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ATM Security System on IRIS Recognition with GSM Module

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Abstract: ***This paper presents current technology of Automatic Teller Machines(ATM) with Iris recognition for high security system. In real time ATM cards are being used as a form of identification and authentication, even though is not more perfect safety, and secured for recognition of the ATM card owner due to misplaced, skimming by someone or stolen that may cause the increase of ATM frauds. However, as other biometric systems, iris system is also under threat of forged iris attack. Some artifacts have been considered to spoof iris recognition system, such as paper printed iris, cosmetic contact lens, and redisplayed videos. For solving the bugs of traditional ones, the objective of this thesis is to develop highly security system. In this ATM is designed to be accessed with a SIM card used for identification and authentication purpose by using GSM module for matching the number and sending message to the number stored in the database and biometric technique such as Iris recognition is deployed here for a high security access environment.***

Keywords: Arduino board ATmega 328 microcontroller, GSM module, Iris recognition, Biometric, SIM card, Cosmetic contact lens**.**

1. Introduction

The ATM is an electronic machine that enables customers of financial institutions to perform financial transactions, such as cash withdrawals, deposits, transfer funds, or obtaining account information, at any time and without the need for direct interaction with bank staff. The ATMs have become very common and user friendly in the public [1]. In real time ATM cards are being used as a form of identification and authentication. But there is a highest possibility for the ATM cards to be steal or lost and even if the card is bent or heated, it becomes useless to access the ATM. With the increase of automated teller machine (ATM) frauds, new authentication mechanisms are developed to overcome security problems. One inherent problem with ATM cards should be carried for each and every transaction, which we forget to do in many cases [2]. Biometrics became popular in security applications due to its personal identification and verification based on the physiological and behavioral characteristics of the subject. Among the existing biometric technologies, it is iris recognition that is considered promising which uses the apparent pattern of the human iris [3].

Iris recognition is an automated method of biometric identification that uses mathematical pattern recognition techniques on video images of one or both of the irises of an individual's eyes, whose complex patterns are unique, stable, and can be seen from some distance. Every individual is recognized by a set of features unique to that individual. No two different individual's posses same set of physical and behavioral characteristics. This uniqueness of an individual can be preserved and deployed to identify and recognize an individual. Biometrics is a field which deals with identifying and recognizing an individual based on some measurable physical characteristics and some biological behavior such as DNA. The word "biometric" is a Greek word that is derived from two words- bio (life) and metric (to measure) [6].Iris recognition has drawn much attention due to its convenience and security. Compared with other biometric modality, iris pattern has been regarded as one of the most accurate biometric modalities for its uniqueness, stability and non-intrusiveness. However, as other biometric systems, iris system is also under threat of forged iris attack [5].

2. Problem statement

In modern world, numerous people are dependent on computers for keeping major record of data. Data are transferred in a cost-effective manner across wide area. ATM is one of the automatic systems being used since 1967. ATM was invented by John Shepherd-Barron on June 1967 at United Kingdom. Today, many people have PIN's and password for operating multiple devices like car, mobile phone, ATM; in using PIN's without extra security may pose a threat and difficulty to customers like usability, memorability and security. Some people keep their PIN and password on paper or diary which is not at all secure. As, it can be easily attacked and hacked by someone, resulting the account holder to suffer. With the growing sector of banking, everyone is using ATM, as these machines are located in different places and the customer can access account anywhere and at any time. A customer holding a bank account can access the account from ATM systems by getting a PIN or password confidentially from bank. By scratching the ATM card into the machine and entering PIN number, one can easily perform transaction, transfer money, etc. PIN number is a crucial aspect used to secure information of customer's account, thus should not be shared with others. In this regard, an intuitive approach is to introduce biometric authentication technique in ATM systems, iris recognition technique by using high resolution camera. Although various biometric technique like- fingerprint, eye recognition, retina and iris recognition, etc. have been devised as an authentication method for ATM, still there is need to enhance the security in ATM systems to overcome various challenges [6]. Current technologies use biometrics to provide authentication and authorization to a person in an organization for security purposes. However, iris pattern has unique features of each individual but nowadays there are

challenge of spoofing iris recognition system, such as paper printed iris, cosmetic contact lens, and redisplayed videos [11]. This paper focuses on high security of ATM system i.e. giving an augment on security for transaction using iris recognition and GSM module by sending verification code massages to the mobile phone of the account holder to access the bank account and make transaction at any a time.

3. Proposed system

This paper discusses about identification and authentication which can be used in the transactions through ATM using the iris recognition system and GSM module by sending message for verification code through the mobile phone number which is stored in the database that used to identify and authenticate subscribers on mobile telephony devices (such as mobile phones and computers). SIM cards are identified on their individual operator networks by a unique Mobile Subscriber Identity (IMSI). The main objective of this paper is to provide a wide range of extra security to our accounts and not to disclose any information to others, with additional code sent to the mobile phone which guarantee extra security that prevent iris spoofing system. In the field of financial services, biometric technology and communication system which use mobile phone number to send verification code has shown a great potential in offering more comfort to customers while increasing their security. The transaction process begins by capturing iris image and matching iris patterns. The system will automatically compare the captured iris image to iris images stored in the database if there is no matching found, the authentication will be denied and the process will stop, if the matching is found of same iris image the password will be required to get verification code, if the entered password is not valid authentication will be denied again, if password is valid, a GSM module which is connected to the Arduino ATmega 328 sends message of a verification code that generated by the system to the registered mobile number. The customer input verification code to the system, if the verification code is not valid authentication will be denied, if the verification code is valid the customer can access account and make transaction as he might wish. The proposed system of this research highlights extra security with improved efficiency and practicable approaches. The figure1 below shows hardware communication system, and figure 2 shows the Flow chart diagram for ATM security system using iris recognition.

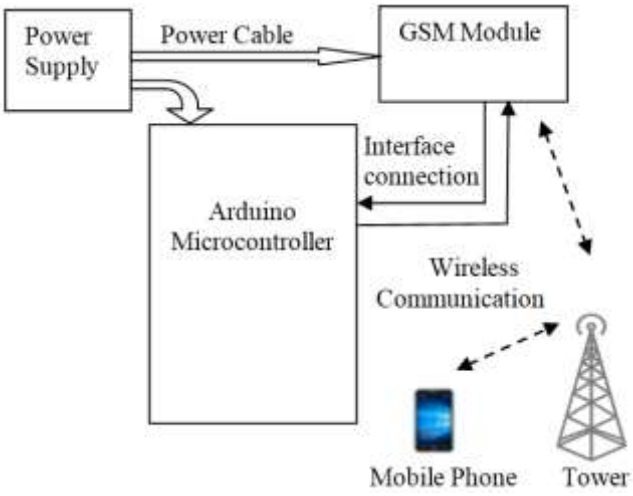

Figure 1: hardware communication system

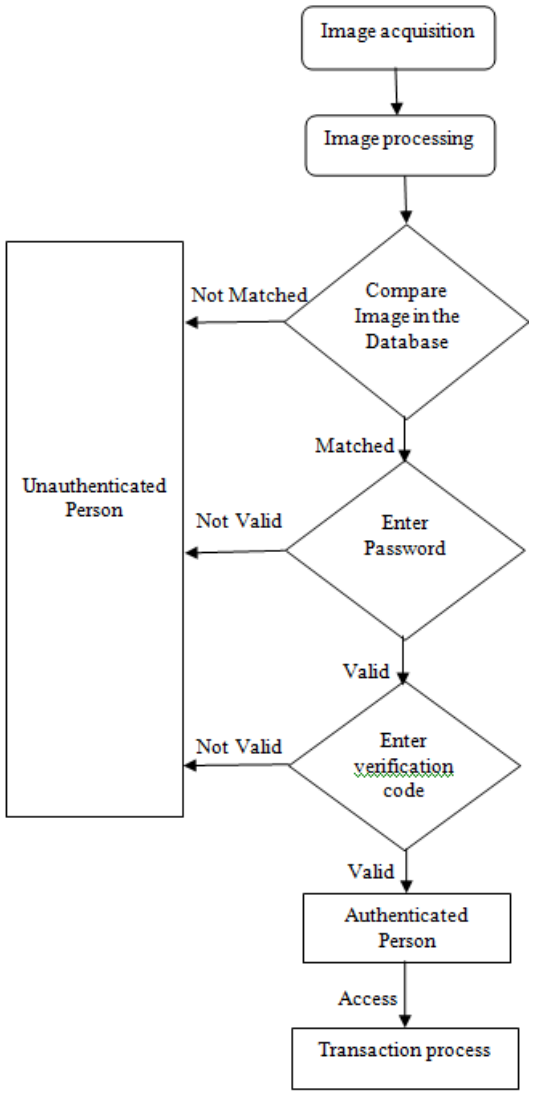

Figure 2: Flow chat diagram for ATM security system using iris recognition

4. Iris recognition process

The iris is the colored portion of the eye that surrounds the pupil as shown in figure 3. It controls light levels inside the eye similar to the aperture of a camera. The round opening in the center of the iris is called the pupil. The iris is embedded

with tiny muscles that dilate and constrict the pupil size. It is full of richly textured patterns that are distinct from person to person, and in fact are distinct from left eye to right eye of the same person [2].

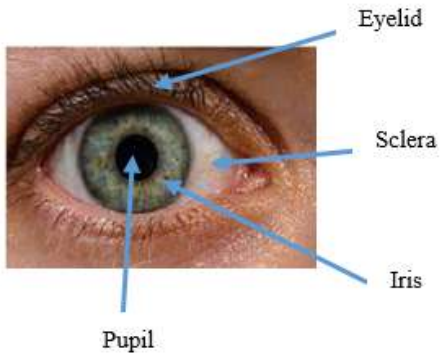

Figure 3: Image of the Eye

Generally, an iris recognition system is composed of many stages as shown in figure 3. Firstly, an image of the person's eye is captured and preprocessed. Secondly, the image is segmentation and localized to determine the iris boundaries. Thirdly, normalization of the iris boundary coordinates are converted to the stretched polar coordinates to normalize the scale and illumination of the iris in the image. Fourthly, features representing the iris patterns are extracted based on texture analysis. Finally, the person is identified by comparing his/her features with an iris feature database [2].

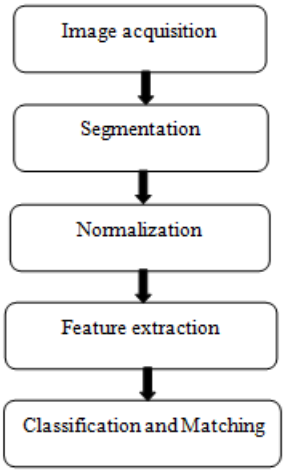

Figure 4: Iris recognition process

4.1 Image acquisition

The first step consists of capturing the iris image of the person whose identity needs to be verified. The image is captured automatically but it needs to be ensured that, the iris is in proper focus and that the image is captured with clarity.

4.2 Segmentation

Segmentation process is used to isolate the Iris from the captured image. The iris region is lies between the outer boundary of both iris and pupil. Segmentation process is most crucial factor in the Iris recognition. The detection of the pupil and Iris boundary technique, that use the circular Hough transform can be employed to deduce the radius and centre coordinates of the pupil and iris regions. Firstly, an edge map is generated by calculating the first derivatives of intensity values in an eye image and then thresholding the result. From the edge map, votes are cast in Hough space for the parameters of circles passing through each edge point, these parameters are the centre coordinates x_c and y_c, and the radius r, which are able to define any circle according to the equation below.

$$x_c^2 + y_c^2 - r^2 = 0$$

A maximum point in the Hough space will correspond to the radius and centre coordinates of the circle best defined by the edge points.

4.3 Normalization

Normalization is the process of converting the iris from the polar coordinate to the rectangular coordinate. After completing segmentation. The next step is Polar to rectangular conversion. Rectangular conversion is applied to the region locating between the radius of the pupil and the radius of the iris. This process will generate the rectangular template as shown in figure 5.

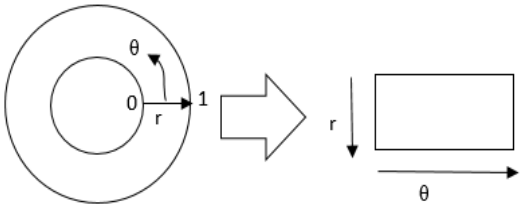

Figure 5: Generating normalized iris image

The remapping of the iris region from the Cartesian coordinates to the normalized non-concentric polar representation is modeled as:

$$I(x(p,\theta), y(p,\theta)) \rightarrow I(p,\theta)$$

With

$$x_p(p,\theta) = x_{po}(p,\theta) + r_p * COS(\theta)$$
$$y_p(p,\theta) = y_{po}(p,\theta) + r_p * sin(\theta)$$
$$x_i(p,\theta) = x_{io}(p,\theta) + r_i * COS(\theta)$$
$$y_i(p,\theta) = y_{io}(p,\theta) + r_i * sin(\theta)$$

Where r_p and r_i are respectively the radius of pupil and the iris, while $(x_p(\theta), y_p(\theta))$ and $(x_i(\theta), y_i(\theta))$ are the coordinates of the pupillary and limbic boundaries in the direction θ. The value of θ belongs to $[0; 2\pi]$, p belongs to $[0; 1]$.

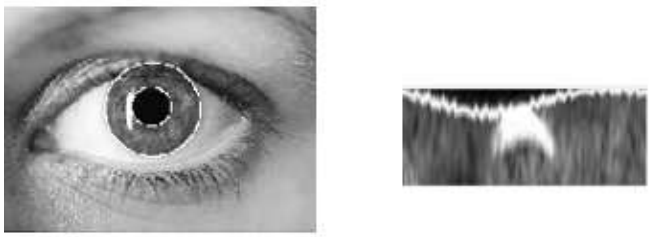

Figure 6: Normalized Iris image

4.4 Feature extraction

This stage aims at extracting the texture characteristics of a given iris. Discriminative features of iris texture are the basis for the comparison (also called matching) of any two images. The resulting template is usually represented by using a binary code composed of bits, called iris code. These bits are obtained by the quantization of the iris features. Once the area which is suitable for feature extraction is determined, the iris region is optimized by removing deep shadows, portions covered by eyelids and reflective areas. This optimized region is also normalized in a rectangular block so that it has fixed dimensions which are comparable with other iris scans [3].

Figure 7: Polar to rectangular templates conversion

4.5 Classification and matching

The encoded structural features, or biometric templates, are then stored in the biometric database at the time of enrollment of a person. If the iris scan has been taken for the purpose of authentication, then the biometric template for the scanned image is matched with biometric templates stored in the database [3]. The final stage of iris recognition systems consists in deciding whether two templates belong to the same iris or not. To this end, a similarity or dissimilarity score is computed between the two binary codes to be compared. The decision of acceptance or rejection is taken by comparing the matching score to threshold. The key at this stage is to fix this threshold appropriately, in order to take the correct decision.

5. Hardware description

5.1 Power Supply

The power supply circuit is built using filters, rectifiers, and then voltage regulators. The input is a 230V AC supply, which is converted into a DC voltage when it passes through the rectifier circuit. The output of the rectifier circuit is an unregulated DC voltage, through the regulator circuit (LM7805). Hence the final output obtained from the power supply circuit is +5V DC supply [2].

5.2 Microcontroller of Arduino circuit board

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board [7].

5.3 GSM Module

GSM or GPRS Modules are one of the commonly used communication modules in embedded systems. A GSM GPRS Module is used to enable communication between a microcontroller (or a microprocessor) and the GSM or GPSR Network. Here, GSM stands for Global System for Mobile Communication and GPRS stands for General Packet Radio Service [8]. A GSM module or a GPRS module is a chip or circuit that will be used to establish communication between a mobile device or a computing machine and GSM or GPRS system. The modem (modulator-demodulator) is a critical part here [2]. A GSM modem can be an external device; it contains a SIM scanning device. Typically, an external GSM modem is connected to a computer through a serial cable or a USB cable. Computer can operate the GSM modem using AT commands, through which a message can be sent as well as received. GSM modems support an extended set of AT commands [2].

5.4 SIM Card

One of the key features of GSM is the Subscriber Identity Module, commonly known as a SIM card. A subscriber identity module or subscriber identification module (SIM) is an integrated circuit that securely stores the International Mobile Subscriber Identity (IMSI) and the related key used to identify and authenticate subscribers on mobile telephony devices (such as mobile phones and computers). SIM cards are identified on their individual operator networks by a unique IMSI [2].

6. Software design

The software which was used to build the system is described below:

6.1 Matlab Software

Matlab was used for iris image processing and created the database of this project, and also took the advantage of it supporting package for Arduino hardware interface with Arduino board.

6.2 Arduino Software (IDE)

Arduino is used for programming codes and downloading to the Arduino board and connection with GSM module by sending message to registered person by using GSM Module for specific mobile number owners.

7. Advantages of iris

- Exceptionally high levels of accuracy
- Reliable identification as well as verification
- Believed to be the most reliable metric
- Stable over a lifetime
- Highly protected, internal organ of the eye

8. Project Result

The result of the project is shown below in figure. 8 and figure 9. The database of the eye images for this project has been taken from the website. This type of ATM system was successfully developed in this paper with Iris Recognition

and universal subscriber module, capable of comparing two digital eye-images and universal subscriber module for comparing the mobile phone number.

Figure 8: authentication process for transaction

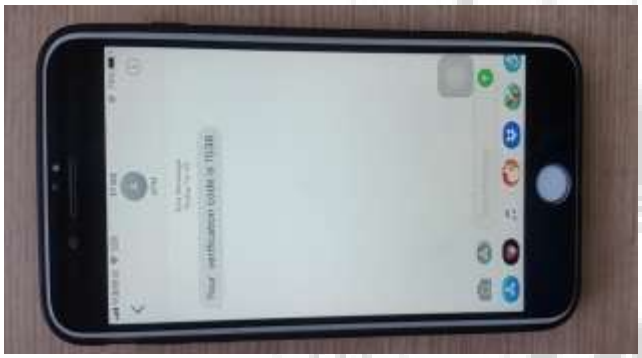

Figure 9: shows the verification code sent to mobile phone

9. Conclusion

The design of ATM terminal system based on iris recognition and GSM Module proved to extra security as it provides identification and authentication with the information of bank account owner's. A new biometric technology based on this system also contains the verifying methods which allow the owner to input password and verification code from the message sent to customer mobile phone. The security features were enhanced largely for the stability and reliability for the owner recognition. The whole system is built on the technology of embedded system which makes the system more safe, reliable and easy to use. It is a viable approach, as it is easy to maintain and operate with lower cost.

References

[1] https://en.wikipedia.org/wiki/automated_teller_machin
[2] B. Sundar Raj. A Third Generation Automated Teller Machine Using Universal Subscriber Module with Iris Recognition, International Journal of Innovative Research in Computer and Communication Engineering, Vol.1, Issue 3, May 2013
[3] Danny Thakkar. biometric technology, iris recognition. https://www.bayometric.com/biometric-iris-recognition-application
[4] Miss. Sable Jyoti P and Prof.Mulajkar R.M. A review on "Removing the effect of contact lens in IRIS recognition"
[5] Kavita Hooda, ATM Security, International Journal of Scientific and Research Publications, Volume 6, Issue 4, April 2016 ISSN 2250-3153
[6] W. Durfee. Arduino Microcontroller Guide. www.me.umn.edu/courses/me2011/arduino/, ver. oct-2011
[7] https://www.electronicshub.org/gsm-gprs-module/
[8] https://epicsearch.in/search?pno=1&q=integrodifferential+operator
[9] k. Mahesh, Hari Hara Brahmal, Dr. G. Kodanda Ramaiah, ATM based recognition technique on iris Technology with GSM module, International Journal of Scientific Engineering and Technology Research, ISSN 2319-8885, Vol.04, Issue.51, December-2015.
[10] K. Laxmi Narshima Rao, Vikram.Kulkarni, C. Krishna Reddy International Journal of Engineering Research and Development, e-ISSN: 2278-067X, p-ISSN: 2278-800X, www.ijerd.com,Volume 3, Issue 11 (September 2012), PP. 39-45
[11] http://www.planetbiometrics.com/articledetails/i/1776/.iris recognition–detecting cosmetic contactleneses
[12] https://en.wikipedia.org/wiki/automated_teller_machine
[13] James S. Doyle, Jr., (student member, IEEE), and Kevin W. Bowyer, (fellow, IEEE). robust detection of textured contact lenses in iris recognition using bsif
[14] V.Kavitha, M.Gowtham, V.J. Arul Karthick. effect of textured contact lenses on iris recognition

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