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A Review Paper on Biometric Recognition using Iris Scanner

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***Abstract*—**The main purpose of the paper is assembling and developing an iris recognition system in order to verify uniqueness of the human eye of faculty in a college for attendance management system. This system based on biometrics and wireless technique solves the problem of spurious attendance and the trouble of laying the corresponding network. Here biometric recognition is performed with respect to iris because of its unique biological properties. The iris is unaffected by external environmental factors and remains stable over time. It can make the college staff attendance management more easy and effective. This paper includes image acquisition, the preprocessing system, segmentation, feature extraction and recognition.

***Keywords*—** *Iris recognition; preprocessing system; segmentation; feature extraction.*

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I. INTRODUCTION

Traditionally college staff attendance management methods were based on physical key, ID card, password, etc. In all the above mentioned methods there are high chances of keys getting lost, forgery or passwords may be forgotten.Due to these shortcomings and requirement for high level of security,it has led to development of personal identification on next level using biometrics. Biometrics refers to metrics related to human characteristics. It is used to identify individuals in a group that ae under surveillance.Within few seconds biometric recognition is able to compare thousands of records.Biometrics are of various kinds. Iris, facial, fingerprint comprises of physiological biometrics whereas voice and signature are considered as behavioural biometrics. Of all these biometric features, fingerprint verification has received considerable attention and has been successfully been used in law enforcement applications.

The human iris is an annular part between the pupil and the white sclera as shown in fig 1.

The probability that two iris are found to be similar is close to zero. Due to such high level of security and uniqueness it is found reliable in most secure applications.There are many applications that require high level of confidence concerning personal identification of people involved. Such applications include banking or physical access to some secure facility. Such applications traditionally used to make use of paper or ID cards for authentication and identification purposes.

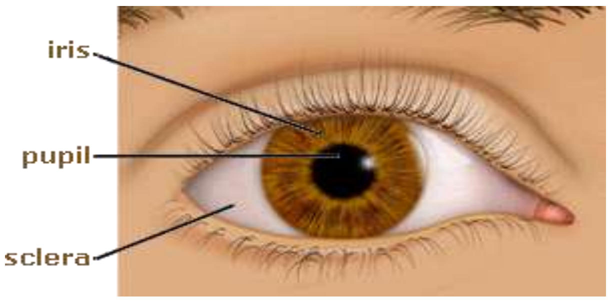

Figure 1. Image of an eye

But nowadays these systems are too easy to defeat. As iris is an organ that is externally visible, identification and authentication based on iris patterns will be of great advantage for practical applications as iris is non-invasive by others.

II. LITERATURE SURVEY

Much advancement have been made in the field of iris segmentation techniques. In 1993, J.G Daugman proposed an approach for iris segmentation. In the segmentation stage, this author introduced an integrodifferential operator to find both the iris inner and outer borders. The methodology used by him is most popular amongst all iris recognition techniques. In this paper, Daugman assumed the iris and pupil to be circular and introduced an operator for edge detection. This operator searches over the image domain (x, y) for the maximum in the blurred derivative with respect to increasing radius r, of the normalized contour integral of I(x, y) along a circular arc ds of radius r and center (X0, Y0) [1,2].

A methodology was proposed by Wildes in 1997 in which the intensity values of the image is converted into a binary edge map. The edge map is constructed through the Canny edge detector. In order to incorporate directional tuning, the image intensity derivatives are weighted to favor ranges of orientation. Then the well-known Circular Hough Transform is used to obtain the boundaries. The accuracy of this methodology is dependent on the edge detection algorithm [1,3]. In 2004, J. Huang proposed an approach which would work for iris images having noise. This method involved rough localization and normalization, edge information extraction and the fusion of edge and region information [4].

In a paper by P.Gupta et al (2006), Circular Hough Transform was used for detection of outer iris and inner iris boundaries. The procedure first finds the intensity image gradient at all the locations in the given image by convolving with the sobel filters. The absolute value of the gradient images along the vertical and horizontal direction is obtained to form an absolute gradient image. The absolute gradient image is used to find edges [5].

III. PROPOSED WORK

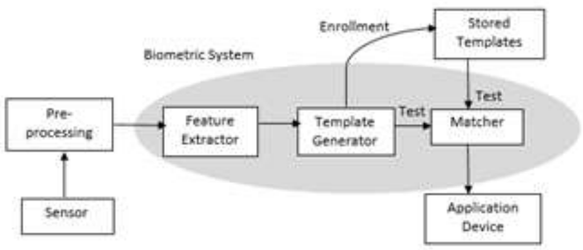

Figure 2: Block diagram of proposed work

The proposed work as shown in figure 2 involves assembling and developing an iris recognition system in order to verify both uniqueness of the human eye of faculty in a college for attendance management system and also its performance as a biometric. This system based on biometrics and wireless technique solves the problem of spurious attendance and the trouble of laying the corresponding network. It can make the users' attendances more easily and effectively. For determining the recognition performance of the system two databases of digitized greyscale eye images were used. Firstly, image preprocessing is performed followed by extracting the iris portion of the eye image. The extracted iris part is then normalized, and IrisCode is constructed using 1D gabor filters. Finally two IrisCodes are compared to find the Hamming Distance, which is a fractional measure of the dissimilarity. Experimental image results show that unique codes can be generated for every eye image.

IV. IMAGE ACQUISITION

Image acquisition is a process of capturing iris images using a specifically designed sensor. Due to small size of iris, capturing all the features of iris to uniquely identify it is a challenging task. To capture an iris image a CCD camera is used of resolution set to 640x480[6]. The distance between the human eye and the camera is normally between half a meter to one meter.The task of CCD camera is to take the image and convert it into electronic data. The image from the camera is taken into consideration and value of each different pixel is transferred. The voltages from the CCD-chip are read out. Thereafter the signals of each data are amplified and sent to an ADC (Analog to Digital Converter). When designing in image acquisition apparatus, three main aspects namely the lightning system, the positioning system and the physical capture system has to be considered. The first record of an individual in the biometric system is called as enrollment[7]. In the enrollment phase individual's information is stored in the database. In the next use the newly captured image is compared with the records in the database.

V. PREPROCESSING

The iris image captured using CCD camera not only contains an iris, but also some unwanted parts such as pupil, eyelids, etc. The captured image needs to be preprocessed to localize the iris and normalize it. We also need to reduce the influence of non-uniform illumination.In this stage the iris images are converted from RGB to gray level. As shown in the figure 3, the part of the image between pupil and sclera are detected.This is how the actual iris image is detected. This is called iris localization. Enhancement in this obtained iris image is obtained by using histogram equalization.

1) Iris localization

In iris localization the inner and outer boundaries of iris are considered as circles. The eye is considered to be comprising of two circles that is the pupil and limbus and two parabolas which are the upper and the lower eyelids. The circles can be defined with equation (1) as

$$(x - x_i)^2 + (y - y_i)^2 = r_i^2 \qquad \ldots\ldots \quad (1)$$

where (x_i , y_i) is the center and ri is its radius. But the two circles are usually not co-centric. The algorithm to detect he boundaries are is canny edge detection [1].These steps are performed more than once for accurate estimate. The pupil and eyelash regions have lower intensity values and reflection and eyelids have higher intensity values. A real part of Gabor filter captures the eyelash in spatial domain. To facilitate the subsequent processing, all kinds of noises are detected and the iris images are approximately segmented.

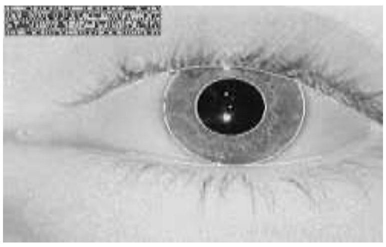

Figure 3. Localized image of an eye.

VI. SEGMENTATION

The image of iris obtained contains noise. This image needs to be filtered in order to remove noise. The filtered image is then subjected to canny edge detector to detect the inner and outer boundaries. Then Hough transform is used to detect the circles in the edge image [6]. After detecting the circles the next step is to find the changes in the intensity level of the image. For this purpose we need to adjust the gamma radiation which will keep the brightness overall under control. Any pixel that is not an edge pixel is suppressed using non maxima suppression. Images obtained of iris for different people may not be of same size which may not lead to accurate recognition results. Due to these reasons we need to compensate for iris deformation. This is done using normalization and enhancement.

1) Iris Normalization

After finding an accurate image of iris we need to generate an unique code for each iris pattern so that it can be easily compared with the existing records and used for identification purpose. For the code generation the iris image needs to be normalized since the features of the iris differ from person to person [3]. So it normalizes different iris sizes to same size. This is done by unwrapping the iris and converting it into its polar equivalent.

2) Image Enhancement

The normalization reduces iris distortion caused by the pupil and simplifies subsequent processing.The image of iris obtained after normalization has brightness which is not uniform and has low contrast [5].The areas at the top and bottom of iris are covered by eye lashes. Due to which only the left and the right portion of the iris are converted into polar coordinates.

VI. FEATURE EXTRACTION

In this paper we have taken into consideration statistical feature for collecting the features of iris. In the statistical approach the correlation between the adjacent pixels is taken into consideration. In many cases an edge detector can be used as a pre-processing stage to obtain image points or image pixels that are on the desired curve in the image space. Due to imperfections in either the image data or the edge detector, however, there may be missing points or pixels on the desired curves as well as spatial deviations between the ideal line/circle/ellipse and the noisy edge points as they are obtained from the edge detector [3]. For these reasons, it is often non-trivial to group the extracted edge features to an appropriate set of lines, circles or ellipses. The purpose of the Hough transform is to address this problem by making it possible to perform groupings of edge points into object candidates by performing an explicit voting procedure over a set of parameterized image objects.

VII. FEATURE MATCHING

After extracting the features of iris image the next step is feature matching. In feature matching step the extracted features are compared with the features which are already enrolled in the database. The most efficient method for matching the features is taking the Hamming Distance between the two feature vectors [2]. The distance between the two featured vector are calculated by

$$D(F_c, F_c^i), i = \overline{1, N} \quad \ldots(2)$$

Where

Fc = Feature of the input pattern

Fci = Feature of the ith pattern from the database

N = Number of patterns in the database.

VIII. PERFORMANCE METRICS

The performance of the biometric system is described by the two error rates: FAR and FRR. False Accept Rate (FAR) is the probability that the system incorrectly matches the input pattern to a non- matching template in the database. It measures the percent of invalid inputs which are incorrectly accepted. False Reject Rate (FRR) is the probability that the system fails to detect a match between the input pattern and a matching template in the database. It measures the percent of valid inputs which are incorrectly rejected. Equal Error Rate (EER) is the rate at which both accept and reject errors are equal. In general the device with the lowest EER is most accurate. The operating point where FAR and FRR are equal corresponds to the Equal Error Rate (EER) that measures the overallperformance of the biometric system. It also corresponds to the threshold at which the FAR is equal to FRR.

IX. CONCLUSION

In this paper, an efficient method for personal identification and verification with iris patterns has been presented. We can develop a new Iris Recognition system capable of comparing and verifying two digital eye-images and this technique is used as an authentication mechanism for maintain college faculty attendance. This identification system is quite simple requiring few components and is effective enough to be integrated within the kind of system that would serve the purpose mentioned above. The errors (False Acceptance Rate, False Rejection Rate, etc) that would occur can be easily overcome by the use of stable equipment. Judging by the clear distinctiveness of each individual‘s iris pattern we can expect iris recognition systems to become the leading technology in identity verification.

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