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Iris Recognition Based Bank Security System

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Abstract — *This paper proposes a technology which is based on two level security system for bank using Iris Recognition. Iris recognition is a very secure biometric authentication that uses pattern-recognition of iris codes. In the first stage customer has to enter his account number, OTP-one time password is sent to the customer's mobile number, then customer gets access to the first stage gate. In second stage, customer scans his iris and scanned iris is matched with stored database and customer can access his bank-locker. The iris recognition system works as this- scanned eye image is taken and then localization of inner and outer boundaries of the iris, which is done by Hough transform. The segmented Iris is normalized using Daugman's rubber sheet model to make up for pupil dilation. Features are then extracted using Log- Gabor filter, then extracted features are encoded into iris codes which are further enrolled for identification. For comparison of stored and recognized iris templates, hamming distance is used which compares bit wise. Minimum hamming distance will be recognized as the correct iris. Database used here is iris images from CASIA (Chinese academy of sciences –Institute of Automation) database.*

Keywords- *Iris Recognition, GSM, Hough Transform, Daugman's rubber sheet model, Log Gabor filter, Hamming distance, CASIA database.*

I. INTRODUCTION

As technology advances, it is difficult to maintain the privacy of citizens knew in the past. In this context, data security has become a major concern. Conventional methods of identification based on use of ID cards or exclusive knowledge like security number or a password are not secure or reliable. ID cards can be lost, stolen and passwords can be forgotten or even hacked. It may happen that an unauthorized user may hack an account with little effort. So it is necessary to ensure denial of access to confidential data by unauthorized persons. Biometric system verifies the identity of a person based on physiological and biological characteristics and hence it gives high security for the sensitive information stored.
Iris recognition is one of the biometric techniques that recognize individuals based on the distinctive patterns in the irises. Iris recognition is based on the most mathematically unique biometric - the iris of the eye. The human iris is very unique, even between twins or an individual's right and left eyes. The human iris is stable throughout a person's life. The physical characteristics of the iris do not change with age. Humans have always identified each other by recognizing faces, voices or some other physical characteristic. [5]
This project basically aims at designing two-stage level security system. In first stage, user has to enter his account number on matrix keypad. Then user is sent one-time password which has to be entered again through matrix keypad. After this in the second stage, iris recognition is performed by extracting the iris portion of the eye image. The extracted iris part is then normalized and iris codes are constructed. Finally, original (stored iris in database) and recognized Iris Codes are compared by using Hamming Distance.

II. RELATED WORK

John Daugman is the first one to give an algorithm for iris recognition [6]. In his algorithm, the first step is to locate the inner and outer boundaries of the iris. Integro-differential operators are used to locate the centre and diameter of the iris, then the pupil is located using the differential operators, for conversion from Cartesian to polar transform, rectangular representation is used. Feature extraction algorithm uses the modified complex valued 2-D Gabor wavelets. Hamming Distance is calculated for matching by using Boolean X-OR operator and for the perfect match, the hamming distance equal to zero is obtained [8]. Considering all this facts, we have proposed a system that works as: iris recognition is performed by firstly extracting the iris portion of the eye image which is done by Hough transform. The extracted iris part is then normalized using Daugman's Rubber Sheet model and Iris Code is constructed using 1D Log-Gabor filters [2]. Finally original and recognized Iris Codes are compared using Hamming Distance.

III. METHODOLOGY OF SYSTEM

This paper basically aims at designing a two stage level security. In first stage, user has to enter account number on matrix keypad. Then User is sent one-time password which has to be entered again through matrix keypad. After the first stage, the second stage as iris recognition is performed by extracting the iris portion of the eye image which is called

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Localization [5]. The extracted iris part is then normalized using Daugman's Rubber Sheet model and Iris Code is constructed. Finally original and recognized Iris Codes are compared to find Hamming Distance, which is fractional measure of the dissimilarity [2]. Experimental image results show that unique codes can be generated for every eye image and Hamming Distance between any two different iris codes has maximum value.

IV. SYSTEM DESIGN

In this project combination of hardware and software is used to build a bank locker system. In this project microcontroller is used for interfacing the software with hardware part. Here, LPC2138 microcontroller is used due to tiny size and low power consumption.

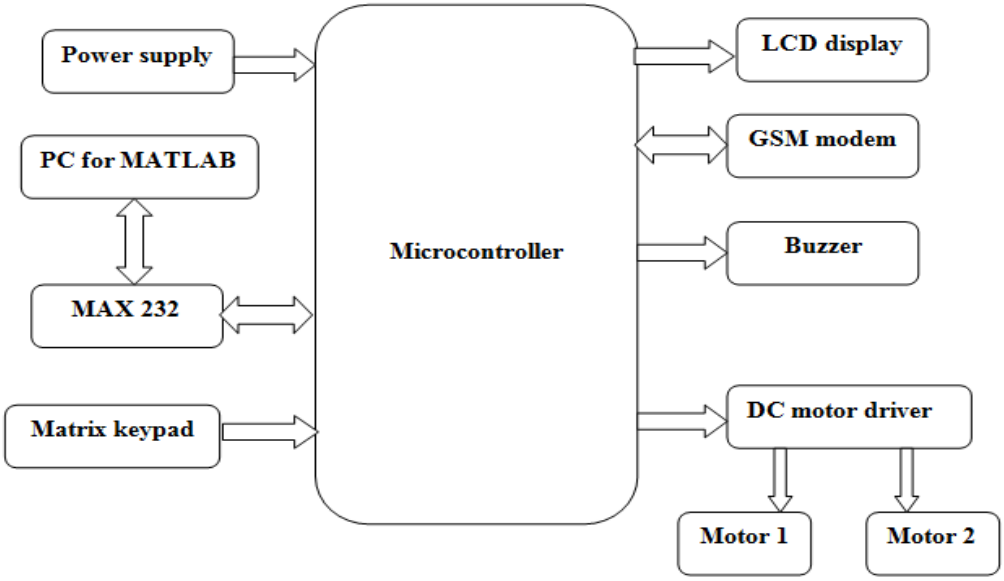

Figure 1. Block diagram of proposed system

Microcontroller can be used for interfacing the software with hardware part. In this project we want to build a security system using iris recognition. Hence, we need to interface hardware security system made up of motors, GSM for sending alerts and passwords, buzzers, LCD displaying instructions with software that recognizes iris and matches it with database. Thus, we require a microcontroller where we could program our security system and use it for implementing Bank security system. We are using LPC 2138 ARM 7 microcontroller. LCD is used in our project to visualize the output of the application. For example, to specify instructions we could use LCD display. We are using GSM for sending one-time password to user mobile and to alert the security personnel. GSM (Global System for Mobile communications) is a digital and cellular technology used for transmitting voice and data services.

Matrix keypad is used for entering account number and password which is received on mobile through GSM as soon as account number is entered. It is a 3 by 4 matrix keypad. Each key is assigned with the special character or digit. RS-232 is a standard communication protocol for linking computer and its peripheral devices like Modem. RS232 defines the voltage levels for the path used for data transfer between the devices. It mentions common voltage and signal level, common pin wire configuration and minimum, amount of control signals. Here, RS232 is used to communicate between GSM modem and PC.

DC motors is used in this system to move the gates for allowing user to enter or leave the system. The dc motor works on 12V. A motor driver is a current amplifier. The function of motor drivers is to take a low-current signal and then amplify it into a higher-current signal that can drive a motor. As microcontroller cannot source high current to drive a motor we need motor drivers. We are using dc motor driver called L293D. This dc motor driver is capable of driving two DC motors simultaneously. To protect the dc motor from a back EMF generated by the dc motor while changing the direction of rotation, the dc motor driver has an internal protection suit.

V. IRIS RECOGNITION ALGORITHM

Iris recognition algorithms can be explained by the following block diagram shown as: Iris Image acquisition, Iris part segmentation and localization, Normalization, Feature encoding, Comparison of iris codes. In this proposed system, we have used iris images from CASIA database. The first step is to locate the actual iris region in a digital eye image. The eyelids and eyelashes normally occlude the upper and lower parts of the iris region. We are using Hough transform [7] which is used to determine circles present in an image. [2] Once the iris region is successfully localized from an eye

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image, the next stage is to transform the iris region so that it has constant dimensions in order to allow comparisons. Pupil dilation also causes variable dimensions. In this normalization process we produce Iris regions, which have the same constant dimensions. This is done using Daugman's Rubber Sheet model [1, 2]. This model remaps each point within the iris regions to a pair of polar coordinates (r, θ) where r is on the interval [0, 1] and θ is angle [0,2π].

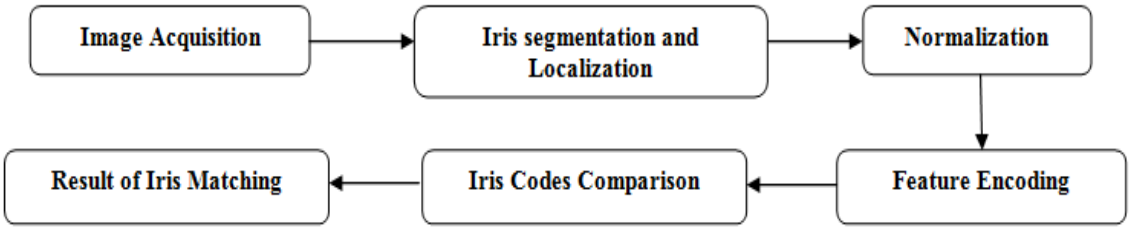

Figure 2. Block diagram of Iris recognition

Feature encoding was implemented by convolving the normalized iris pattern with 1D log Gabor filter [3]. This method extracts the iris phase information using modified Log-Gabor filter. For bit-wise comparison of stored and recognized iris templates, Hamming distance [2] is chosen as a metric for recognition. This distance was calculated using the bits generated from the real iris region. Hamming distance is calculated between two iris templates, one from processing and the second stored in the database. Hamming distance is chosen as bit-wise comparison is necessary. The hamming distance is minimum, if both irises belong to one person.

VI. EXPERIMENTAL RESULTS

As per the proposed system the iris images used from CASIA database have been recognized successfully using the above algorithms mentioned. We have used MATLAB R2011b software to implement the iris recognition. MATLAB software gives us an ease platform to implement the proposed system. It helps to exhibit the codes for segmentation localization and feature encoding, matching easily. It also helps to build a GUI.

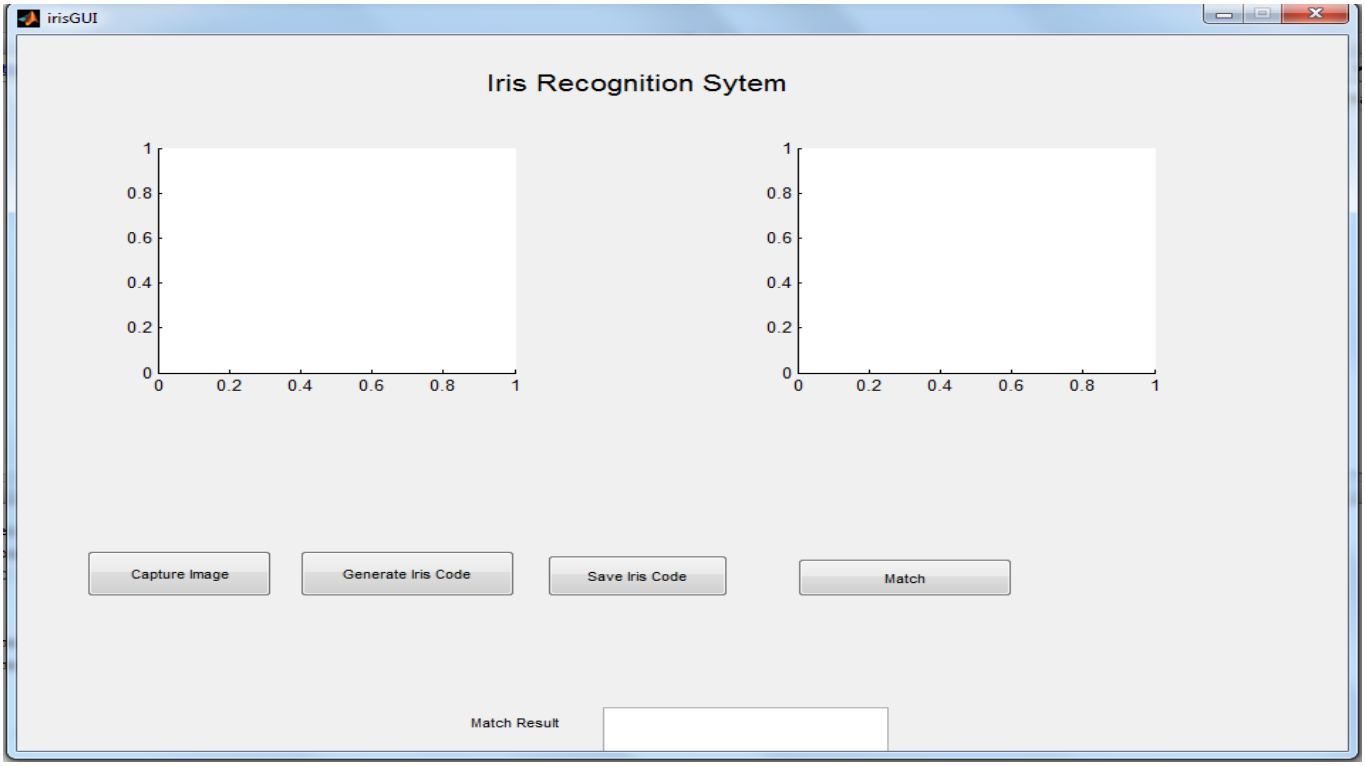

Figure. 3. Graphical user interface of the system

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We have made an Iris recognition GUI as shown in figure.3, where we upload iris image, then generate iris codes and then save it in database named as 'compare', then to match again capture iris image and match it with stored iris codes. The GUI can be seen in the Figure. 3 which displays name of system, various options. Figure. 4 shows the Iris image captured and the localization and segmentation of Iris part can be seen in Figure. 5. The noise of eye lashes, reflections are also removed, this is shown in Figure. 6. Final iris code generated is shown in Figure. 7

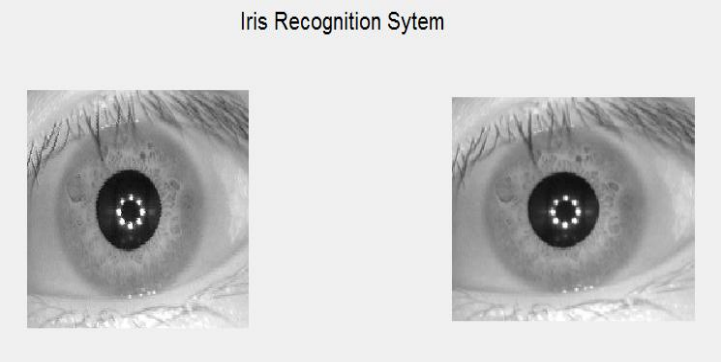

Figure. 4. Captured Iris image

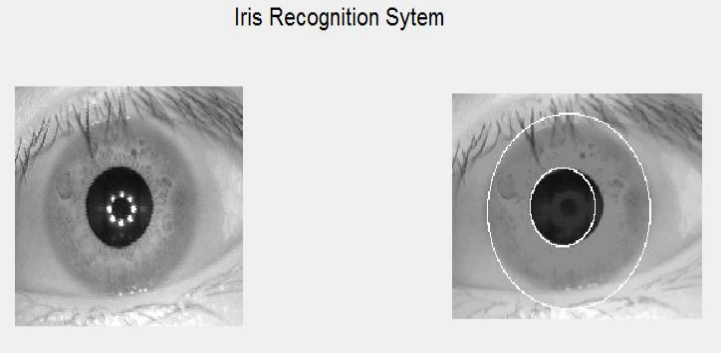

Figure. 5. Iris part localization

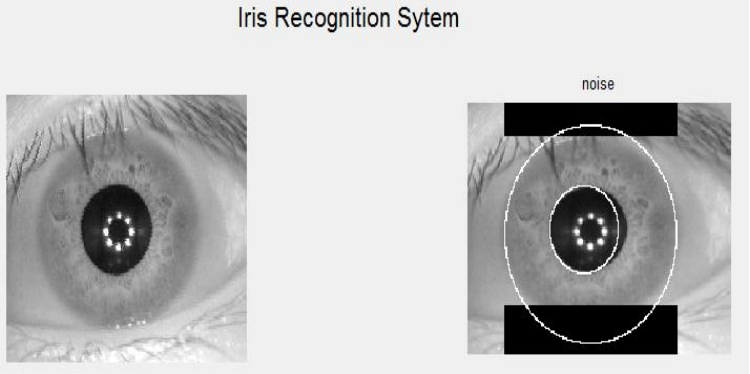

Figure. 6. Noise part removed from Iris

If the iris code is stored in database then the GUI displays: Match found with: 1 where 1 is the serial number of the iris image stored in database. Figure. 7 shows the output. The hardware part of microcontroller is also working correctly and GSM is also sending SMS to user and security accordingly.

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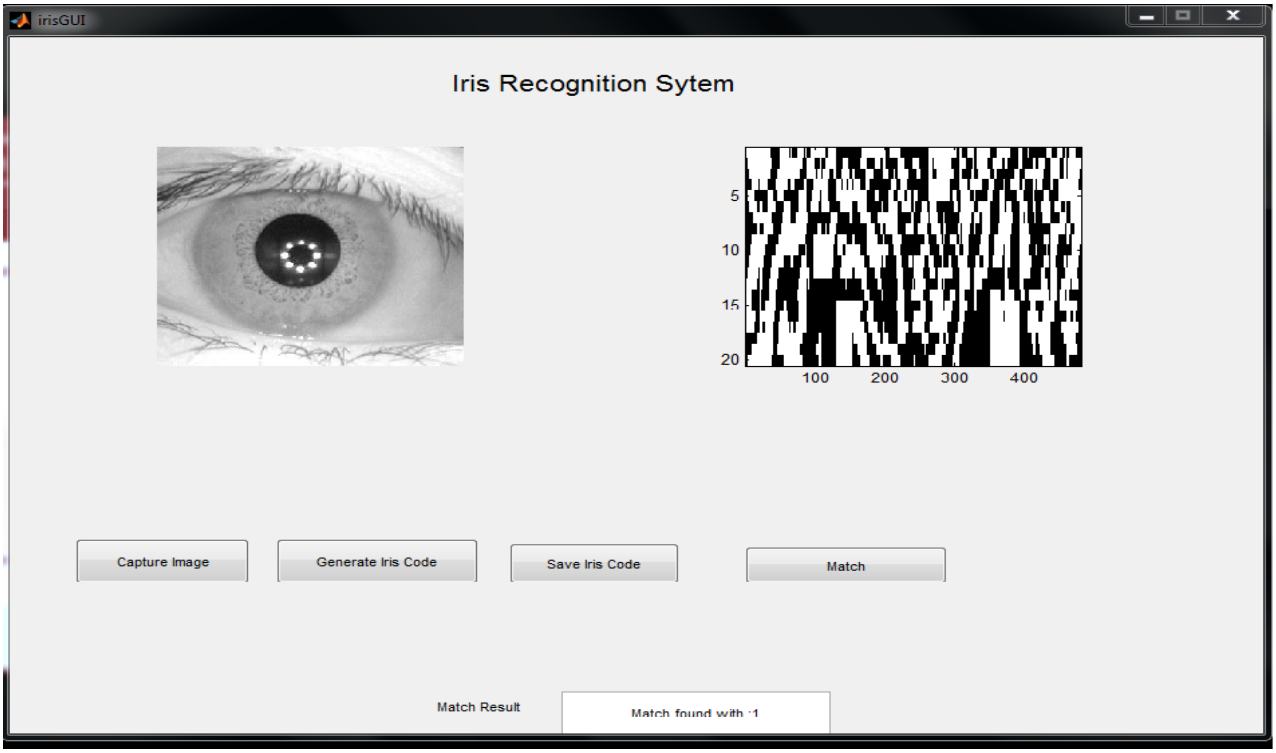

Figure 7. Iris recognition output

VII. CONCLUSION

In this proposed system, it is found that iris recognition is an efficient and secured authentication system. This is a real time application based project which tells that there is a need to bring in a revolution in the bank locker security system by making the procedure a little easy and more systematic for the bank officials. This is just a proposed model which when implemented, will surely give a highly secured protection of the bank lockers reducing risk of theft. In this project, an efficient method for personal identification and verification with iris patterns are presented. This project has enhanced the performance of iris recognition with various statistical features. Iris Images are obtained from CASIA database. Iris part segmentation and localization is done using Hough transform. Normalization is done using Daugman's rubber sheet model. Feature encoding is done using Gabor filters. The comparison of iris patterns is done by using Hamming Distance. The results show that the iris recognition systems are the leading technology in biometric identification and are fast due to faster working algorithms. Also, the interfacing with microcontroller helps to interface the iris recognition system with the whole bank security system.

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