Biometric Locker System using Eye-vein Scanning and NFC

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Abstract – This project is aimed at developing an accurate biometric secured locker system using eye veins recognition as a biometric feature and NFC and OTP as other authorization means. Eye veins identification serves the purpose of verification. In identification, the identity of the user is not known in advance, but shall be determined based on sample image of user's eye vein and a set of known identities. The identification system processes the eye vein of the user with the set. Depending upon the comparison value, above a certain threshold, the user is successfully identified to be authorized person. NFC and OTP serves as other levels for authentication increasing the security. NFC is an updation of RFID.

Keywords-NFC, Eye-Vein, OTP, Biometric, RFID.

INTRODUCTION

In today's real time modern industrialized world security systems place a vital role. This bank security system is mainly designed to meet the requisite of the security of valuables things (jewels) which are hard earned. unlike the present system involving the physicals locks which can be easily forged this has the main feature of biometrics together with digital (electronic) code locks which will open the door automatically whenever the series of authentication is verified and gives alert sounds when any mismatch occurs. In this system, micro controller continuously monitors the sensors of the biometric system (Iris Scanner and Vein Detector), the keypad for the authenticated Codes (Unique Password and Registered Identification Number) and the output of wireless motion detector. Biometrics has been used for identification or recognition purposes. The physical, behavioral, biological traits of an individual can verify aperson's identity. Physical traitsinclude face, fingerprint, iris, and sclera. Behavioral traits are like gait, voice and biological include DNA. Each of these 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. Biometric systems compared with traditional authentication schemes are more reliable and it is difficult to copy, share or distribute the biometric feature. The biometric characteristics have the following requirements due to which they can be used in authentication schemes. Biometric scanning of eye vein which is a new and unique way of authentication. The veins in the sclera — the white part of the eyes — can be imaged when a person glances to either side, providing four regions of patterns: one on each side of each eye. Verification employs digital templates from these patterns, and the templates are then encoded with mathematical and statistical algorithms. These allow confirmation of the identity of the proper user and the rejection of anyone else. Advocates of eye vein verification note that one of the technology's strengths is the stability of the pattern of eye blood vessels; the patterns do not change with age, alcohol consumption, allergies, or redness. Eye veins are clear enough that they can be reliably imaged by the cameras on most smart phones. The technology works through contacts and glasses, though not through sunglasses. At least one version of eye vein detection uses infrared illumination as part of the imaging, allowing imaging even in low-light conditions. The NFC technology implementation directed for fast transaction such as supermarket payment or transportation payment. Here we are using this fast authentication device for a locker. The NFC can beused for authentication due toits uniqueness. Near Field Communication is a wireless close- range connectivity technology which allows data trade between two gadgets. NFC commonly integrated within mobile devices. This will allow the device to establish communication with sim card or other reader devices. NFC works using 13.56 MHz radio frequency. This technology optimizely works under the space of 20 cm.

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BACKGROUND AND MOTIVATION

While we were choosing this topic, we conducted a literature survey. We found 4 IEEE papers of great interest.

1. In the first paper effective monitoring and controlling of the bank locker rooms is autonomous. This system is basically used to detect the illegal entrance of robbers. In case of robberies, the system will save the image and communicate through LAN and send the warning message to operator using GSM.

2. In second paper, the system operates with 2 different keys. One the branch head's key and one user's key. This two level of authentication helps in functioning of locker with their biometrics and secret code.

3. In third paper, highly reliable multi-level and most efficient locker room security system has been designed. It includes fingerprint, iris scanner for locker and RFID for locker room area.

4. The fourth paper presents efficient methods for automatic detection and extraction of blood vessels in retinal images. The proposed algorithm composed is of match filter, entropy thresholding, length filter, vascular intersection. Matched filter: since blood vessels have lower reflectance than background, it is used to enhance blood vessel. Entropy thresholding is used to distinguish between blood vessel and background. Length filter is used to remove misclassified pixels. Vascular intersection is the window based on probing processes.

Table 1: Comparison of different Biometric features

CHARACTERISTICS	EYE VEINS	IRIS	FINGER PRINTS	FACE	VOICE
LONGTERM STABILITY	HIGH	HIGH	HIGH	MEDIUM	MEDIUM
ERROR INCIDENCE	NONE	LIGHTING	DRYNESS, DIRT, AGE,	LIGHTING,AGE, GLASSES, HAIR	NOISE, COLDS
ACCURACY	VERY HIGH	HIGH	MEDIUM	LOW	LOW
USER ACCEPTANCE	MEDIUM	MEDIUM	MEDIUM	MEDIUM	HIGH
PERFORMANCE	HIGH	HIGH	HIGH	LOW	LOW
COST	HIGH	HIGH	LOW	HIGH	MEDIUM

NEED FOR PROPOSED SYSTEM

In this new technological word of new innovations and the obsolete technology getting compromised, we are to make striking balance for making our system fool proof. In the existing bank locker system, the traditional lock and key method is used for securing our possessions. However, it is not as secured as needed. The current system is suffering with the issue of security levels. The unreliable security levels can be easily penetrated by robbers. Therefore, a need for secured bank locker system with multilevel authentication is felt.

ALGORITHMS TO BE USED

Thresholding is a process of converting a grey scale input image to a bi-level image by using optimal threshold. The purpose of thresholding is to extract those pixels from some image which represents an object. Though the information is binary the pixels represent a range of intensities. Thus the objective of binarization is to mark pixels that belongto foreground regions with a single intensity and background regions with different intensities.

Table 2: Comparison of different Algorithms that can be used

CORRELATION MATRIX	EUCLIDEAN DISTANCE
correlation matrix method is used for extraction and matching pattern wise	In Euclidean distance method distance of veins is found w.r.t reference point and then matched
Finds pattern of eye vein acc. to pixel value of veins	Finds distance of veins w.r.t. reference point
Pattern cannot change	Distance can change w.r.t reference point
More accuracy	Less accuracy

Correlation matrix is the method used for the matching the eye vein pattern with the pattern stored in the database. Correlation matrix stores the pixel values of the vein pattern in the form of matrix which is calculated after subtracting the red pixel values from the white pixel values of eye vein matrix. This pattern of pixel values is then matched with the pattern of eye vein stored in database
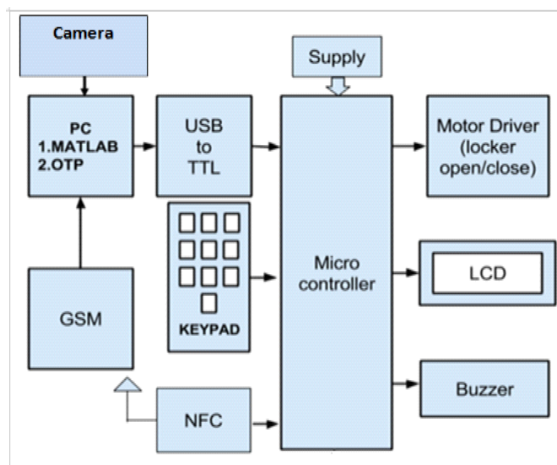
PROPOSED SYSTEM

Figure 1: Block diagram of the proposed system.

Keypad Password:

The 16-button keypad provides a useful human interface component for micro controller. The password is entered through this keypad.

GSM for OTP:

The OTP part by which user gets the password to be entered for final verification.

NFC:

Near Field Communication or NFC is a short-range high frequency wireless communication technology which enables the exchange of data between devices over about a 10 centimeter (around 4 inches) distance.

Eye vein using IP in Matlab**:**

Here we are using MATLAB as a platform to programming using image processing technology. Here we will be having set of images whose access should be given to open locker. These images will be used as database images. We will extract veins of these images and store as a database.

Arduino micro Controller:

The Arduino Mega is a microcontroller board based on the ATmega2560. It contains everything needed to support the micro controller; simply connect it to a computer with a USB cable or power it with a AC-to- DC adapter or battery to get started.

Motor opening Locker Mechanism:

It is a quadruple half-H- bridge Motor driver. It is designed to provide 600mA current at voltages from 4.5V up to 36V. It is possible to drive 2DC-Motors in both directions with it, using only 2 pins per motor. Motor driver drives the motor to open the lock of locker. As the all stages of authentication is done.

NFC

It is a very short-range protocol. It supports communication at distances measured in centimeters. The devices have to be literally almost touched to establish the link between them. This has two important consequences:

(1) The devices can rely on the protocol to be inherently secured since the devices must be placed very close to each other. It is easy to control whether the two devices communicate by simply placing them next to each other or keeping them apart.

(2) The procedure of establishing the protocol is inherently familiar to people: you want something to communicate – touch it. This allows for the establishment of the network connection between the devices be completely automated and happen in a transparent manner. The whole process feels then like if devices recognize each other by touch and connect to each other once touched.

Figure 2: NFC

CONCLUSION

Current biometric systems are generally inflexible and not optimized for use within an enterprise to provide high security. Therefore there is a need to develop a robust system to recognize a person using eye veins which will enable to create an access control system. The purpose of this paper is to

demonstrate the verification of a person in a locker system using eye veins and NFC along OTP and password by comparing current systems within their current architecture to like systems supportedby a more robust and modern architecture. Human blood vessels are the best biometric method because the dataset lives within the body.The best part is those blood-vessel patterns can be turned into unique data signatures which can be used to replace or supplement traditional passwords. NFC also increases the security on another level. There is scope to improve the system by increasing the accuracy and speed.

ACKNOWLEDGMENT

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