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CONTACTLESS PALM VEIN RECOGNITION USING A CANNY EDGE DETECTION ALGORITHM

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Abstract- In this modern world, we are using e-mail, internet resources etc. This leads to increasing necessity of security concern. Automated measurement of physiological and behavioral characteristics are used as authenticate identity is known as biometrics. The physiological characteristics would be the physical human traits like fingerprints, hand shape, eyes, face and veins. The behavioral characteristics measure the hand gesture, facial expressions and signature. Canny edge detection algorithm is popular for texture representation owing to its discrimination ability and computational efficiency. In this paper, an improved canny edge detection algorithm is presented for achieving a better matching performance for contactless palm vein recognition. Using this algorithm, abuse of stolen identity cards and passports will be reduced enormously.

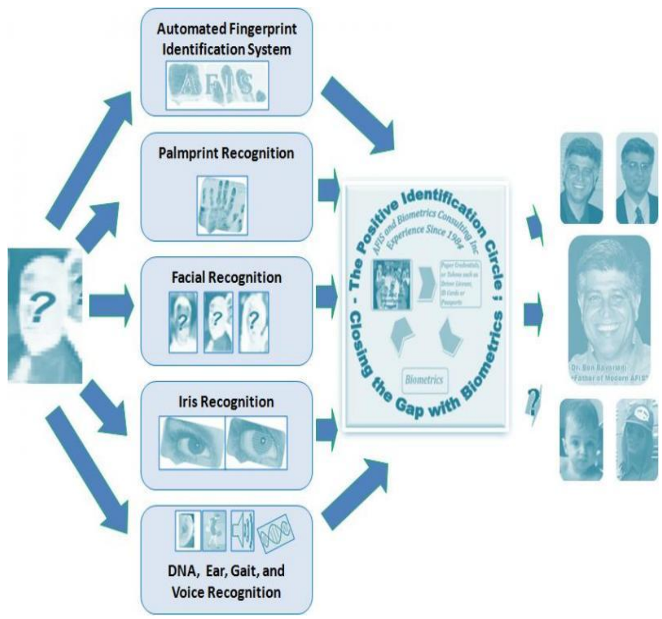
***Keywords*-Biometrics, Palm vein recognition, canny edge detection algorithm, matched pixel ratio.**

1. INTRODUCTION

In this paper, a rapid development of financial activities and security awareness, society authentication such as passwords, smart cards and personal numbers was highly incapable of reaching the needs of convenience and security in day-to-day applications. Under such condition, biometric techniques are used for identification and it will be able to find the intrinsic and extrinsic characteristics of human such as face iris, palm print, hand shape and handwriting or signature. Physical biometrics includes iris, retina, vein pattern, hand geometry, face, finger print and ear shape. Behavioral biometrics includes keystroke dynamics, signature dynamics, walking gait and voice.

Among these, facial recognition is popular for identifying individuals in clean environments on the basis of their unique facial characteristics in the absence of direct contact with the individual. Face view can be blocked little bit by hair, glasses, scarves and facial notification can be varied based on lighting conditions which causes lower

performance in real world applications. In factory or construction sites, external particles such oil on the finger, dirt and moisture also have an ill effect on recognition performance. In iris recognition, high perceptive is its greatest advantage, but the cost of scanner is unacceptable. In hand shape recognition, the process is easily accepted by users, but arthritis or rheumatism and change in temperature causes deformation in shape of hand which leads to decrease in rate of recognition.



Related Work

In general , veins includes palm veins, dorsal veins, finger veins, wrist veins and sclera veins. Among these, palm vein pattern has higher performance and superior to other vein patterns due to the reason of getting higher biometric characteristics and flexibility of image acquisition. Geometry based methods are isolated from fingerprint and palm print recognition that gains line-like, curve and point information. Statistical-based methods has statistical information such as histogram and moments

2. EXISTING SYSTEM:

Fingerprint recognition is the identification by using patterns of friction ridges and valleys on an individual's fingertips which are unique to that individual. Voice recognition is the identification using the acoustic features of speech that have been found to differ between individuals. Face recognition uses the visible physical structure of the face and analyses the spatial geometry of distinguishing features in it to identify an individual. The iris is the colored ring of textured tissue that surrounds the pupil of the eye. The process used by a biometric system to verify a signature is called as dynamic signature verification. The angle at which the pen is held the number of times the pen is lifted. There are many disadvantages in the existing system which includes a person voice changes over time, some people have damaged or eliminated fingerprints and system can be fooled by imitating and a lot of memory for the data etc.

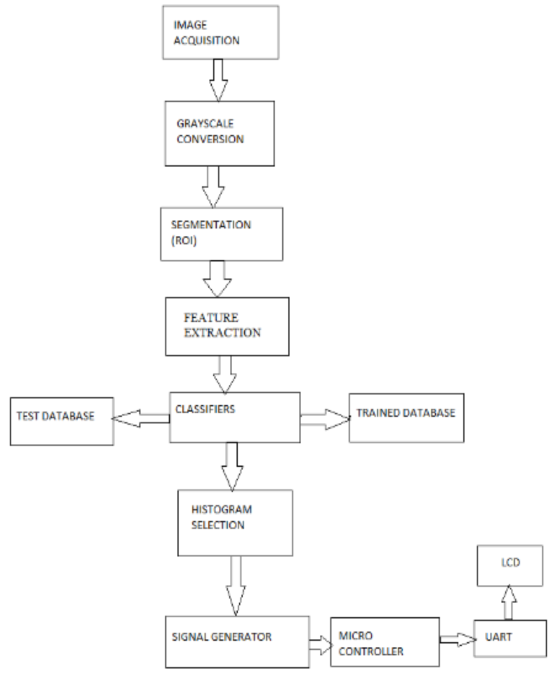
3. PROPOSED SYSTEM:

In this technology ONE'S PALM is used as the "PASSWORD" for verification. The veins in the palm of the individual are scanned and verified thus providing the access. Palm vein authentication is one of the vascular pattern authentication technologies. It includes vein patterns of the palm, hand or fingers as personal identification data. The palm vein authentication uses the vascular patterns of the palm as personal identification data. First, the individual places his palm on the sensor, thus the sensor takes the "palm vein image" and compares it with the pre registered one with the help of infra red rays. If there is a match with the pre-registered accept it, if not access is denied.. A palm has wide area and more complicated vascular pattern and contains some differentiating features for personal identification when compared with the patterns present in the back of the hand and the ventral side or dorsal side of the fingers. The palm normally has no hair and thus eliminates an obstacle to capturing the vein pattern and it is less susceptible to a change in skin color. For this purpose the contactless palm vein authentication device was launched.

3.1. ARCHITECTURE DESIGN

Image acquisition in image processing can be broadly defined as the action of retrieving an image from hardware-based source. It is always the first step in the workflow sequence. The goal of this process is to have a source of input that operates within such controlled and measured guidelines. In photography and computing, a grayscale digital image is having the value of each pixel , that is, it carries only intensity information. Images of this sort, is black and white, are composed of shades of gray, changing from black at the poor intensity to white at the highest. Grayscale images are different from black and white images. Grayscale images have many shades of gray in between.

In computer vision, image segmentation is the process of partitioning a digital image into many segments. The aim of segmentation is to simplify and/or change the representation of an image. The result of image segmentation is a set of segments that collectively cover the whole image extracted from the image. Each one of the pixel in a region is similar with respect to some characteristic or computed property. The segmented image is sent into feature extraction block which depends on canny edge detection algorithm.



A histogram is a graphical representation of the distribution of data. The signal generator is used to generate a signal according to the histogram results. The generated signal is sent into microcontroller AT89S52 which is connected with UART and the output signal is fed into LCD to display whether the person is authenticated or not.

4. CANNY EDGE DETECTION ALGORITHM

The Process of Canny edge detection algorithm can be broken down to 5 different steps:

1. Apply Gaussian filter to smooth the image in order to remove the noise
2. Find the intensity gradients of the image
3. Apply non-maximum suppression to get rid of spurious response to edge detection
4. Apply double threshold to determine potential edges
5. Track edge by hysteresis: Finalize the detection of edges by suppressing all the other edges that are weak and not connected to strong edges. Every step will be described in details as following..

Gaussian Filter: As all edge detection result can be easily affected by the noise from the image, it is essential to filter out the noise to prevent the detection from mistakes caused by them. To smooth the image, a Gaussian filter is applied to convolve with the image. This step will slightly smooth the image, so that it will not be significantly affected by separate obvious noise in the image. The equation for a Gaussian filter kernel with the size of 2k+1*2k+1 is shown as following:

$$H_{ij} = \frac{1}{2\pi\sigma^2} * \exp\left(-\frac{(i-k-1)^2 + (j-k-1)^2}{2\sigma^2}\right)$$

Pay attention that, the selection of the size of the Gaussian kernel will affect the performance of the detector. The larger the size is, the lower is the detector's sensitivity to noise. Additionally, the localization error to detect the edge will slightly increase with the increase of the size of Gaussian kernel. It is better to use 5x5 filter.

Finding the Intensity Gradient of the Image: An edge in an image may point in a variety of directions, so four filters are used to detect all edges in the image and also used to correct the blurred pixels. The edge detection operator writes a value for the first derivative in the horizontal direction (G_x) and the vertical direction (G_y). From this the edge gradient and direction can be determined:

$$\mathbf{G} = \sqrt{\mathbf{G}_x{}^2 + \mathbf{G}_y{}^2}$$
$$\mathbf{\Theta} = \operatorname{atan2}(\mathbf{G}_y, \mathbf{G}_x),$$

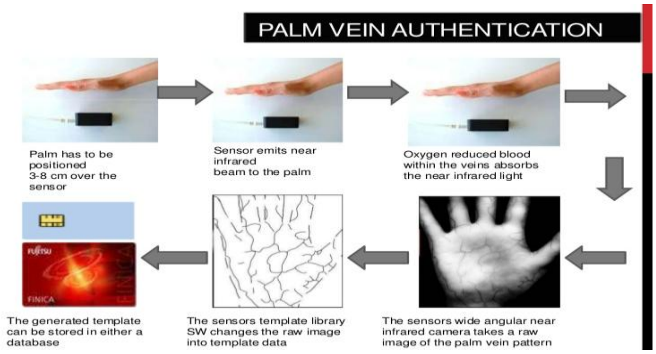
where G can be computed using the hypot function and atan2 is the arctangent function with two arguments. The edge direction angle is rounded to one of four angles representing vertical, horizontal and the two diagonals (0, 45, 90 and 135 degrees for example). An edge direction falling in each color region will be set to a specific values.

Non-maximum Suppression: Non-maximum suppression is an edge thinning technique. Non-Maximum suppression is applied to "thin" the edge. After applying gradient calculation, the edge extracted from the gradient value is still blurred. With respect to condition 3, there should be one accurate response to the edge. Thus non-maximum suppression can help to suppress all the gradient values to 0 except the local maximal, which indicates location with the sharpest change of intensity value. The algorithm for each pixel in the gradient image is: Compare the edge strength of the current pixel with the edge strength of the pixel in the positive and negative gradient directions. If the edge strength of the current pixel is the largest compared to the other pixels in the mask with the same direction (i.e, the pixel that is pointing in the y direction, it will be compared to the pixel above and below it in the vertical axis), the value will be preserved. Otherwise, the value will be suppressed.

At every pixel, it suppresses the edge strength of the center pixel (by setting its value to 0) if its magnitude is not greater than the magnitude of the two neighbors in the gradient direction. For example, if the rounded gradient angle is zero degrees (i.e. the edge is in the north–south direction) the point will be considered to be on the edge if its gradient magnitude is greater than the magnitudes at pixels in the east and west directions, if the rounded gradient angle is 90 degrees (i.e. the edge is in the east–west direction) the point will be considered to be on the edge if its gradient magnitude is greater than the magnitudes at pixels in the north and south directions, if the rounded gradient angle is 135 degrees (i.e. the edge is in the northeast–southwest direction) the point will be considered to be on the edge if its gradient magnitude is greater than the magnitudes at pixels in the north west and south east directions, if the rounded gradient angle is 45 degrees (i.e. the edge is in the north west–south east direction) the point will be considered to be on the edge if its gradient magnitude is greater than the magnitudes at pixels in the north east and south west directions.

Double Threshold: After application of non-maximum compression, the edge pixels are quite accurate to present the real edge. However, there are still some edge pixels at this point caused by noise and color variation. In order to get rid of the spurious responses from these bothering factors, it is essential to filter out the edge pixel with the weak gradient value and preserve the edge with the high gradient value. Thus two threshold values are set to clarify the different types of edge pixels, one is called high threshold value and the other is called the low threshold value. If the edge pixel's gradient value is higher than the high threshold value, they are marked as strong edge pixels. If the edge pixel's gradient value is smaller than the high threshold value and larger than the low threshold value, they are marked as weak edge pixels. If the pixel value is smaller than the low threshold value, they will be suppressed. The two threshold values are empirically determined values, which will need to be defined when applying to different images.

Edge Tracking by Hysteresis: So far, the strong edge pixels should certainly be involved in the final edge image, as they are extracted from the true edges in the image. However, there will be some debate on the weak image pixels, as these pixels can either be extracted from the true edge, or the noise variations. To get an accurate result, the poor strength edges caused from the latter reasons should be get rid of. The criteria to determine which case the weak edge belongs to is that, usually the weak edge pixel caused from true edges will be connected to the strong edge pixel. To track the edge connection, Binary Large Object-analysis is applied by looking at a weak edge pixel and its 8-connected neighborhood pixels. As long as there is one strong edge pixel is involved in the BLOB, that weak edge point can be identified as the one that should be preserved.



5. CONCLUSION

In this paper, Palm vein pattern authentication technology developed by Fujitsu. It was being used in a wide range in Japan. If this palm vein authentication technology is introduced in our country we can solve many problems such as password protection in ATM. According to the government timings, employees can work accordingly if we implement this technology to have high security. Definitely this technology will bring a revolution in the future in the field of science and technology.

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