Iris Scanning: A Comprehensive Review of Identification and Verification

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Abstract— **Iris Scanning is a method of biometric authentication that uses pattern recognition technique based on high resolution of the irises of an individual eye. Biometric is a method of capturing a person's unique data that distinguishes him or her from others. Iris Scanning is one of the powerful and accurate identification technique in modern world. Iris Scanning is fool proof technique for identification of individuals without using the cards, passwords or pins. This technique is quicker and secure. It facilitates automatic identification where by electronic transactions or access to places, accounts or information are made easier, quicker and secure.**

***Keywords*— Cornea, Retina, Sclera, Iris**

1. INTRODUCTION

Now a days, IT system and security environment can have one of the main threats is the possibility of intruders in he system. This is normally used by user authentication schemes based on secret codes, passwords and identification cards.

Iris Recognition System

Most dangerous security threats is the impersonation in which somebody claims to someone else. The current trend in the research world is headed towards biometrics since the level of security is highly increased. The security services that counter this threat are identification and authentication. The verifier can be identified and authenticated by what he knows(password), by what he owns(passport) or by who is he (biometrics).The most popular biometrics features are based on individual's signatures, faces, iris, fingerprints, retinal, voices and hands. However, as research evolves the claim that the human Iris is one of the most appropriate features gain way. Ophthalmologists proved to be right and now Iris Recognition is expected prevail as the best way to go for human recognition. It is considered to have the best results along with DNA pattern recognition. Using other Biometrics techniques the probabilities of False Reject (Type I) and False Accept (Type II) error are graphically shown using a graph ranging from 0 to 10 %. Iris Recognition needs a graph ranging from 0-0.09% since reported results show error rates at approximately 0.00076%.

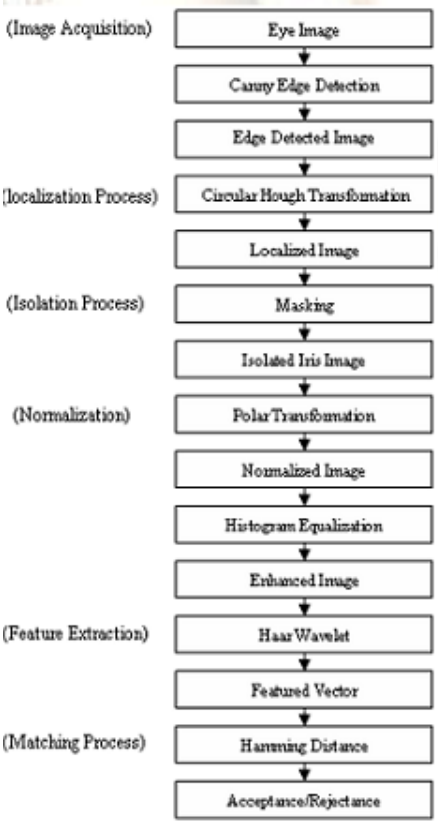

Fig1: Iris Recognition System

When a subject wishes to be identified by iris recognition system, his/her eye is first photographed and then a template (iris code) created for his/her iris region. This template is

then compared with the other templates stored in a database until either a matching template is found and the subject is identified or no match is found and the subject remains unidentified. There are several method for accomplishing single task as edge detection I have Sobel Operator, Prewitt Operator, Canny Edge Detection, Roberts method and so on, for boundary detection as Hough Transformation, Circular Hough Transformation, Integro-Differential Operator, Gradient based approach, Clustering algorithms and so on, for feature extraction I have phase based methods, zero crossing and texture analysis based methods.

2. **Technical Issues**

2.a.Localization: The acquire iris image has to be preprocessed to detect the iris which is an annular portion between the pupil(inner boundary) and the sclera(outer boundary).The first step in iris localization is to detect pupil which is black circular part surrounded by iris tissues. The center of pupil can be used to detect outer radius of iris patterns. The important steps involved are: a .pupil detection b. outer iris localization

Fig2.localized iris image

2.b.Isolation: Now the task is to isolate the iris.There is some presence of white of the eye in the images used. This was done by using a masking technique as here i am choosing best technique among other so i will use Gaussian Mask and cropping the image to minimize the area that does not contain any edge data. The mask is a circular one which has the same radius as the iris. It thus passes all pixels that are contained in the circle which al are the pixels forming the iris. By making use of the center and radius which are calculated in advanced step we set the polar coordinate system. The feature of the iris is extracted in this coordinate system.

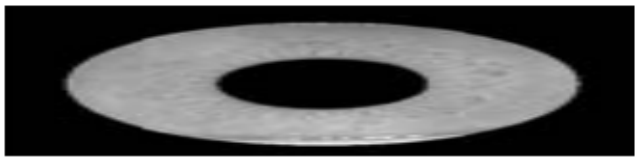

Fig3. Isolated iris image

2.c. **Image Acquisition:** One of the major challenges of automated iris recognition is to capture a high-quality image of the iris while remaining non invasive to the human operator. Given that the iris is a relatively small (typically about 1 cm in diameter), dark object and that human operators are very sensitive about their eyes, this matter requires careful engineering. Several points are of particular concern. First, it is desirable to acquire images of the iris with sufficient resolution and sharpness to support recognition. Second, it is important to have good contrast in the interior iris pattern without resorting to a level of illumination that annoys the operator, i.e., adequate intensity of source (W/cm) constrained by operator comfort with brightness (W/sr-cm). Third, these images must be well framed (i.e., centered) without unduly constraining the operator (i.e., preferably without requiring the operator to employ an eye piece, chin rest, or other contact positioning that would be invasive)

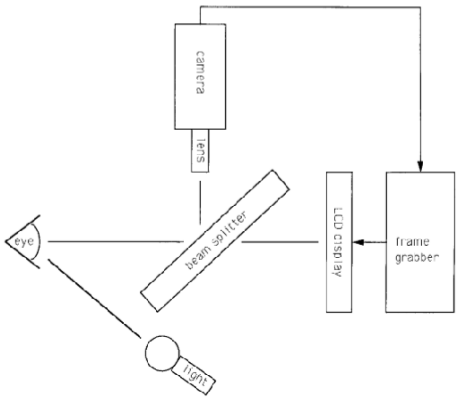

Fig. 4(A) Image Acquisition

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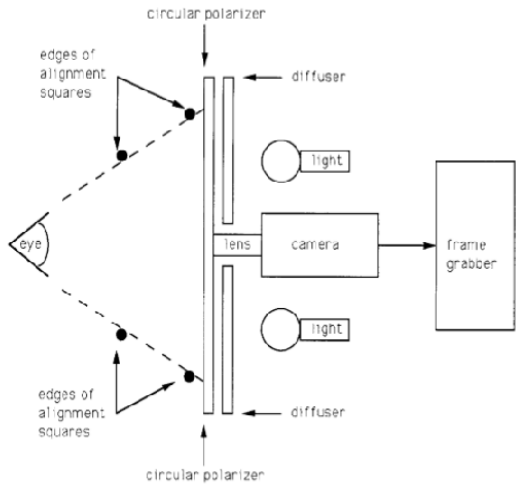

2. System Implementation:

Daugman's Iris recognition system consists of an image acquisition rig (standard video camera, lens, frame grabber, LED illuminator and miniature video display for operator positioning interfaced to a standard workstation (Sun 4). The system can operate in three modes including enrolment, verification and authentication. The enrolment and verification modes take less than a second to complete. It has been awarded a US patent. There exists a commercial version of this model through Iris Scan. In this system further optimization and specific hardware modules were used.

3.a. Image Analysis

As we have already mentioned the edge detector operator detects the sharp boundary at the limbus between the iris and the white sclera. However, there are cases that this edge is not present in the picture most frequently due to closed eyelids or even no present of eyes in the image. The system deals with this by continuing grabbing image frames until several frames in sequence confirm the resent of an iris. In the actual system a miniature liquid-crystal TV monitor provides live video feedback helping the users see if their eye is included in the recordings. This procedure also produces some measurements of the reaction of the oscillations in the iris pupil. Something that could be of further use in building even higher security systems since it could overcome special efforts from impostors that could paint an iris in a lens

3.b. Correspondence

The final codes that will represent the iris have to be extracted from corresponding areas of iris texture. The same regions of the iris need to be tested for similarity. Scaling and the overall iris image can be varied due to pupillary contraction or difference in the camera distance. The stretching from the iris for pupil contraction is modelled through the homogeneous rubber sheet. This is accomplished through the use of a projected polar coordinate system. Thos sheet has the topology of the annulus anchored along its outer dimensionless real coordinates to each point of the iris.

After this mapping zones of analysis are defined in this projected doubly dimensionless coordinate system. This zones regards the top of the iris as well as the area where the light source coming from the below causes a corneal reflection. The illumination of an angle even if it causes reflection because it helps avoiding influence from human sunglasses.

3.c. Feature Code

In order to construct identifying codes from the analyzed iris textures 2-D Gabor filters are used across multiple scales. More precisely, one of the effective ways for extracting coherent and incoherent textual information from the detailed texture of an iris is the computation of 2-D Gabor phasor coefficients. Daugman introduced these particular filters in 1980. Their mathematical properties include the ability of providing the high-resolution information about the orientation and spatial frequency content of the image structure. Obtaining the required coefficients for these complex functions provide the necessary information needed to represent the iris by its Gabor transform. The final code for the particular Iris (256 bytes) is calculated

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bit by bit by projecting particular iris regions to the Gabor filters. The number of bytes was selected according to the capacity of the three channel magnetic stripe of the standards credit cards. However, this is the upper bound on the capacity of the iris information.

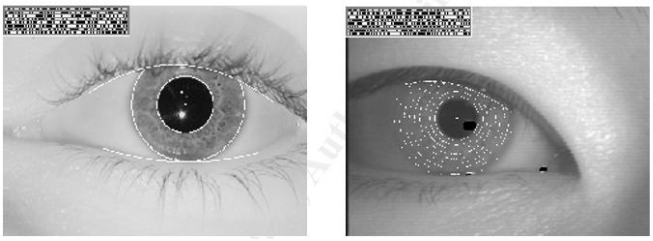

Fig.5 a) Edge Detection b) Iris with Segments

3.d. Pattern Recognition

Samples from stochastic signals with sufficient complexity it is very easy to find ways to check whether two samples show enough agreement to reject the hypothesis they come from independent distributions. In this work demodulating the iris texture and coding the phasor argument converts the problem of pattern recognition to a simple statistical test of independence. In order to reach the recognition result the Hamming Distance of the code of the new iris and all the stored codes is calculated. A simple XOR operation between the corresponding pair of codes provides this Hamming Distance. This is done due to the fact that the iris has approximately 400 degrees of freedom, a number far less than 256 x 8. The reasons for this are the substantial radial correlations within an iris. A furrow usually propagates across the radial distance of the iris and thus its influence is extended in various remote parts of the code. The Fourier Transform of such features can be represented in the various octaves and subsequently in the different scales of analysis. Furthermore, correlation are introduces by the bandpass property of the Gabor Filters.

4. Conclusions

In this review paper, I show how a person can be identified by no. of ways but instead of carrying bunk of keys or remembering things as passwords we can use as living passwords, which is called biometric recognition technology it uses physical characterstics or habits of any person for identification. In biometrics we have a number of characterstics which we are using in our recognition technology as palm print, finger print , signature, face, iris recognition, thumb impression and so on but along those irises recognition is best technology for identifying a person. I can say that this technology is not completely developed and we need a no of scientists, researchers and developer who can work on this technology and can complete the dream of Mr. Daugman by applying the uses of iris recognition in each and every field where security is needed by the human being.

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