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Identification System based on Biometric Concept Using Human Eye

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ABSTRACT: This paper proposes the study and development of multimodal system which can be used for identification system using human eye (iris and sclera) features as its input. Iris is circular shaped structure in the eye and is responsible for controlling the diameter and size of the pupil and thus controlling the intensity of light reaching the retina. The iris images captured are segmented and features are extracted using enhanced iris recognition system. Sclera has multilayered vessel structure and hence it poses challenge. Automatic segmentation and feature extraction are the two methods which are used for analyzing the sclera. During registration the templates containing the essential features are stored in database and during the identification process, the stored templates are retrieved from database and matched with the claimed identity. Fusion decision is taken while performing pattern matching. This system will prove effective and beneficial where all the other types of biometric system might fail individually.

KEYWORDS: Biometric System, Iris recognition, Sclera recognition, line descriptor, Identification System, Human Eye.

I. INTRODUCTION

Biometric systems can be used for recognition, identification and many different types of purposes depending upon its application and uses. The physical, behavioral and biological traits of an individual can verify a person's identity. Physical traits include face, fingerprint, iris, and sclera. While on the other hand behavioral and biological traits include gait, voice and DNA respectively. Every trait has its own advantages and disadvantages. Some traits could change over a period of time, cannot be used for recognition from a distance or can cause hygiene issues. A biometric may be more applicable in a particular scenario than the rest. No biometric is perfect or can be applied universally and thus the situation demands modifications. Biometric systems as compared to other traditional authentication schemes are more reliable and it is difficult to copy, share or distribute the biometric features. In order to be used for authentication process and schemes, biometric characteristics and system have certain requirements. The requirements include Universality, Distinctiveness, permanence, collectability. A practical Biometric system includes specified recognition accuracy, speed and resource requirements. Commonly used biometric are DNA, ear, face, gait, hand geometry, fingerprint, iris, signature, keystroke, voice, palm print and retinal scan. Sometimes there can be possibility of biometric signal or representation variations due to several reasons like inconsistent presentation, irreproducible presentation and imperfect signal. Biometric system can be used for verification, identification as well as screening purposes. The four major important modules which are important and commonly used as far as the biometric systems

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are concerned are sensors, feature extraction, matches and system database. It is applied for commercial purposes and also for government license, forensic etc. There are certain limitations for single biometric systems such as Noise in sensed data, Intra class variance, Distinctiveness, Non universality, Spoof attacks and this limitations could be overcome using multimodal systems.

II. EXISTING SYSTEM

Iris provides great accuracy and reliability among all the different biometrics. Sclera is another biometric that is unique to every person and it can be used for human ID and Identification. But there are several limitations as far as Sclera is concerned. The limitations include Image Acquisition, Multilayered sclera. This makes the single biometric system fail to provide correct results.

2.1 IMAGE ACQUISITION

The biometric iris shows high accuracy rates in recognition or identification scenarios. The iris recognition system gets input from image capture device. Iris is circular shaped structure in the eye and is responsible for controlling the diameter and size of the pupil and thus controlling the intensity of light reaching the retina. It has various features like ridges, furrows and rings. The clarity of the image is inversely proportional to distance between the person and the capture device. This affects the feature which is extracted. The image obtained at a long distance will not be focused to obtain the iris feature required for the ID system. Therefore this system will not provide ID at a distance.

2.2 MULTILAYERED SCLERA

The Sclera is also known as the white portion of the eye and is the opaque, fibrous, and protective outer layer of the eye containing mainly collagen and some elastic fiber. There are blood vessels in the sclera portion which can be used as feature for the identification purposes and the thickness of blood vessels will not be same every time. The blood vessel position with respect to the center of eye i.e. the pupil will be the feature extracted and will be used for ID. This feature can be obtained from images at a long distance. Unlike iris, this biometric can be used for ID at a specific distance. The vessel is multilayered and has complex nonlinear deformations. These challenges make extracting the sclera feature a complex operation.

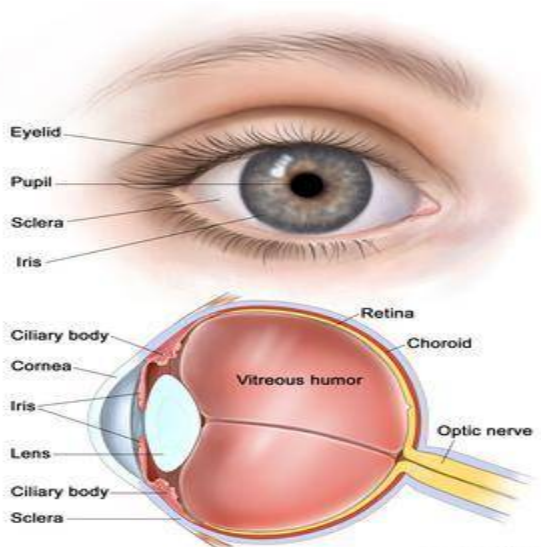

Fig.1: Structure of a human eye

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III. PROPOSED SYSTEM AND METHODOLOGY

3.1 HARDWARE UTILIZATION

The Hardware utilized in this project is Arduino, LCD, Battery, Biometric sensor.

3.2 PROPOSED SYSTEM

The combination of iris and sclera recognition system represents the proposed system. Firstly for identification purpose the unique feature of both iris and sclera are stored as templates in the data base for a particular individual. Then during the identification or recognition process, the template value of a specific person is being compared with the already existing template value stored in the data base and if there is match then the identity claimed is genuine. This system will ensure that the desired user of the system does not suffer any loss concerning the security and any sort of fraud or forgery can be avoided. When the image is not taken from a desired close range then the value stored for sclera will be more definite and accurate as compared to that of iris.

3.3 SYSTEM ARCHITECTURE

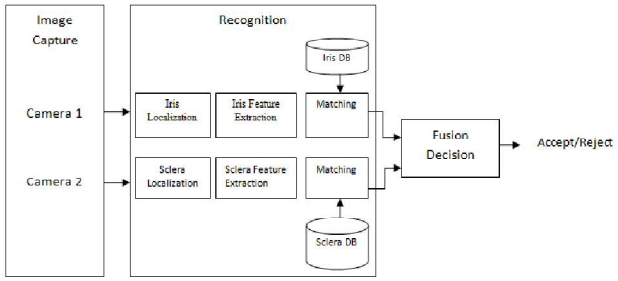

Fig.2: System Architecture

The fusion that we take in to consideration while using iris and sclera is done at the decision level. Iris and sclera are segmented and extracted. The resulting template is merged and stored in the database as part of the registration process. During identification, the feature extracted from the template is compared with the stored template in the database. The stored template contains the iris and sclera feature of the individual whose identification needs to be confirmed. The sclera and iris feature is compared with the sclera and iris feature of stored template in the entire database. A new set of matching templates is then considered for the next comparison. If a match is found, then it indicates that the user is an authorized one and if no such match is found then the user is not an authorized one. The matching algorithm is applied again and result is obtained for each set and user. Hamming distance between the templates is used as a measure of matching between the claimed identity and database template. Also there will be a decision making algorithm at the decision making level. Firstly the sclera feature is compared. The stored template and the claimed identity's sclera blood vessel pattern are compared and decision is made and this gives a set of matches. Then iris feature is compared with new set of templates formed after the previous comparison. The resulting match will enable to identify person as imposter or not.

3.4 METHODOLOGY

Once we obtain the iris image, following algorithms and steps are used for extracting the required feature and use it later for the purpose of identification.

3.4.1 IRIS

1]The algorithms used for Iris segmentation are Enhanced pupil boundary detection algorithm, Finding pupil center algorithm, Detecting iris boundary algorithm, Exclusion of eyelid and eyelash.
2]The algorithms used for Localization are Hough Transform and Integero Differential operator which is also called as daugman method.
3]It is necessary to remove dimensional inconsistencies and it is done by using normalization.

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4]Image enhancement is an important algorithm which should be taken in to consideration and it is done by using Histogram equalization technique.
5]Feature extraction is mainly applied for pattern identification in picture processing to diminish the dimension of the picture. It is obtained by using cumulative sum.
6]Enhanced iris recognition system employs pattern matching algorithm that helps to reduce computational match time.

3.4.2 SCLERA

1]Segmentation of Sclera can done by calculating
Estimate glare area, Iris boundary detection, Sclera area detection, Refine eyelids and iris.

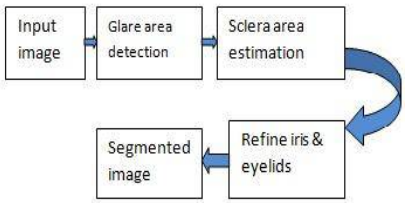
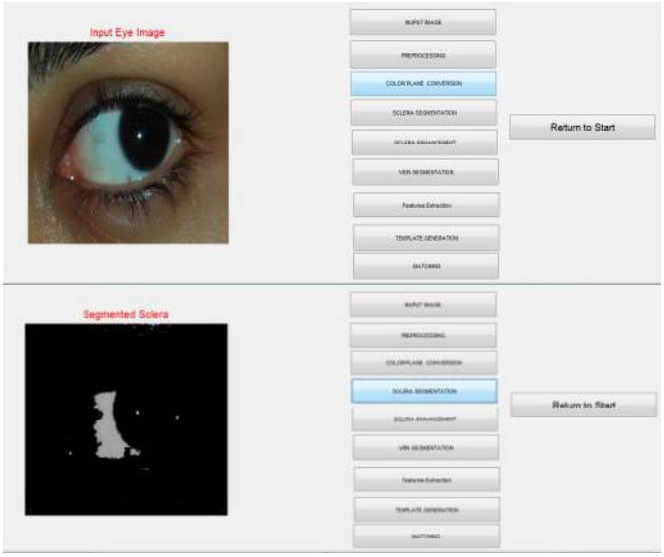


Fig.3: Segmentation of Sclera.

2] The blood vessels are considered as line segment. The segment position with respect to pupil center can be obtained by finding the segment descriptors.
3] Random sample consensus type algorithm is used to estimate the best fit parameters for registration between the two sclera vascular patterns. Patterns are registered as set of points in order to avoid false accepts. The points are the centers of line segments that make up the template. If the distance between the templates is minimized, then the registration can be considered optimum.

IV. RESULTS AND DISCUSSION



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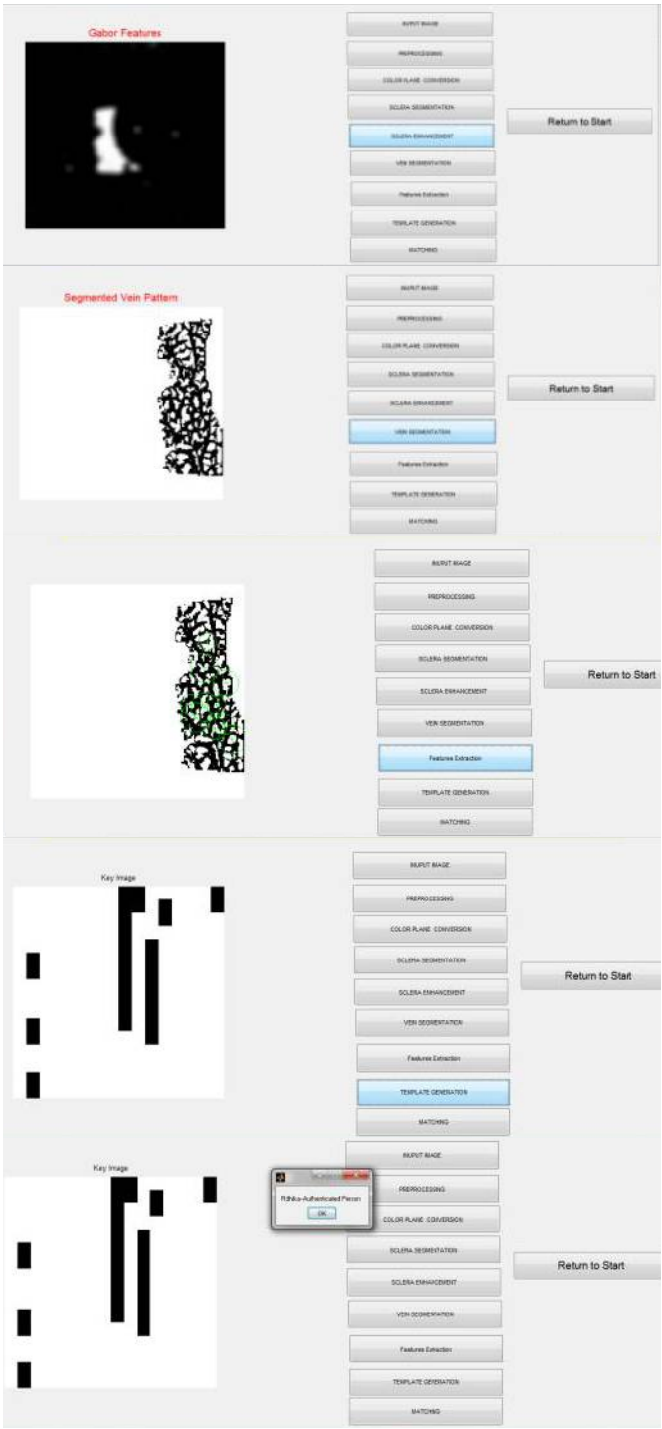

V. CONCLUSION

The multimodal biometric system can combine the advantages of several biometric and result in producing higher recognition accuracy which can enhance its accuracy and prove out to be very beneficial. Limitations of individual

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biometrics can be reduced to some extent by combining biometrics. This proposed system combines iris and sclera. This can be used for identification purposes. The future enhancements to this system can be made by using algorithms that will reduce the computational time. The overall computational time can be reduced if the task to be completed by the algorithm can be run in less time. The use of multiple biometrics generally will increase the calculating time. The choice of algorithms in such a case would determine the overall efficiency of system.

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