Iris Recognition System :A Review

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Abstract— *By expanding security necessities, biometric as an ideal answer for individuals identification is utilized. One of the biometrics which is considered as the most exact and solid technique, is iris biometric. The iris biometric is about investigation of patterns in the iris surface. The activity should be possible in a few phases. Image acquisition, preprocessing, segmentation, normalization, feature extraction and matching are different stages of iris recognition. In this paper a review on Iris Recognition System is proposed.*

Keywords-
IrisRecognition,Identification,Classification,Challenge.

Introduction

Iris recognition is a strategy for biometric identification that utilizes numerical pattern acknowledgment strategies on video or pictures of either of the irises of a person's eyes, whose complex designs are exceptional, stable, and can be seen from some distance.

Iris recognition uses video camera technology to acquire pictures of the detail-rich, complex structures of the iris which are noticeable externally. Computerized formats encoded from these patterns by numerical and statistical algorithms allow the identification of an individual or somebody pretending to be that individual. Databases of enlisted templates are searched by matcher engines at speeds measured in the millions of templates per second, and with remarkably low false match rates.

A key advantage of iris recognition, other than its speed of matching and its extraordinary protection to false matches, is the stability of the iris as an internal and protected, yet externally visible organ of the eye.

The human iris has a complex structure which has a lot of information which can be used for iris biometric. Today, Due to the advancement of technology, iris recognition has developed in comparison with the previous version. In general, iris recognition includes different stages like image acquisition stage, preprocessing stage and the main processing stage: segmentation, normalization, feature extraction and matching. Figure 1 shows a diagram of iris recognition stages.[1]

Iris recognition collect around 240 biometric features, the combination of which are one of a kind to each eye. The system then create a digital representation of the iris using the collected data. Then the information that is extracted from the iris is stored in a computer database.

Sometime Iris recognition is utilized with other biometrics, such as fingerprints and face recognition, to get the most accurate results.

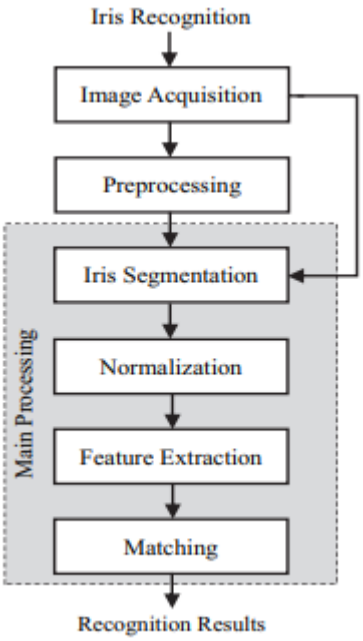

Fig. 1. Diagram of iris recognition stages

METHODOLOGY

Biometrics frameworks are popular in light of their potential for application to distinguish and confirm people for controlling access to made sure about zones [2]. Iris recognition has risen as one of the most encouraging advances to give solid human distinguishing proof [3]. The properties of iris which makes it valuable and better is that it is unmistakably obvious yet for a more clear and ideal view there is some enlargement arrangement required. Properties like uniqueness, steady and nonintrusive nature makes iris acknowledgment one of the most solid strategy with higher acknowledgment rate and lower equivalent mistake rate [4]. An iris comprises of numerous sporadic little squares, similar to stripes, spots, crowns, wrinkles, and different others which are liable for making the dispersion of these surfaces in the iris irregular [5]. These are the merits and the demerits which are to be observed and dealt with while understanding an Iris Recognition System.

Iris acknowledgment framework might be ordered into two unique modes first mode is enlisting mode, the subsequent mode is checking and distinguishing mode. Enrolment mode might be characterized as the progression which includes including iris design into database. Confirming and recognizing mode is required to build up an iris pattern and afterward to look for the matched pattern in stored database by comparison mode.[1]

Iris scanning measures the unique or special patterns in irises(the colored circles in people's eyes). Biometric iris recognition scanners work enlightening the iris with undetectable infrared light to pick up unique patterns that are not visible to the naked eye. Iris scanners recognize and avoid eyelashes, eyelids, and specular reflections that commonly block parts of the iris. The conclusive outcome is a lot of pixels containing just the iris. Next, the pattern of the eye's lines and colors are investigated to extract a bit pattern that encodes the information in the iris. This bit pattern is digitized and are compared with the stored templates in a database for verification(balanced layout matching) or identification(one-to-numerous format matching).

Iris scanning cameras might be mounted on a divider or wall or other fixed area, or they might be handheld and portable. Researchers at Carnegie Mellon University are developing long-range scanners that could even be used to capture images surreptitiously from up to 40-feet away.

The Systematic process of Iris Recognition System has been depicted in Figure 2.

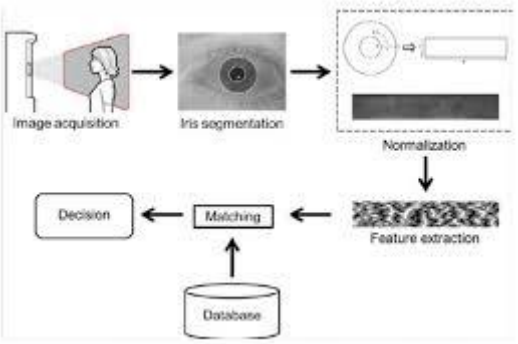

Fig. 2. Systematic Process of iris recognition

THERE ARE THREE BASIC STEPS THAT ARE RESPONSIBLE FOR RECOGNISING AN IRIS BY THE SYSTEM:

1. SEGMENTATION– THIS PROCEDURE USES DAUGMAN'S INTEGRODIFFERENTIAL OPERATOR FOR FINDING THE IRIS AND PUPIL REGIONS, AND ALSO THE ARCS OF THE UPPER AND LOWER EYELIDS.

2. NORMALIZATION- THE HOMOGENOUS ELASTIC SHEET MODEL DEVISED BY DAUGMAN'S INTEGRODIFFERENTIAL OPERATOR IS UTILIZED TO REMAP EACH POINT WITHIN THE IRIS DISTRICT TO A COUPLE OF POLAR COORDINATES (R, Θ) WHERE R IS ON THE INTERVAL [0,1] AND Θ IS ANGLE [0,2Π],

3. FEATURE ENCODING- WAVELETS CAN BE UTILIZED TO BREAK DOWN THE INFORMATION IN THE IRIS REGION INTO COMPONENTS THAT APPEAR AT DIFFERENT RESOLUTIONS.THE ADVANTAGE OF USING WAVELETS OVER THE TRADITIONAL FOURIER TRANSFORM IS THAT THE FREQUENCY OF THE DATA IS LOCALISED, ALLOWING FEATURES WHICH OCCUR AT THE SAME POSITION AND RESOLUTION TO BE MATCHED UP. [6]

The Methodology of Iris Recognition System has been depicted in Figure 3.

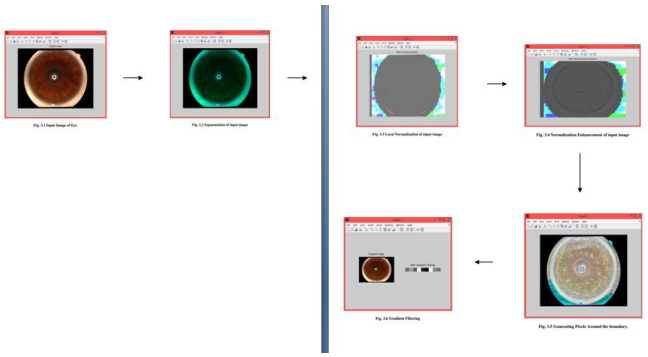

Fig. 3. Methodology of iris recognition

CHALLENGES

Iris has its own issues and difficulties like other biometrics. One of the difficulties that can be talked about here is the contact lenses [7]. Regularly, lenses spread the entirety of the iris yet some piece of the iris might be covered up in certain contacts or some part of the iris may be defaced. Another sort of lenses have brand or other organization data distributed all alone. The utilization of glasses by various individuals may make trouble distinguish the iris. Extraordinary reflections, residue and smirch on glasses what's more, optical distortion are problems which may be caused by using glasses. Glasses can cause mistakes in segmentation algorithm to determine the boundaries of the iris. As depicted in Figure 4 and Figure 5.

Fig. 4. Eye with a hard contact lens

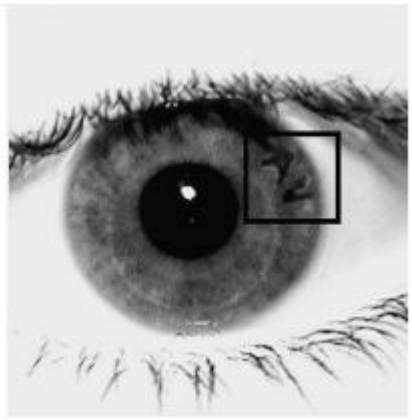

Fig. 5. Lens with a printed text

The next challenge of iris recognition is hardware implementation [8]. This challenge is because of iris recognition is complex. In addition to algorithms for the next generation will be even more complex because it will enhance performance and reliability

Another problem which is discussed recently, iris identification challenges and the iris segmentation at iris images with intense noise [10]. Peihua Li et al [10], Labati and Scotti and Kwang Yong Shin et al [11] have researched about this challenge and have improved it to some extent.

The following test comes when the iris isn't in its regular state. Sometimes by events such as accidents where the iris is harmed, it is hard to distinguish. Once in a while on account of eating certain medications, drinks and such, iris gets unusual for minutes, during this time it is difficult to distinguish it and in some cases may be failed. Figure 6 shows a case of the iris wherein the individual had devoured liquor subsequently, as a result the pupil and iris resize and the iris loses its natural state [9].

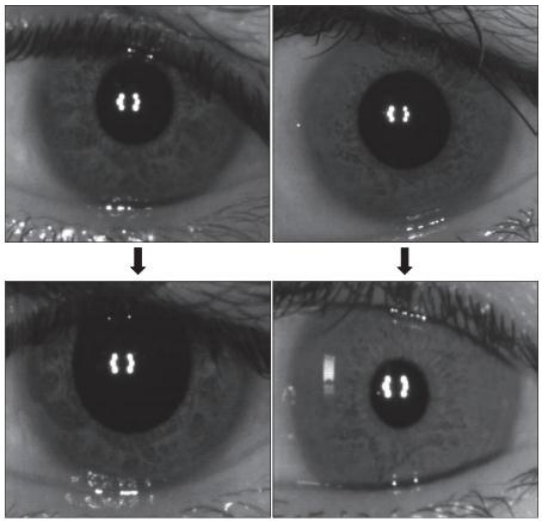

Fig. 6. Changes in Iris due to alcohol consumption

As you can see in Figure 6 images in the top row are normal iris images and in the bottom row are the images of the same iris after alcohol consumption. In some cases pupil become big and in other cases become small, and this resize, makes the identification difficult. Arora and Vasta [9] have searched to

solve this problem. In this study, the researchers have succeeded to improve the identification process to some extent, the iris identification in which the person has used alcohol.

Numerous commercial used iris scanners can be easily tricked by a high quality picture of an iris or face instead of the genuine one(iris or face). The scanners are frequently difficult to adjust and can become bothersome for multiple people of different heights to use in succession. The accuracy of scanners can be influenced by changes in the lighting. Iris scanners are fundamentally more expensive than some other forms of biometrics(like the password and proximity card security systems).

Iris recognition is very difficult to perform at a distance bigger than a couple of meters and if the individual to be identified is not cooperating by holding the head still and looking into the camera.

Likewise with other photographic biometric technologies, iris recognition is influenced by poor image quality, with associated failure to enroll rates. Similarly as with other identification infrastructure or devices(like national residents databases, ID cards, etc.), civil rights activists have voiced concerns that iris-recognition technology may assist governments with tracking people beyond their will. Scientists have deceived iris scanners utilizing pictures created from digital codes of stored irises. Criminals could abuse this defect to steal the identities of others.

The primary examination on surgical patients involved in modern cataract surgery, showed that it can change the iris

texture in such a way that iris pattern recognition is no longer feasible or the probability of falsely rejected subjects is increased.

MERITS AND DE-MERITS

The greatest advantage of iris scanning is its accuracy and reliability: it's evaluated to be at least ten times more accurate than fingerprint recognition (as per a recent report by Britain's National Physical Laboratory), however engineers claims it tends to be" more than 1,000 times more accurate". While fingerprints are continually presented and vulnerable to harm, the iris is normally ensured by the cornea (the eye's transparent front coating) and its pattern seems to remain reliably unchanged. Unlike fingerprint scanners, which need direct contact and have to be kept perfectly clean, iris scans can be performed safely and hygienically.

The drawbacks of iris recognition incorporate more prominent beginning expense and the way that it's as yet a generally untried innovation (a few preliminaries, for instance, have discovered a much greater rate of false matches than initially guaranteed). In spite of the fact that iris checking works with individuals of all ages, it's remarkably less precise with children (ages 1–4) than with grown-ups. Civil liberties campaigners have additionally voiced security concerns—that future iris-recognition innovation could be built up that will permit individuals to be tracked secretively without either their knowledge or collaboration.

Protection and security are additionally concerns. Supporters of biometric innovation guarantee that it naturally makes things like PC and ATM access more secure than traditional, for example, straightforward passwords and PIN numbers. However, critics have featured the dangers of lawbreakers bargaining iris recognition security, either by utilizing high-quality photos of eyes or even an individual's dead eyeballs. The most recent iris-recognition frameworks endeavor to get around this by recognizing eye developments or perceiving how an individual's eyes change in various lighting conditions. There's likewise the matter of hacking and information penetrates, which are conceivably increasingly genuine if the taken data is biometric. In the event that your fingerprints are taken, and would then be able to be utilized to get to whatever other frameworks that utilization unique mark get to, what can you do about it? You can't change your fingers the manner in which you can change your home keys or your PC passwords. Then again, it's imperative to recall that biometric frameworks don't for the most part store crude biometric data. Iris filters, for instance, are utilizing an encoded design got from your iris, not your iris itself, and regardless of whether this gets taken, it's conceivable to create an alternate iris code for a similar individual, which would be proportionate to changing the locks on your home after a thievery.

CONCLUSION

Today, in the improvement of biometric frameworks, a developing pattern can be seen. The employments of Iris as a biometric have been generally acknowledged for recognizable proof and verification applications regardless of the challenges included. The need is to distinguish and survived these difficulties, with the goal that the innovation can be appropriately utilized. In general, iris recognition includes image acquisition stage, preprocessing stage and the main processing stage which the main processing stages are: segmentation, normalization, feature extraction and matching. In the process of development of algorithms we are going in the direction in which the algorithms become quicker and lighter than previously, so they can be utilized in little convenient gadgets. To do this, checking on past techniques that are the premise of this information are expected to improve understanding right now.

References

[1] Sasan Harifi,Azam Bastanfard" Previous Works About Iris Recognition Stages: A Brief Survey" Fourth International Conference on e-Technologies and Networks for Development,Lodz,Poland,pp15-22,2015.

[2] Anshul Khatter, Dipali Bansal,Tazeem Ahmad Khan, "Design and Development of a Real Time System for acquiring video images in MATLAB", International Conference on Engineering Innovations: A Filip to Economic Development,Continental Group Of Institutes,Jalvehra,N.H. 1,FatehgarhSahib,Punjab.18th-20thFeb.2010.

[3] Henryk BLASINSKY, Frederic AMIELA, Thomas EA, Florence ROSSANT, Beata MIKOVICOVA, "Implementation and Evaluation of Power Consumption of an Iris Pre-processing Algorithm on Modern FPGA", RADIOENGINEERING, Vol. 17, No. 4, December 2008.pp 108-114

[4] Arun Ross, "IRIS RECOGNITION: THE PATH FORWARD". Published by the IEEE Computer Society, February2010, 0018- 9162/10.pp 30-35

[5] H.Proenca and L.A.Alexandre, "Iris segmentation methodology for non-cooperative recognition'', IEE Proc.-Vis. Image Signal Process., Vol. 153, No.2, April 2006.pp 195-205.

[6]KalpanaJaswal, Sanchita Kadambari, =Praveen Kumar, Seema Rawat" Methodology for Iris Recognition for Application in Biometric Systems" Journal of Basic and Applied Engineering ResearchVolume1,Number9;October,pp83-98,2014

[7] K. Bowyer, K. Hollingsworth, and P. Flynn, "Image Understanding for Iris Biometrics: A Survey," Computer

Vision and Image Understanding, Elsevier, Vol.110, pp.281-307,2008.

[8] K. Grabowski, and A. Napieralski, "Hardware Architecture Optimized for Iris Recognition," IEEE Transactions on Circuits and Systems for Video Technology, Vol.21, pp.1293-1303,2011.

[9] S. Arora, M. Vatsa, R. Singh, and A. Jain, "Iris Recognition under Alcohol Influence: A Preliminary Study," IEEE International Conference Biometrics, pp.336-341, 2012

[10] P. Li, X. Liu, L. Xiao and Q. Song, "Robust and accurate iris segmentation in very noisy iris images," Image and Vision Computing, Elsevier, Vol.28, pp.246-253, 2009.

[11] K.Y. Shin, G.P. Nam, D.S. Jeong, D.H. Cho, B.J. Kang, K.R. Park, and J. Kim, "New iris recognition method for noisy iris images," Elsevier on Pattern Recognition Letters, Vol.33,pp.991-999,2012.