Iris Biometric for Effective Human Identification

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Abstract-The biometric is the study of physical traits or behavioral characteristics of human such as finger prints, face, hand geometry, gait, key strokes, voice and iris. Among the biometrics, iris has highly precise and consistent characteristics. Now days, security is one of the important factor in the field of information technology, business, e-commerce, military and etc. For this reason Personal identification has become very important. Some methods of identification are used such as PIN, Password, ID card, Signatures that are widely used and have some drawbacks. ID card or PIN can be stolen or forgotten and signatures can be limited. Most of the Companies started to use biometric authentication to protect the top secret assests. Iris detection is one of the most perfect and secures means of biometric identification. Iris has many properties which generate its ideal biometric recognition. The iris has the unique personality of very little variation over life period yet a multitude variation between individuals. Iris not only differs between identical twins but also from left to right eye. This paper covers the review of iris recognition methods which includes image acquisition, preprocessing, feature extraction and matching.

Keywords: Biometric Authentication; Iris Recognition; Image Acquisition; Matching.

I. INTRODUCTION

Biometric authentication systems use behavioral or physical characteristics to authenticate a user. These systems have become more reliable sources of authentication as compared to the traditional means like passwords or hardware tokens such as smart cards [1]. The iris recognition techniques potentially prevent unauthorized access to ATMs, cellular phones, desktop PCs, workstations, buildings and computer networks. The accuracy of iris recognition systems is proven to be much higher compared to other types of biometric systems like fingerprint, handprint and voiceprint [9].

Genetically, same identities including twins and irises of left and right eye of the same person represent different iris pattern. Another important property of biometric is its stability.

Human iris is a thin curved diaphragm, which lies between the cornea and the lens of the human eye. The front view of the iris is shown in Fig 1. The function of the iris is to control the amount of light entering through the pupil, and this is done by the sphincter and the dilator muscles, which adjust the size of the pupil. The average size of iris diameter is 12 mm, and the pupil size can vary from 10% to 80% of the iris diameter [13][14].

The iris is externally visible, yet protected organ whose epigenetic pattern remains constant throughout adult life. These characteristics make it very gorgeous for identifying individuals.

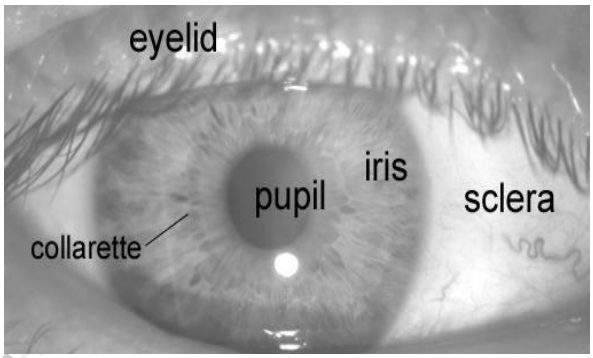

Fig.1: A Front – on view of the human eye.

Table 1 shows clearly that the out of all biometrics iris is the best as its identification rate is one person is rejected out of 12,00,000 iris pattern.

Table 1: comparative list of biometrics [2]

Method	Code pattern	Rejection rate	Security	Application level
Iris	Iris Pattern	1/12.00,000	High	High Security
Finger Print	Finger Print	1/1,000	Medium	Universal
Voice	Voice Characteristics	1/30	Low	Telecommunication
Signature	Letters Shape	1/100	Low	Low Security
Face	Outline Shape	1/100	Low	Low Security
Palm	Size, Length, Thickness of Hand	1/700	Low	Low Security

A typical iris recognition system involves four main modules that are Image Acquisition, Preprocessing, Feature extraction and Matching.

Image Acquisition deals with capturing sequence of iris images from the subject using cameras and sensors. An image acquisition consists of illumination, position and physical capture system. The occlusion, lighting, number of pixels on the iris are factors that affect the image quality. The good and clear image reduces the process of noise removal and also helps in avoiding error calculations. The infrared light can be used to enlightening the eye to avoid any secular reflections.

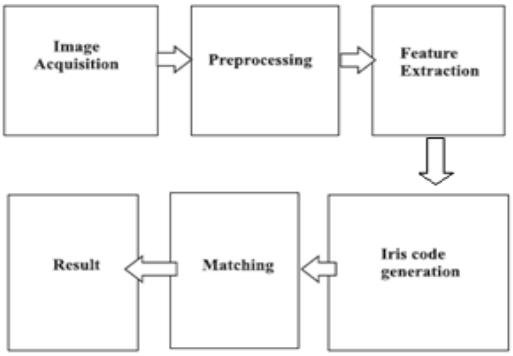

Fig.2: Iris Recognition System

II. REVIEW OF LITERATURE

M.Mani Roja et al., Dr. Sudhir Swarkar adopt a method to identify iris recognition using orthogonal Transforms. For Preprocessing they have been using Canny edge detector using a Gaussian filter. Then the iris edge and the pupil edge are extracted using image morphological operation. After normalization of red, green and blue components of the color iris using Euclidian distance method, they are combined to form the localized color iris. For feature vector extraction, orthogonal transforms like discrete cosine transform, discrete sine transform and discrete Fourier transform have been considered. For matching process they have generated match score by using Euclidean distance and decide the winner [5].

Bhawna Chouhan et al. Dr(Mrs.)Shailja Shukla developed Iris recognition system using Canny edge detection for Biometric Identification. For Preprocessing they used Integro Differential operators are then used to detect the centre and diameter of the iris, then the pupil is also diagnosed using the Differential operator for conversion from Cartesian to Polar transform. For the segmentation they applied method called Canny edge detection. By using this detection they can easily see the gradient value. Segmentation is attained either by considering a gradient in the texture feature space or by using unsupervised clustering or by texture classification. Canny edge detection is optimum even for noisy images as the method bridge the gap between strong and weak edges of the image by connecting the weak edges in the output only they are connected to strong edges. Therefore compared to other edge detection method, this canny operator is less fooled by unauthentic noise. And then they used the Hough Transform for edge linking for line mining. Its main advantages are its tactless to noise and its capability to extract lines even in areas with pixel absence. For feature extraction they have used multi resolution technique. Gabor filters have been used for multiresolution with highest accuracy result. For matching hamming distance classifier have been used [6].

Suganthy.M et al. and P.Ramamoorthy adopted the Iris Localization based on morphological or set theory which is well in shape detection. Principal Component Analysis (PCA) is used for preprocessing, in which the elimination of redundant data is carried out. Median Filtering and Adaptive thresholding are the applications used for managing the variations in lighting and noise. Feature extraction was carried out using Wavelet Packet Transform (WPT). Finally matching is performed using KNN [7].

Swati Pandey et al., Prof. Rajeev Gupta proposed an iris recognition method using segmentation and window technique. They have used the Hough transform based method to iris localization. Automatic segmentation algorithm is used to test the localized image. Windowing technique has been adopted to retrieve the region of interest and detect the iris edge. The extracted features were tested and they have proved 99% accuracy[8].

Sulochana Sonkamble et al. and Ravindra Thool have proposed a new method for feature extraction of an Iris image for personal identification system. They proposed a new approach to extract the features of ROI (region of interest) using the wavelet transform. The extracted Iris region could be normalized into a rectangular block of fixed dimensions. The Gabor wavelet transform is an effective technique that had been applied on the data set to get feature vectors of iris recognition. The normalized iris image is further encoded to generate iris template. By using this iris template the Euclidian Distance is calculated for each individual iris image. For inter class and intra class iris pattern comparison is done by applying iris code [9].

Pravin S. Patil et al. has presented a new approach for iris ferature extraction based on Gaussian-Hermite Moments. Iris image is initially sited by using circular contour Technique. Daugman's rubber sheet model have been used to generate intensity normalized flat bed iris image, which is decomposed into a set of 1D intensity signals which retain most local variations of the iris, and the significant features have been extracted from such signals using Gaussian-Hermite moments. Euclidian distance is used to appraise the degree of dissimilarity between the iris feature vector sets. The recognition performance has been observed and 99.50% result is achieved [10].

Emmanuvel Raj et al., M. Chirchi and Dr. R.D.Kharradkar used Biometric Iris Recognition for Person Identification using Cumulative sum Algorithm. They have used Three steps to locating iris. Step 1 Consists in locating the inner and outer boundaries of the iris. Step 2 to normalize iris and Step 3 to enhance the Original image. The Daugman's system, Integro Differenctial operators are used to detect the Center and diameter of Iris and Pupil. Cartesian to Polar reference transform are used to normalize the Image. For Feature Extraction they applied a method called Cumulative Sum Algorithm. Matching is based on Minimum Hamming Distance (MHD) [11].

S.Hari Prasath et at., V.Mohan Proposed a Noval Multiresolution approach based on Wavelet Packet Transform (WPT) for Iris Texture analysis and recognition. They used Integrao Differential Operator (IDO) for Iris Localization and

Normalization. For the Feature Extraction they approached methods called Morlet Wavelt and Wavelet Packet Tree Based Approach. Modified Hamming Distance (MHD) used for the Matching [11].

Jafar M. H. Ali et al., Aboul Ella Hassanien discussed efficient techniques for iris recognition system with high performance. A method of evaluating the quality of an image in the image acquisition step and Excluding it from the subsequent processing if it is not appropriate. A computer graphics algorithm is for detecting the centre of the pupil and localizing the iris area from an eye image. Transforming the localized iris area into a simple coordination system, a compact and efficient feature extraction which is based on 2D multiresolution wavelet is transformed. Matching process is based on Hamming distance function between the input code and the registered iris codes. This system finds out the recognition rate which is about 97.3% [12].

III. CONCLUSION

We have recapitulated an overview of the latest research methodology available in iris biometric recognition. The survey of various existing techniques provides a platform for the development of the novel techniques in this area as future work.

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