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Implementation of an Efficient Hand Vein Structure Authentication

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ABSTRACT: Biometric authentication provided a high security and reliable approach to be used in security access system. However, this authentication method has not been widely implemented in a resource-constrained embedded system. The pattern of blood veins is unique, even in identical twins. The human veins have a broad and complicated vascular pattern and thus contain many kinds of features. In this project, investigated a method of personal authentication based on infrared vein pattern in the back of the hand. A biometric feature is extracted from the vein pattern image. In this project the algorithm consists of four modules: image capturing, image pre-processing, and feature Extraction and the authentication module. An array of infrared light-emitting diode (LED) and a thermal camera modified from a webcam was used to capture the vein pattern. The current work proposes a very low-cost hand vein pattern recognition system using a simple modified webcam. The system introduces a noise removal algorithm for enhancing the results of the segmentation and uses a modified version of Hausdorff distance for feature matching for the recognition purposes. System can achieve a zero false acceptance ratio while keeping the true acceptance rate in an acceptable level. It is relevance to security and can be used in computer systems, laptops, cellular phones, ATM, Man and machine diagnostics, person identification. It has been implemented using MAT LAB graphical user interface. This paper aim to develop a hand vein recognition program in MAT LAB uses the information of the hand vein structure to find the feature of the vein pattern structure.

Keywords: Preprocessing, post processing, segmentation Vein pattern, Feature extraction

I. INTRODUCTION

Recognition systems are widely employed now days for identification purposes in different areas including access control applications. The demand for secure identification systems has increased exponentially over the last ten years. These systems are required to be very reliable but also easy to use since their application is no longer restricted to high-security facilities. The advantages of hand vein pattern recognition are due to the fact that veins lie underneath the skin which makes them easily accessible for the system but also hard to alter. Biometric authentication provides a high security and reliable approach to be used in security access system. Traditional method using PIN number, password, and key to identify a person is unreliable and provide a low level security. Hand vein pattern provided more reliable feature than the password based authentication system as biometric characteristic cannot be lost or changed. Biometric feature are difficult to replicate, and require the person to be present for the authentication process. Many biometric authentications such as face, finger print, and iris and voice recognition have been developed. The vein pattern recognition method of authentication is not so popular. Hand vein patterns are the vast network of blood vessels underneath a person's skin. The vein patterns are unique and are stable over a long period of time. It is invisible to human eye and it avoids the external distortion and it is not easy to replicate the vein patterns as compared to other biometric traits.

Due to the uniqueness, stability, and high resistance to criminal tampering, vein pattern offers a more secure and reliable traits for biometric authentication system [1] [2]. In this dissertation, study of authentication by back hand vein pattern recognition has been made ,which consist of four stages : 1. obtaining the image of back of hand vein 2.Image segmentation and extracting the vein pattern from the vein images of back of hand; 3. getting the features from the vein pattern; 4. The matching schemes for authentication.

In this project the main task to extract the co-ordinate of vein pattern and image segmentation. In this project local thresholding methods used for segmentation of hand vein pattern.

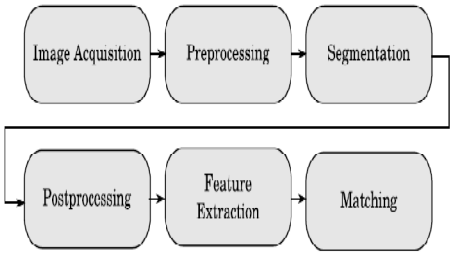


Fig. 1. Block digram of proposed system.

In this paper has been made to study and implantation of an efficient hand vein structure authentication using

mat lab graphical user interface. The various study steps have been described blow.

- To design MAT LAB graphical user interface.
- Image acquisition and image preprocessing.
- Image segmentation and post processing.
- Feature extraction.
- Matching

II. IMPLEMENTATION OF MAT LAB GUI

This section described how to design MAT LAB graphical user interface.

A graphical user interface (GUI) is a graphical display in one or more windows containing controls, called components that enable a user to perform interactive tasks. The user of the GUI does not have to create a script or type commands at the command line to accomplish the tasks. Unlike coding programs to accomplish tasks, the user of a GUI need not understand the details of how the tasks are performed. GUI components can include menus, toolbars, push buttons, radio buttons, list boxes, and sliders—just to name a few. GUIs created using MATLAB tools can also perform any type of computation, read and write data files, communicate with other GUIs, and display data as tables or as plots.

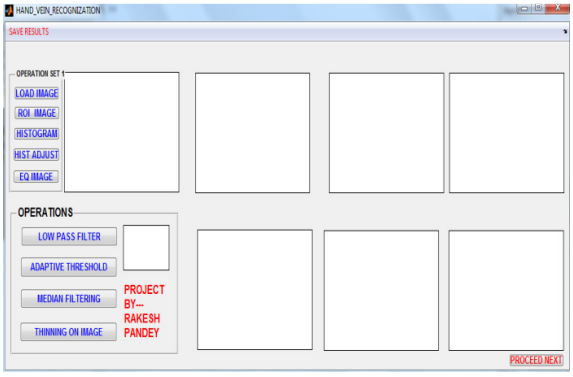


Fig. 2. Design of MAT LAB GUI.

III. IMAGE ACQUISITION & PREPROCESSING

In this section, the first two steps in the vein recognition process have been described: (1) Image acquisition where an input image of the hand is captured (2) preprocessing where that image is prepared for further processing by the system.

An array of infrared light-emitting diode (LED) and a thermal camera modified from a webcam was used to capture the vein pattern in our system. The first step of the preprocessing is smoothing and noise removal step is applied. To remove the effect of the noise a Gaussian filter is used. Then a median filter is employed to remove noises resulted from the presence of hairs on the back of the hand. Histogram equalization is used for contrast enhancement [5].

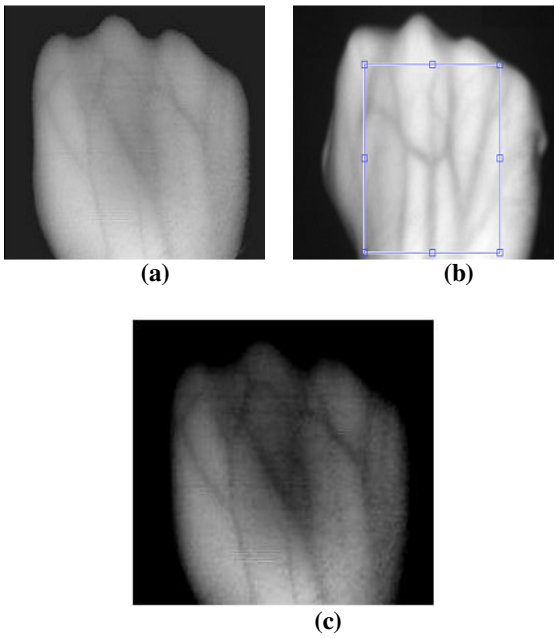


Fig. 3. (a) original hand image (b) ROI of an image (c) Gaussian filtered image.

III. IMAGE SEGMENTATION & POSTPROCESSING

In this section discussed the method that has been proposed in the paper for extracting the vein pattern in an image. This process of segmentation is most crucial and prominent to the performance of the system. These are methods used to clean up the segmented image and remove undesired elements caused by noise.

Various segmentation methods are used into segments an image. The fundamental mean of segmentation is to partition an image into several meaningful parts. These segmentation methods are Local Thresholding, Reapated Line Tracking, and Edge Detection Using Laplacian of Gaussian. Local Thresholding gives better segmented image of the gray scale image [3] [4]. Local thresholding technique used method in this project. Segmentation of an image is prominent process of the entire vein pattern system.

Local adaptive thresholding

$$\text{Thresholding value(T)} = \frac{\text{mean value of the pixels(m)} + \text{median value of the pixels(M)}}{2}$$

For example given a 3×3 window:

110	110	114
100	104	104
95	88	84

$$= \frac{\text{m}}{110 + 110 + 114 + 100 + 104 + 104 + 95 + 88 + 85}{9}$$

$$= 110$$

Now next calculate to median value of the given a 3×3 window: These pixels are arranged in ascending order:

$$\{84,88,95,100,104,104,110,110,114\}$$

The number of pixels is odd now median value of the pixels

$$\text{M} = \frac{(\text{n}+1)^{\text{th}}}{2} = \frac{(9+1)^{\text{th}}}{2} = (5)^{\text{th}} = 104$$

Where: n represents the number of pixels

$$\text{T} = \frac{(\text{mean pixel value} + \text{median pixel value})}{2}$$

$$= \frac{(110 + 104)}{2} = 107$$

The threshold value of the 3×3 window size is 107.it means if pixel value is below the threshold it set to be background value. If pixel value is above the threshold it set to be foreground value. Result show in figure 1.4

(a)

(b)

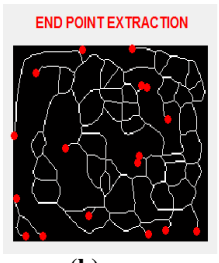
Fig. 4. (a) Original image (b) Local threshold image

IV. FEATURE EXTRACTION & RECOGNITION

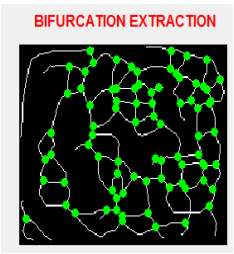
In this section, talks about the final steps involved in the vein pattern recognition system namely feature extraction and recognition. These steps are highly dependent on each other since recognition method generally only works on a specific kind of feature. Feature extraction is the process to find some characteristic of each pixel for example pixel value, pixel color components. Feature extraction plays an important role in biometrics recognition because the performance of feature matching is greatly influenced by its output.

End and crossing points are features [6] [7] that are often used for vein pattern recognition. Here is introduced the method for extracting these points based on a vein image after thinning. Extraction here basically means finding the coordinates and characteristics of these specific points. Such as pixel value, pixel color etc.

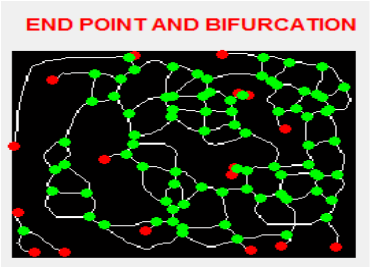
(a)



(b)



(c)



(d)

Fig. 5. End and Crossing point points of original hand image

V. CONCLUSION

Co-ordinates of end points and crossing points depicted in figure has been found after finally simulation of the program for hand vein pattern fig 1.5depicts the original image with extractions.

Form the above results, it can be summarized that the filter complexity reduced and the result found is unique

and it has the property of zero false acceptance rate and on the basis of the result obtained it is evident that the hand vein pattern can be implemented for high security and reliability application. The programming developed is simple, less complex and low cost. The result obtained is better as compared to the previous research work.

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