AN EFFECTIVE APPROACH FOR AUTHENTICATION USING IRIS RECOGNITION

Sonu Jose

Abstract— Biometrics which refers to automatic identity authentication of a person on the basis of his or her unique physiological or behavioral characteristics is inherently more reliable in and more capable of discriminating between an authorized person and imposter than traditional methods. This paper uses a Biometric-based personal verification and identification method which have gained much interest with an increasing emphasis on security. The main concerns of this paper include the use of biometric system in low cost for border control application. Iris recognition is a fast, accurate and secure biometric technique The main stages of iris recognition system are:1) The preprocessing stage and 2)The matching stage

Index Terms— Biometrics, Iris Localization, Iris Recognition.

1. INTRODUCTION

THE pressures on today's system administrators to have secure systems are ever increasing. One area where security can be improved is in authentication. Iris recognition, a biometric, provides one of the most secure methods of authentication and identification thanks to the unique characteristics of the iris. Once the image of the iris has been captured using a standard camera, the authentication process, involving comparing the current subject's iris with the stored version, is one of the most accurate with very low false acceptance and rejection rates. This makes the technology very useful in areas such as information security, physical access security, ATMs and airport security. The technology is accurate, easy to use, nonintrusive, and difficult to forge and, despite what people may think, is actually quite a fast system once initial enrolment has taken place. However, it does require the cooperation of the subject, needs specific hardware and software to operate and administrators need to ensure they have a fall back plan should the resources required to operate the system fail, for example power. Iris recognition technology does provide a good method of authentication to replace the current methods of passwords, token cards or PINs .The iris pattern is unique to each person and to each eye and is essentially stable over a life time.

Iris recognition is a fast, accurate and secure biometric technique that can operate in both verification and identification modes since the iris texture pattern has no links with the genetic structure of an individual and since it is generated by chaotic processes.

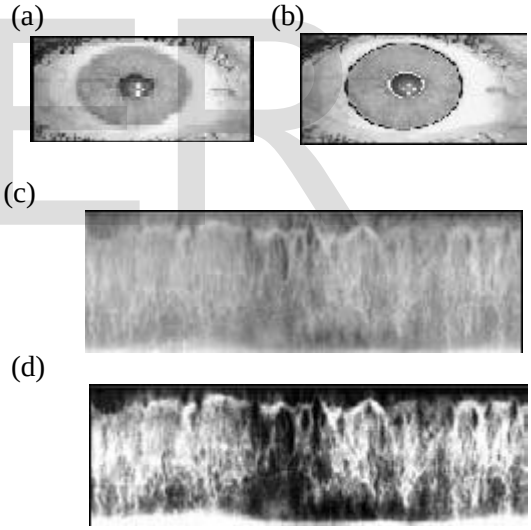


Figure 1. a) An eye photo before processing, b) a located iris, c) iris texture after unwrapping, d) unwrapped iris texture after histogram equalization.

A general iris recognition system is composed of following steps. Firstly, a image containing the user's eye is captured by the system. Then, the image is preprocessed to normalize the scale and illumination of the iris and localize the iris in the image. Features representing the iris patterns are extracted. Then comparison of images has been done for iris recognition.

2 PREPROCESSING AND MATCHING

The proposed algorithm is done in two stages 1) the preprocessing stage and 2) the matching stage.

2.1 Capturing the Image

The image of the iris can be captured using a standard camera using both visible and infrared light and may be either a manual or automated procedure. The camera can be positioned between three and a half inches and one meter to capture the image.

In the manual procedure, the user needs to adjust the camera to get the iris in focus and needs to be within six to twelve inches of the camera. This process is much more manually intensive and requires proper user training to be successful. The automatic procedure uses a set of cameras that locate the face and iris automatically thus making this process much more user friendly.

2.2 Preprocessing

The purpose of preprocessing is to localize the iris region in the captured image and to produce a normalized iris texture image with a fixed size(256 * 128 pixels)A typical eye image contains some irrelevant parts which cause significant degradation of matching performance. The preprocessing step is designed to remove these irrelevant parts correctly from the given image and to extract only the iris region. After capturing the iris image which is a JPEG Color image that should be converted to gray scale image to reduce the space complexity, to achieve good performance and also for performing further computation faster without losing reliability and accuracy. For converting JPEG Color image to 8 bit gray scale we have to convert the RGB values to gray value using formula

grayValue=(0.299*redValue+0.587*green Value + 0.114*blueValue).

After conversion apply Gabor filter. This is a special smoothing filter which is used on the original intensity image.2D Gabor filters are used to extract a feature vector corresponding to a given iris image .This type of filter helps to eliminates noise while preserving image boundary. And the contrast of the image can be enhanced using histogram equalization.

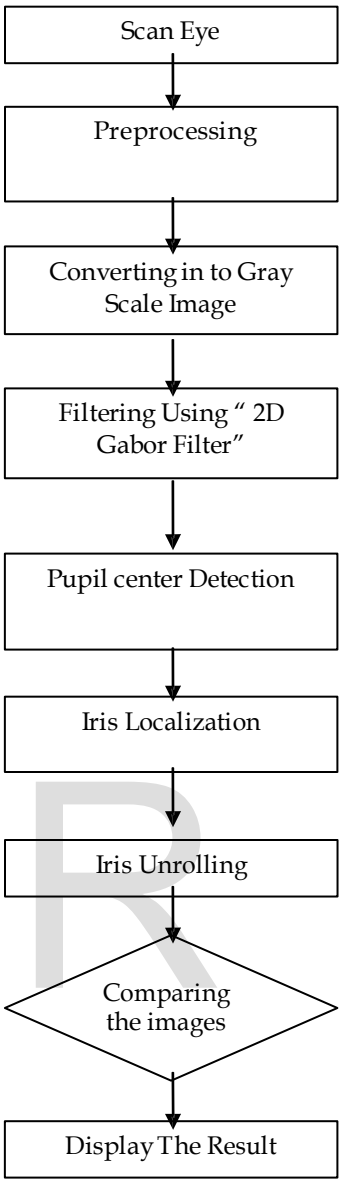


Fig 2 Flow Diagram of the Proposed Algorithm

2.3 Pupil Center Detection:

The gradient based method can be used for locating the pupil and then determine the center of the pupil by counting the number of black pixels .The procedure is as follows First Count every pixel in each row. Then obtain the row which has got maximum number of pixels. Obtain the position of the first and last pixels respectively, (a1, b1) and (a2, b2) of this row. Then find the center of this row by, a0=a1+a2/2.Similarly, apply the previous

steps for determining the center of the column of maximum number of pixels by b0=b1+b2/2.We select the center point as the most frequently crossed point.

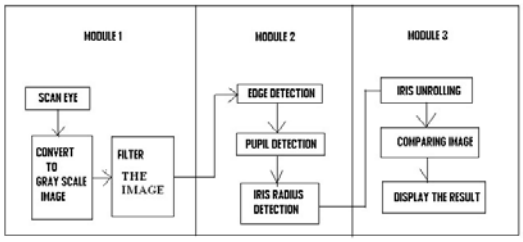


Fig 3: Block Diagram of the iris recognition system

2.4 Iris Localization

Iris localization is one of the most important steps in iris recognition system and determines the accuracy of matching. Here Hough transform has been used for iris localization. It uses gradient based hough transform to decide the two circular boundaries of an iris. It includes two steps .First a binary edge map is generated by using a Gaussian filter. Then votes in a circular Hough space are analyzed to estimate the three parameters of one circle (x0,y0,r).A Hough space is defined as

$H(x0,y0,r) = \Sigma_i H(x_i,y_i,x0,y0,r)$

Where

(x_i,y_i)=An edge pixel

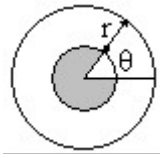
$H(x_i,y_i,x0,y0,r)$= 1 if (x_i,y_i) is on the circle (x0,y0,r) or 0 otherwise.

The location (x0,y0,r) with the maximum value of H (x0,y0,r) is chosen as the parameter vector for the strongest circular boundary.

2.5 Iris Unwrapping

The geometry of the iris is circular and most of its interesting textural features are extended in the radial and to a lower extent, the angular direction. Therefore analysis is simplified by an adapted polar transform, suggested by Daugman.

The adaptation is motivated by the fact that the pupil and iris is not necessarily concentric, the pupil is often somewhat displaced towards the nose and downwards, and also since the pupil diameter is not constant. This is amended by a transform that normalizes the distance between the pupil boundary and the outer iris boundary. Such a transform is expressed by equation given below.



$$x(r,\theta) = rx_i(\theta) + (1-r)x_p(\theta)$$
$$y(r,\theta) = ry_i(\theta) + (1-r)y_p(\theta)$$

where (xp,yp) and (xi,yi) are a pair of coordinates on the pupil and iris border. The figure to the left of equation 1 defines the angle variable θ and the radius variable r. The radius is normalized to the interval [0,1].The unwrapping of iris image is done so that irises of different sizes can be normalized to the same size. The normalization not only reduces to a certain extent the iris distortion caused by pupil movement but also simplifies subsequent processing.

2.6 Iris Matching

The unwrapping of the iris image has been done. After this process, an agent memory is created to save this iris image. Agent Memory is used to keep all the iris images. When a user wants to match his iris against the one saved in the agent memory, the image of his iris is first loaded to the agent. It undergoes all the above processes and finally an unwrapped image of the iris is obtained. This image is then compared with all the stored images in the agent memory and if a match is found, the user is authenticated. The iris images can be compared by subtracting the compare image from the base image that have stored in the agent memory. Then the intensity value per pixel of the result is calculated and percentage value of the average percentage difference per pixel is returned. If this value is greater than or equal to 1, the best match is obtained. Else no match is found.

3. CONCLUSION

The need for secure methods of authentication is becoming increasingly important in the corporate world today. Passwords, token

cards and PINs are all risks to the security of an organization due to human nature. Our inability to remember complex passwords and tendency to write these down along with losing token cards or forgetting PINs all contribute to the possible breakdown in security for an organization. The uniqueness of the iris and low probability of a false acceptance or false rejection all contribute to the benefits of using iris recognition technology. It provides an accurate and secure method of authenticating users, is a non-intrusive method and has the speed required to minimize user frustration when accessing company systems. Users no longer have to worry about remembering passwords and system administrators no longer need to worry about the never-ending problem of users disclosing passwords or having weak passwords that are easily cracked. The system has been developed to satisfy the needs of the organization. The entire system is user friendly and interactive and the performance of the system is provided efficiently.

4.REFERENCES

[1] L. Flom and A. Safir, "Iris Recognition System," US Patent 4 641 394, 1987.

[2] R.P. Wildes, "Iris Recognition: AnEmerging Biometric

[3] L. Ma, T. Tan, D. Zhang, and Y. Wang,"Local Intensity Variation Analysis for Iris Recognition," Pattern Recognition, vol. 37, no. 6, pp. 1287-1298, 2004.

[4] H. Proenc¸a and L.A. Alexandre, "Iris Segmentation Methodology for Non cooperative Iris Recognition," IEEE Proc. Vision, Image, and Signal Processing, vol. 153, no.2, pp. 199-205, Apr. 2006.

[5] W.W. Boles and B. Boashash, "A Human Identification Technique Using Images of the Iris and Wavelet Transform,"IEEE Trans. Signal Processing,vol. 46, no. 4, pp. 1185-1188, Apr. 1998.

[6] Y. Huang, S. Luo, and E. Chen, "An Efficient Iris Recognition System," Proc. First Int'l Conf. Machine Learning and Cybernetics, pp. 450-454, Nov. 2002.

[7] V. Dorairaj, N. Schmid, and G. Fahmy, "Performance Evaluation of Non ideal Iris Based Recognition System Implementing Global ICA Encoding," Proc. IEEE Int'l Conf. Image Processing, pp. 285-288, Sept.2005.

[8] An Effective Approach for Iris Recognition Using Phase-Based Image Matching Kazuyuki Miyazawa, Student Member, IEEE, Koichi Ito, Member, IEEE,Takafumi Aoki, Member, IEEE, Koji Kobayashi, Member, IEEE, and Hiroshi Nakajima

[9] A. Jain, R. Bolle, and S. Pankanti, Biometrics: Personal Identificationin a Networked Society. Kluwer, 1999.

[10] K. Miyazawa, K. Ito, T. Aoki, K.Kobayashi, and H. Nakajima, "A Phase-Based Iris Recognition Algorithm,"Advances in Biometrics, vol. 3832, pp. 356-365, Jan. 2006.

BIOGRAPHY

Sonu Jose has 4 years of teaching experience in an academic institution in India. She worked as Asst.Professor in IT Department, TocH Institute of Science and Technology,Arakkunnam, Kerala, India. She is a B.Tech holder in IT and M.E in CSE from Anna University Coimbatore. She has presented technical papers in many national and international seminars and conferences.