Volume 6 • Number 2 April - Sep 2015 pp. 27-32

International Journal of Computer Science & Communication

Volume 6, Issue 2, April-September 2015

ISSN: 0973-7391 Impact Factor: 2.5 Available at www.csjournals.com

A Novel Approach to Increase the Performance of Biometrics Iris Sensors

Nitin Sambharwal[1], Arun Kumar Yadav[2], Dr. Chander Kant[3]

[1,2] Research Scholar, Department of Computer Science and Applications, K.U., kurukshetra, INDIA

[3]Asst. Professor, Department of computer Science and Application, K.U., Kurukshetra, INDIA

Abstract: This paper presents a new approach that is to increase the performance of a biometric system. The iris is a highly accurate biometric identifier. However widespread adoption is hindered by the difficulty of capturing high-quality iris images with minimal user cooperation. This paper also describes to increase performance of iris system designed for stand-off cooperative access control. The iris system captures the image of who stand in front of and face the system after 3.2 seconds on average. The iris camera lens has its focal distance automatically adjusted based on the subject distance to identify a individual. Here in this paper, we have proposed a idea that will increase the performance of a system by increasing the recognition speed and reduce the access time along with some parameters of a iris sensor.

Index Terms: Iris, Iris parameters, Distance based sensors, Wavelength based sensors etc.

1. INTRODUCTION

The human being iris has been used in various automated recognition systems, as well as others biometrics, for the purpose of identification and verification. Since its characteristics are only one of its kind to each individual and also stable with the age, the iris has a great potential use in the biometric noninvasive evaluation [1][2].

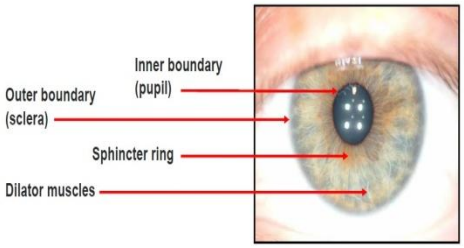


Fig 1 Showing the different parts of Iris.

So basically an iris is the colored portion of the eye surrounding the pupil. Its pattern results from a meshwork of muscle ligaments, and its color and contrast are determined by Pigmentation.

There are some basic advantages of Iris trait and these are as follow:

a) Difficult to forge because it is very unique, potentially more discriminate than fingerprints.

b) Remains stable over an individual's lifetime span.

c) For co-operating point of view, iris pattern is captured very quickly into a image.

Before starting the iris based recognition system there are some features of a good biometric sensor are given as follows and these are as follows[3]:

a) It should correctly convert analog input data into digital data for processing.

b) The sensor should be easy to operate and use.

c) The sensor should be non-intrusive i.e. spoof attacks should not be possible on it.

d) It should not accommodate any such hardware which physically affects user.

e) Error rates should be low.

f) Biometric sensor should be of reasonable cost.

1.1) Parameters of iris sensors: There are some basic parameters of iris sensors and these are explained below with the help of Fig 2[4]:

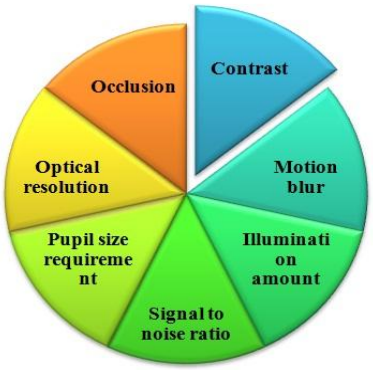


Fig 2 showing various parameters of iris sensors

a) Contrast: It is the difference in luminance or color that makes an object (or its representation in an **image** or display) noticeable. The term contrast is related to lens design. The typical values specified by ISO say that there should be minimum separation of 70 gray levels between iris and sclera and 50 gray levels between iris and pupil.

b) Motion blur: If a person's eyes are not in a proper constant ratio (for e.g. in case of head movement, so a focused image can't be obtained). This can also be possible if there is camera in motion direction but eyes are not moving according to it. The problem of motion blur can be addressed by using visor. It helps in reducing head movement by touching the forehead.

c) Illumination amount: The wavelength between 700nm-900nm is generally used for iris recognition. The Light that is used can be near infrared or visible light of electromagnetic spectrum.

d) Signal to noise ratio: Typical SN ratio for iris recognition is 40 db.

e) Pupil size requirement: size of pupil depends on amount of light entering into the eye. According to ISO Pupil size should be less than or equal to 7 mm. This can be achieved by adding additional visible light source with infra-red light. Due to excess light iris size increases and size of pupil will contract.

f) Optical resolution: It is defined as pixels per inch. Typical optical resolution in case of iris recognition is 16.7 pixels per mm. Iris diameter should be 200 pixels.

g) Occlusion: It is obstruction of the iris. It is caused by eyelids. Maximum 30% occlusion can be there that means 70% of iris should be clearly visible. Occlusion is determined more by acquisition process that camera.

h) Ambient light and reflections: strong reflection on iris and camera reduces image quality so this should be avoided. To avoid this visor or hood is used to avoid strong lights. Narrow band pass filters can also be used.

These are the few parameters of iris sensors on which the quality of iris sensors will depend upon. In the section 2 the detailed expiation of various type of iris sensors are explained

2. IRIS SENSORS

Iris sensors: An iris is the elastic, pigmented, connective tissue that controls the pupil. The iris of the eye has a unique pattern, from eye to eye and person to person. Iris sensor detects the detail-rich, intricate structures of the iris [5]. The iris sensors can be grouped into two categories based on distance and wavelength as shown in Fig 2.

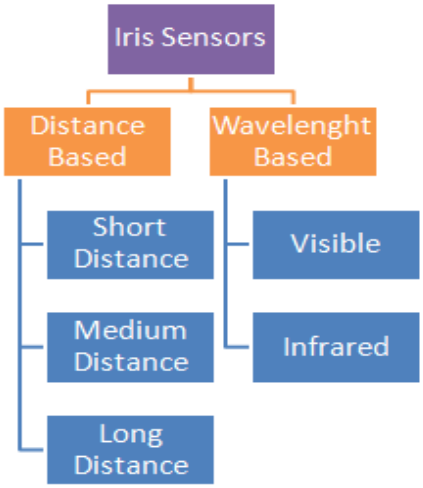


Fig. 2 Classification of various Iris sensors.

A) Distance based cameras:

The working principal of distance based camera is that these cameras are used from the distance apart between the camera and the subject.

1. Short Distance iris camera:

In this type of iris sensor as shown in Fig. 3 the scanner is placed very close to a person's eyes to capture its iris sample. It is mostly used with the assist of an operator but self-use is also possible.

Fig. 3 Example of short distance based iris camera

2. Medium distance based iris camera:

As shown in Fig. 4 the Medium distance iris camera. The distance between scanner and the person is about 50-100 cm.

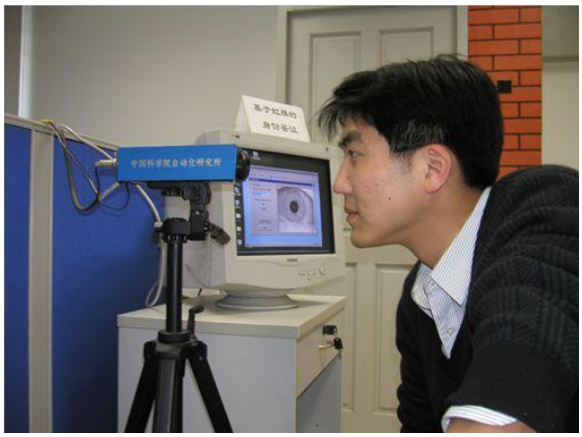


Fig 4. Example of medium distance based iris camera.

These camera or scanners can be mounted on a wall or tripod therefore can be used very easily in unattended applications. But for unattended applications correct user interactions are very much required. If user don't stand at required distance or don't focus properly towards camera, correct and high quality images can't be obtained.

3. Long distance iris camera: As shown below in Fig 5 the long distance based iris camera scanner the distance between scanner and the person is up to 2 meters.

Fig. 5: Example of distance based classification of iris cameras

These are implemented as portal. These involve using more than one camera for image acquisition. One camera locates the face and eyes and other camera take zoom pictures of iris. This type of cameras is relatively new or latest among all in the field of iris recognition cameras.

B) Wavelength based Iris Cameras:

Based on wavelength iris sensors are of following two types:

1. **Visible Wavelength (VW) sensors:** In the visible wavelength the iris recognition systems acquire images of an iris while being illuminated by light in the(Wavelength range is 700–900 nm) of the electromagnetic spectrum. The majority of persons worldwide have "dark brown eyes", the dominant phenotype of the human population, revealing less visible texture in the Visible Wavelength band but appearing richly structured, like the cratered surface of the moon. As shown in Fig 6 left side shows image capture of visible wavelength iris image.

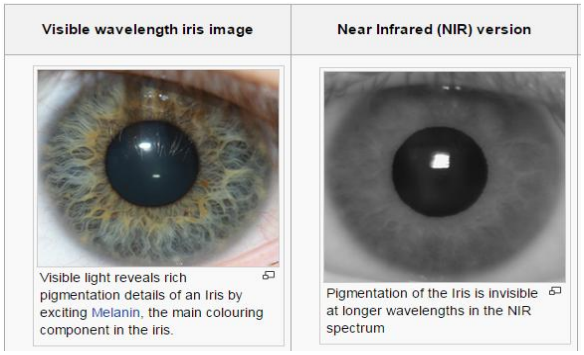


Fig 6 Visible Wavelength (on Left) & Near Infrared (on Right)

2. Near Infrared (NIR) sensors: As shown in Fig 6 (Right) the wavelength range is 700nm-900nm. Using the Near Infrared spectrum also enables the blocking of corneal specular reflections from a bright ambient environment, by allowing only those Near Infrared wavelengths from the narrow-band illuminator back into the iris camera. reflections. But problem is it can't distinguish colored pigment melanin.

3. RELATED WORK

Related work points out the significance of investigate the impact of diverse of various iris sensors. Iris recognition systems can be implemented using several types of approaches. Some of them are described as follows. The system proposed by Daugman [6,7, 8] uses an integro-differential operator to locate the borders of the iris, based on the ascension of the gradient to adjust the circular contours. The encoding (representation) of the iris it is done through the application of the 2D Garbor wavelet and to measure the dissimilarity between the irises, the Hamming Distance is computed between the corresponding pair of iris representations. Wildes's [8] system uses border detection based on the gradient and Hough Transform to locate the iris in the image. The representation makes use of a band-pass decomposition derived from application of Laplacian of Gaussian filters, implemented in the practice by the Laplacian Pyramid. The degree of similarity is evaluated with base on normalized correlation between the acquired and database representations. The algorithm proposed by Li Ma [9] et al. uses a bank of Gabor filters to capture both local and global iris characteristics to form a fixed length feature vector. Iris matching is based on the weighted Euclidean distance between the two corresponding iris vectors and is therefore very fast. Shinyoung [10] et al. uses a approach to making a feature vector compact and efficient by using Haar wavelet transform, and two straightforward but efficient mechanisms for a competitive learning method such as a weight vector initialization and the winner selection. The system proposed by Tisse [11] et al. uses gradient decomposed Hough transform / integro-differential operator's combination for iris localization and the "analytic image" concept (2D Hilbert transform) to extract pertinent information from iris texture. Boles [12] uses the Wavelet Transform zero crossings for extracting features from images of the iris and representing them, by fine-to-coarse approximations at different resolution levels, calculated on concentric circles in the iris, to generate a sign one dimensional (1D). These signs are compared with the model's features using different dissimilarity functions. The extraction of features can be implemented through several different techniques [6, 8, 13, 14,]. However, In other words, the choice of a certain feature depends on its capacity for separating patterns.

4. PROPOSED FRAMEWORK

This paper proposed an architecture and related algorithm to increase the performance of a most secured biometric system by using some aspects and these are as follows:

a) **Easy to acquire**: The first and foremost reason is that capturing the data from a user is very easily via iris scanner.

b) **Access time**: By comparing the data in the starting it will take very less time to authenticate an individual.

c) **Highly Accepted:** Iris possess high acceptance rate.

d) **Low Cost:** there are various iris sensors are available in market according to need we can use it (316-3000$).

e) **Accuracy:** Iris technology is very safe and highly accurate as compare to other

Accuracy % = (100 - (FAR%+FRR%)) / 2

The accuracy of the system increases when FAR and FRR decreases.

Architecture of Proposed Scheme:

In this proposed architecture when a user faces the iris camera then the camera capture the data. Then for

- **Enrollment phase:**

The iris template would be store along with the iris color into the database.

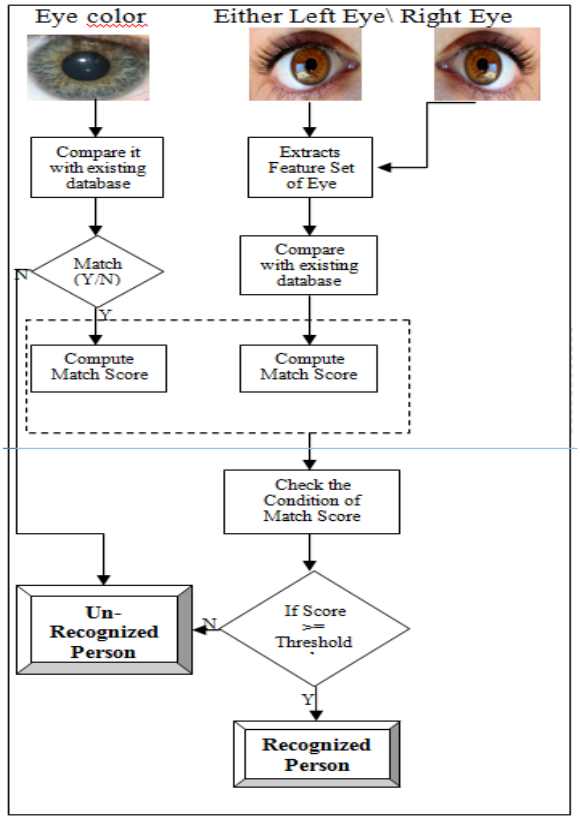
- **Identification/Verification phase:**

Firstly the sample is taken by the iris camera without using use the direct matching performs. It would be compare the color of data captured and data stored.

If the value is matches exactly then proceed for next steps matching module to match the data with the template stored in the data base.

Else the user is not a genuine person or it is an imposter.

Architecture is given below:



Algorithm for recognition in proposed scheme

1) Capture Iris color
2) Compare it with existing database
3) If (result is non match)
4) Unrecognized person
5) else
6) Compute Match Score of matched Iris color.
7) Extract feature set of Iris
9) Compare with existing database
10) Compute Match Score of user Iris with database template
11) Get Match
12) If (Fusion Score >= threshold value)
13) Recognized Person
14) else
15) Unrecognized Person
16) End

There are some Challenges or draw back in design of iris sensors [3] [15]:

a. Cost: cost of iris cameras is relatively high as compared to other sensors. This can limit its use in applications. Also these visors and hoods can further increase the cost.

b. Usability: Relationship between depth of field and maximum achievable optical resolution is the main factor affecting usability. Usability should be high.

c. Height adjustment: If iris camera is mounted then it would be difficult for person with different heights to give their samples. Height of camera has to be adjusted according to the height of the person. So there will be wastage of time and also user can get irritated.

d. Single capture ability: Most iris sensors are capable of taking only one picture at a time and also it has to manually enter whether it is of left or right iris. So it slows down data collection process.

5. CONCLUSION AND FUTURE PROSPECTUS

Many biometric traits can be used to identify an individual like fingerprint, iris, and face, hand geometry, voice etc. but out of which the iris recognition technology is most secure among all. The biometric technology is successfully deployed in many areas like forensic science, military, security etc. There are various sensors of iris available in the market depending of system design. We presented a method to increase the performance as shown above. This method eliminates the effects of the inconsistencies in the iris code that arise from the quantization of the complex filter response in a canonical iris biometrics algorithm.

As the overall performance is increase but possess some demerits also. In future all the demerits would be overcome and it will recognize a person who wears color contact lens.

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