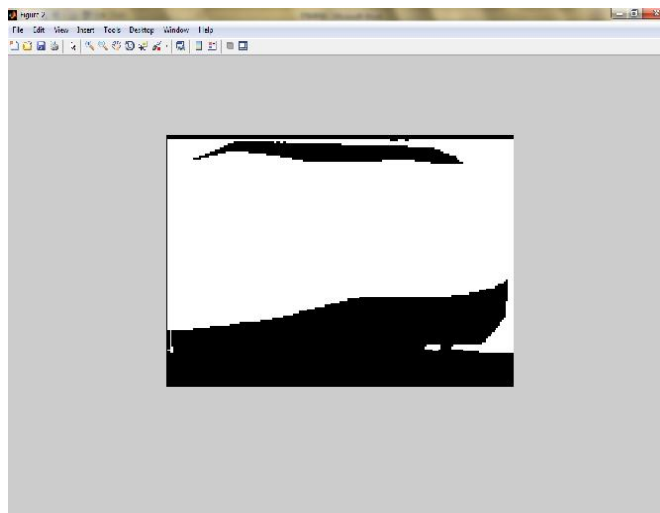
2. Binary Image:
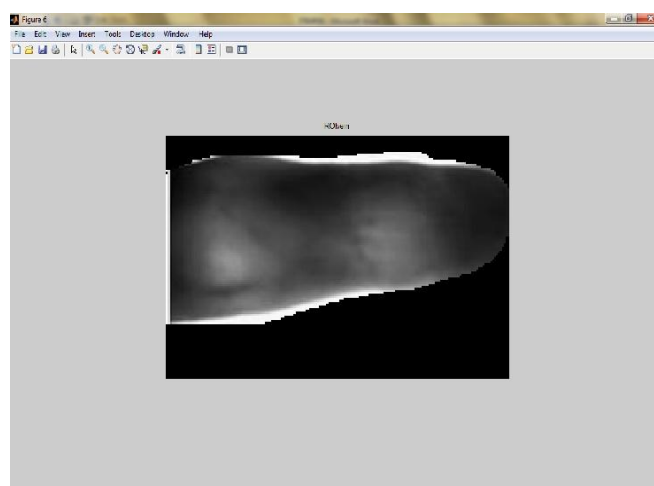
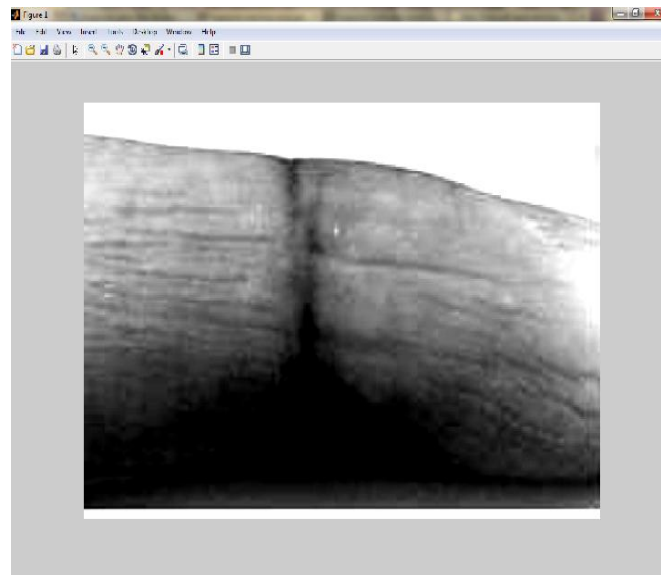
3. Region of Interest:
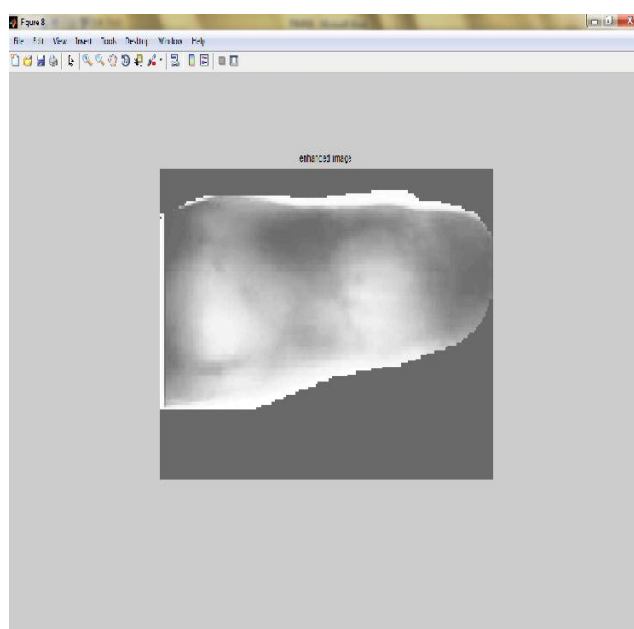
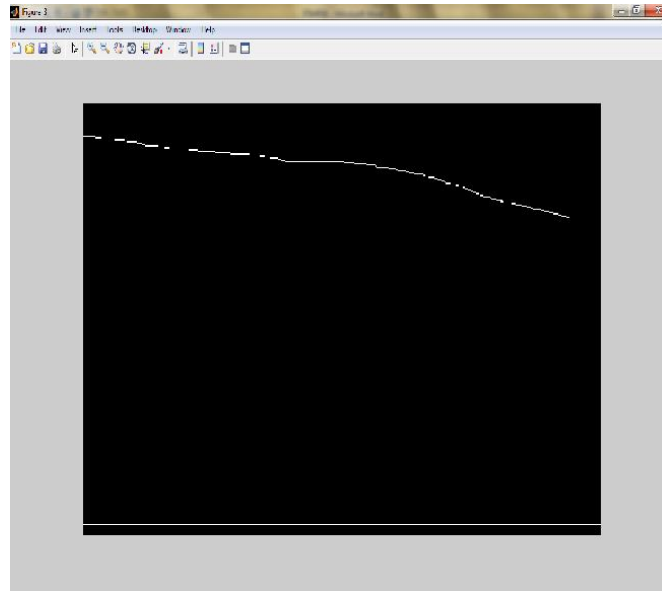
4. Enhanced Image:
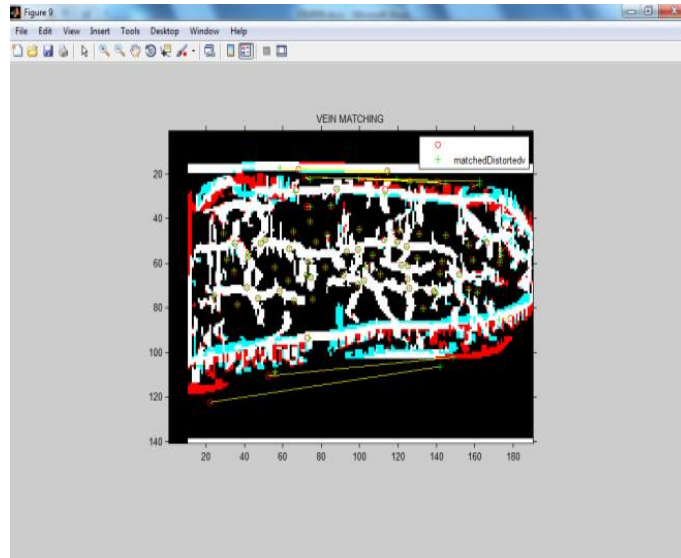
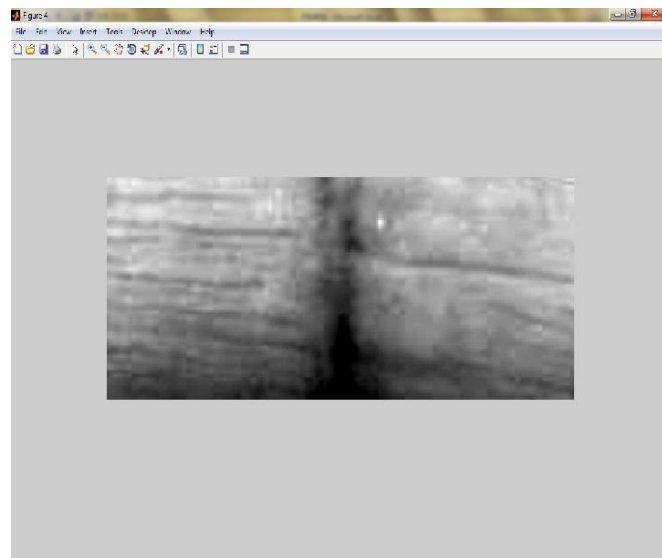**5. Feature Extracted Vein:**

6. Vein Match:

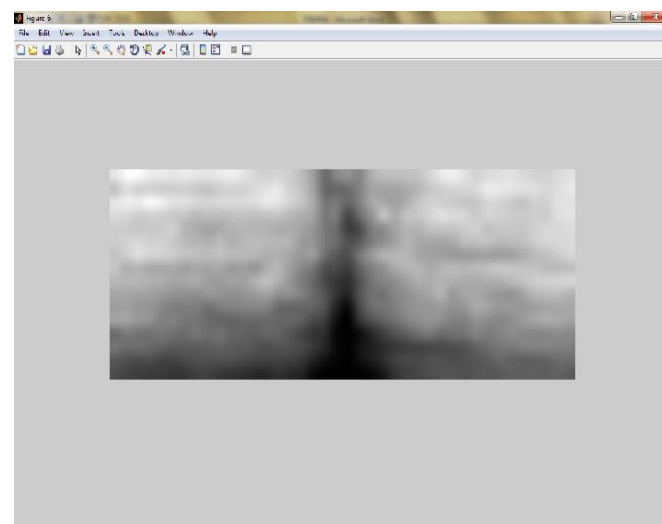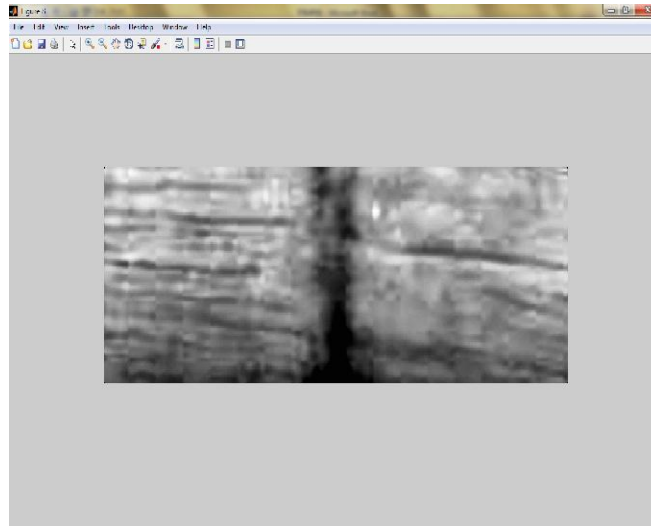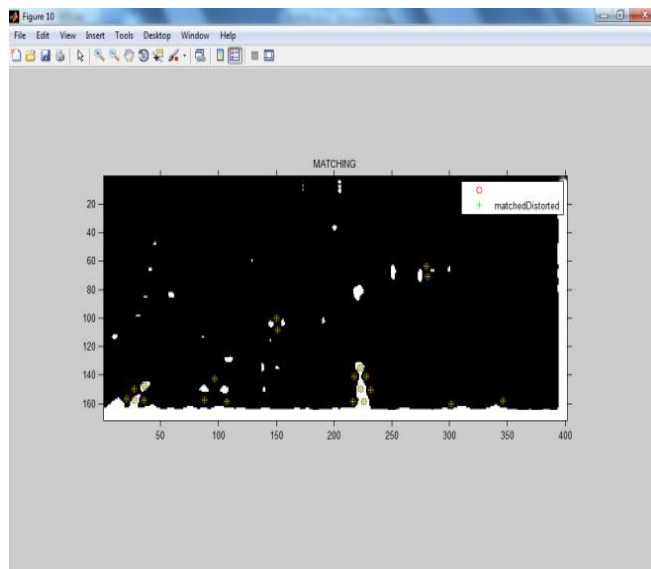**7. Texture Input Image**:

8. Image after Area Thresholding:

9. Segmented Texture Image:

10. Median Filtered Image:

11. Enhanced Texture Image:

12. Texture Match

13. Matching Scores

VII. APPLICATIONS

Time attendance software allows to track the time your employees spend at work, classic time attendance solutions use pin codes, passwords, badge readers, etc. but now a number of isometric solutions is emerging. The advantage of biometric time attendance is that your employees cannot forget their code or lose their badge, also a biometric solution is more tamper proof: you cannot ask a colleague to check-in for you when a fingerprint is required.

Fingerprint recognition refers to the automated method of identifying or confirming the identity of an individual based on the comparison of two fingerprints. **Fingerprint recognition** is one of the most well known biometrics, and it is by far the most used biometric solution for authentication on computerized systems. The reasons for fingerprint recognition being so popular are the ease of acquisition, established use and acceptance when compared to other biometrics, and the fact that there are numerous (ten) sources of this biometric on each individual.

The application of other techniques such as ultrasonic scanning using a high frequency transducer, X-ray imaging, computerized tomography, and magnetic resonance imaging could also provide valuable finger image data for the personal identification. However, the optical imaging techniques are not only economically feasible but are also sensitive to detect (subsurface) close-to-skin as well as the deeper tissue features/characteristics.

VIII. CONCLUSION

We have presented a complete and fully automated finger image-matching framework by simultaneously utilizing the finger surface and finger subsurface features. We presented a new algorithm for the finger-vein identification, which can more reliably extract the finger vein shape features and achieve much higher accuracy than previously proposed finger-vein identification approaches. Our finger-vein matching scheme works more effectively in more realistic scenarios and leads to a more accurate performance, as demonstrated from the experimental results.

We examined a complete and fully automated approach for the identification of low resolution finger surface texture images for the performance improvement. This investigation and they obtained results are significant as they point toward the utility of touch less images acquired from the webcam for personal identification and its extension for other utilities such as mobile phones, surveillance cameras, and laptops. Finally, the availability of the acquired database from this paper for the benchmarking/comparison will help further the research efforts in this area. Currently, there is no publicly available database for the performance comparison and research efforts on finger-vein identification.

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