Multilevel Security System for Bank Locker

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Abstract-From the ancient time to present time human are constantly changing the world with its valuable knowledge and concise. But We are always concerned with the security of our relatives and of our valuable things like ornaments , vehicles , wealth etc. Banks are one of the most secured places to keep our valuable things but they lacks some serious security features hence leading to robbery. In this paper we tried our best to enhance the security of BANK LOCKERS through some embedded security technology as stated below:

1. The Main purpose of the system is used to design and implement a Bank locker with a Security System Based On Fingerprint Scanner [5], User Password,RFID[9] ,Temperature And IR Sensor which can be implemented in homes and offices as well apart from the Banks.
2. Only authentic and verified person can access his/her belongings from the Bank locker.
3. In case of any attempt to open the bank locker without proper clearance. The security system will blow the alarm bell or buzzer[9] at security monitoring places.

Keywords- *Fingerprint scanner, user password, RFID, temperature sensor and IR sensor*

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I. Introduction

In a sensitive country such as India it is a great challenge for the banks to channelize funds and maintain security of the bank lockers. Almost every day we come to know about bank robberies from various parts of the country via news which leads to the questioning on bank systems reliability and safety to a common man.

Hence we decided to fix this issue by developing a "MULTILEVEL BANK LOCKER SECURITY SYSTEM " which is highly reliable , safe and secure for keeping our valuable things secured from other persons in our bank lockers.

Our system is focused on two fields of operation:

Authenticating An Authorized Customer Before Enabling Him/her To Access The Allotted Locker.

Monitoring Bank Locker Security And Alarming The Security Department In Case Of Any Undesired Activity With Bank Locker.

The temperature sensor [11] is actually used for detecting any sudden changes in temperature of locker which happens if anybody tries to use any sort of gas or laser based cutting tool in an attempt to open the bank locker in undesired way. And the Infra redsensor [12] detects the movement around bank locker when the bank locker room is closed and somebody is still inside which helps in giving alarming signal to security system making it more reliable and efficient.

II. Objective of System-

To ensure safe and secure access to a bank locker from a genuine authorized user by the following security check levels-

1.RFID

2.Password Insertion

3.Fingerprint Sensor

If incorrectpassword then alarm will get activated.

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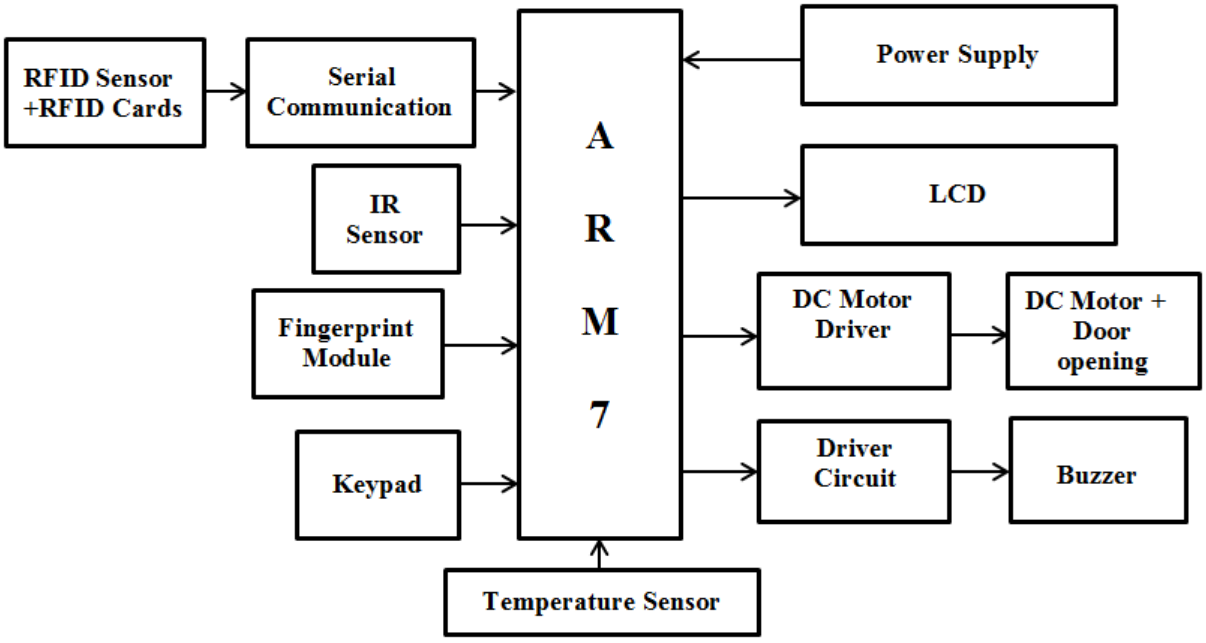
III. Proposed System



The block diagram mainly consists of the following blocks:

1. Microcontroller ARM 7
2. Fingerprint scanner(R303a)
3. RFID Sensor
4. LCD interface
5. Serial interface
6. Keypad
7. Motor Driver Unit(ULN2003)
8. DC motor.
9. Temperature Sensor(LM35).
10. Infrared Sensor
11. Buzzer/Alarm

Working And Explanation-

1. Microcontroller ARM7(LPC2138)-
   The LPC2138[4] microcontrollers are based on a 32/16 bit ARM7TDMI-S™ CPU With real-time emulation and embedded trace support, that combines the microcontroller With 32 kB, 64 kB and 512 kB of embedded high speed Flash memory.

2. Fingerprint Scanner[5]&[1] And Module(R303a)-
   This is the final security clearance level based on scanning fingerprint of the person who wants to access the locker room and performs a matching from its database collection to verify whether the person is authorized or not before opening the locker room.
   The sensor also has some other excellent features like low power consumption and serial interfacing along with numerous commands that can be integrated as per the need of an application. Also the module is compact and durable.

3. RFID-

   RFID[9]Stands for Radio Frequency Identification. Our RFID module has two parts one the RFID tag as shown in picture above and second is the RFID tag sensor. The tag acts like a kind of bar code which is unique and efficient for identification of the authorized person for accessing the bank locker. It emits the radio frequency waves that contains the identification code which is sensed by the sensor that reads the identification code and declares whether the person is authorized or not before moving to next security clearance level.

4. LCD(Liquid crystal display)-
   As our system needs to display the messages for the successful identification as well as unsuccessful

identification attempts and how many attempts are left. We need some kind of cheap and efficient display device. Hence the LCD[8] is the optimum choice. It is configurable and readily available in market. The LCD configuration that we have opted is 16x2 which is enough for our need.

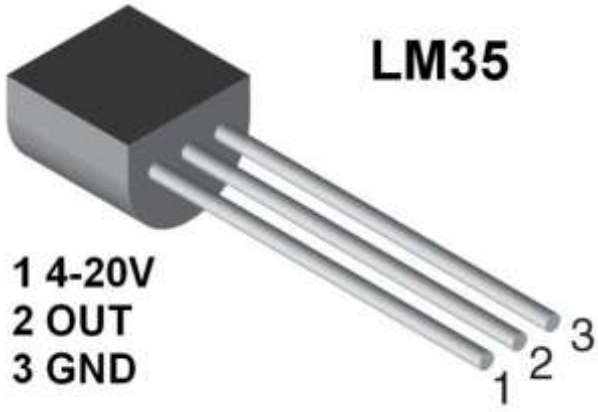
5. Serial Interface-
The most commonly used interfaces these days for interfacing and communication is RS232[6].It provides a very effective method for data transmission with less wires and less cost Besides the fact that serial port is harder to program than parallel port.RS232 basically provides three links as follows[9]:
   i. Link1 for transmit.
   ii. Link2 for receive.
   iii. Common ground.

6. Keypad 4X4-
[7]It is simply used for entering the password when asked by our system for security clearance. Three attempts are provided for correct password insertion failing which will activate the alarm.

7. Motor Driver Unit(ULN2003)-
[6]It is very much reliable for providing the high current and voltage to relay for opening and closing of the locker room door.UTC ULN2003 is high current and high voltage provider and handler. It has array of seven NPN Darlington transistors providing 50 V and 500mA Output. It is also compatible to CMOS logic[9].

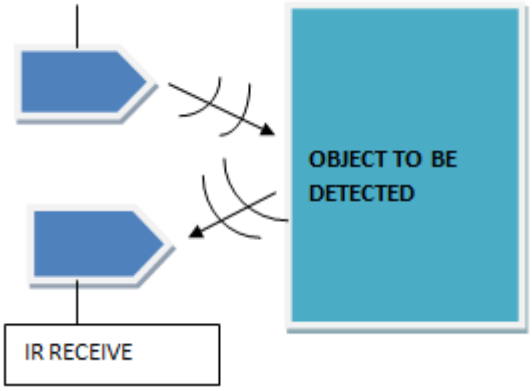
8. Dc Motor-
They work on the principle of electromagnetic induction but in reverse manner. The current is provided to armature of motor[9] which is kept in between magnetic field. As a result a torque is produced in the armature by magnetic field interaction with current and the motor armature revolves.

9. Temperature sensor(LM35)-
[11]It is kept for monitoring of the bank lockers by constantly measuring the temperature and if there is any sudden change in temperature above threshold value then the alarm will be activated. We chose LM35 for this purpose as it is small, cheap and very much efficient. Some other important features[9]:
   - **Calibrated Directly in Celsius (Centigrade)**
   - **Linear + 10-mV/°C Scale Factor**
   - **0.5°C Ensured Accuracy (at 25°C)**
   - **Rated for Full −55°C to 150°C Range**



10. Infrared Sensor-
[12]Among the two bank locker monitoring sensors INFRARED sensor is the second sensor. It is basically used for motion detection in front of the bank lockers so that if anybody is present inside the room during the closed hours of bank or when the room should be devoid of any person then that person will be get detected by the IR sensor if he/she moves even a little for accessing any bank locker.
On any kind of motion detection the alarm will be activated except when the actual authorized person is accessing his/her allocated locker.
As the Infrared sensor works by emitting and detecting reflected infrared light hence it is more efficient and has faster response than Ultrasonicsensors. Range: 700nm to 1400nm for near range applications [9].

11.Alarm/Buzzer-Abi-003-Rc PiezoIndicator-
It is solely used for the purpose of for producing fairly decent loud sound which can be used or interpreted as an alarm.



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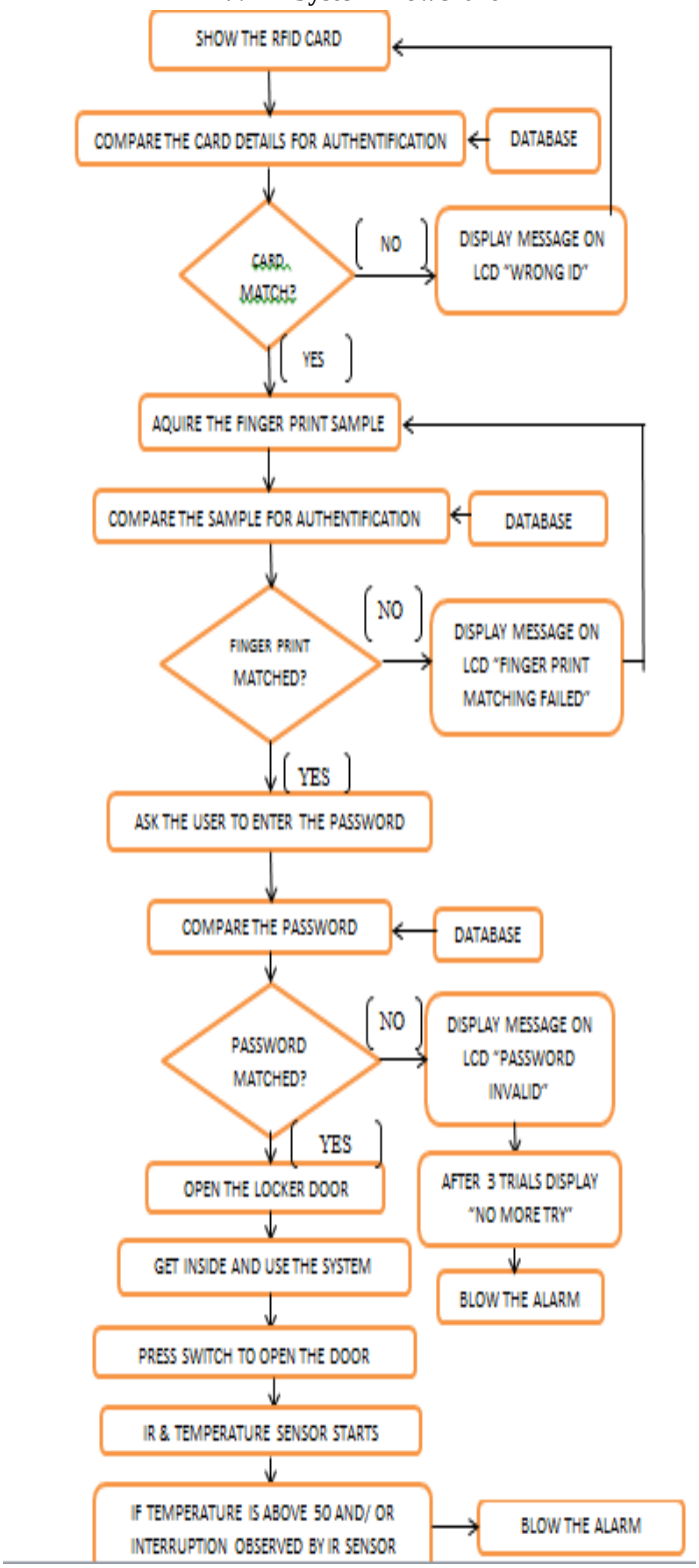
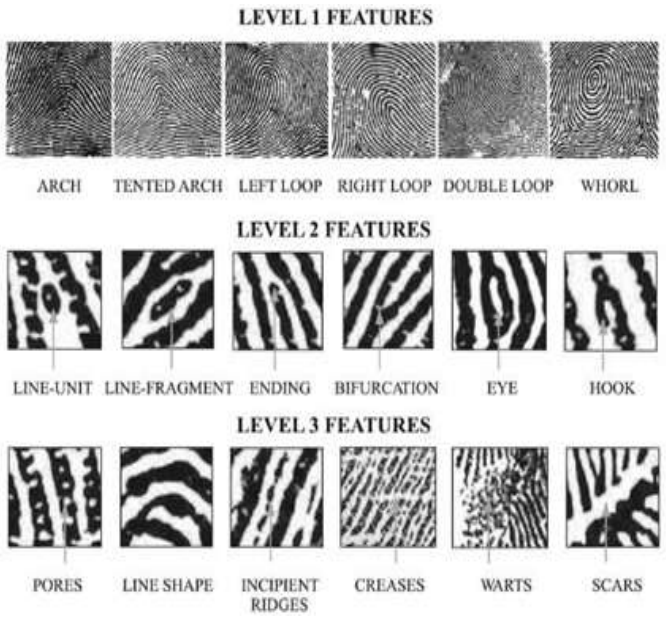
IV. System Flowchart-



V. Fingerprint Sensing-

[9]There are two primary methods of capturing a fingerprint image: inked (off-line) and live scan (ink-less).[3] An inked fingerprint image is typically acquired in the following way: a trained professional obtains an impression of an inked finger on a paper and the impression is then scanned using a flat bed document scanner. The live scan fingerprint is a collective term for a fingerprint image dIRectly obtained from the finger without the intermediate step of getting an impression on a paper. Consequently, portions of the image formed on the imaging plane of the CCD corresponding to ridges are dark and those corresponding to valleys are bright. More recently, capacitance-based solid state live-scan fingerprint sensors are gaining popularity since they are very small in size and hold promise of becoming inexpensive in the near future. A capacitance-based fingerprint sensor essentially consists of an array of electrodes. The fingerprint skin acts as the other electrode, thereby, forming a miniature capacitor. The capacitance due to the ridges is higher than those formed by valleys. This differential capacitance is the basis of operation of a capacitance-based solid state sensor[1]&[2].

VI.Feature Extraction-



A feature extractor finds the ridge endings and ridge bifurcations from the input fingerprint images. If ridges can be perfectly located in an input fingerprint image, then minutiae extraction is just a trivial task of extracting singular points in a thinned ridge map. However, in practice, it is not always possible to obtain a perfect ridge map. The performance of currently available minutiae extraction algorithms depends heavily on the quality of the input fingerprint images.[3] It mainly consists of three components[10]: *(i)* Orientation field estimation, *(ii)* ridge extraction, and *(iii)* minutiae extraction and post processing.

VI (A). Orientation Estimation:

[10]The orientation field of a fingerprint image represents the directionality of ridges in the fingerprint image. It plays a very important role in fingerprint image analysis. A

number of methods have been proposed to estimate the orientation field of fingerprint images5.[3] Fingerprint image is typically divided into a number of non-overlapping blocks (e.g., 32 x 32 pixels)and an orientation representative of the ridges in the block is assigned to the block based on an analysis of grayscale gradients in the block. The block orientation could be determined from the pixel gradient orientations based on, say, averaging5, voting9, or optimization7.

VI (B).Segmentation:

It is important to localize the portions of fingerprint image depicting the finger (foreground). The simplest approaches segment the foreground by global or adaptive thresholding.[3] A novel and reliable approach to segmentation exploits the fact that there is significant difference in the magnitudes of variance in the gray levels along and across the flow of a fingerprint ridge. Typically, block size for variance computation spans 1-2 inter-ridge distance.

VI(C).Ridge Detection :

The approaches to ridge detection use either simple or adaptive thresholding.[3] These approaches may not work for noisy and low contrast portions of the image. An important property of the ridges in a fingerprint image is that the gray level values on ridges attain their local maxima along a direction normal to the local ridge orientation7,8. Pixels can be identified to be ridge pixels based on this property. The extracted ridges may be thinned/cleaned using standard thinning10 and connected component algorithms11.

VI(D). Minutiae Detection:

Once the thinned ridge map is available, the ridge pixels with three ridge pixel neighbors are identified as ridge bifurcations and those with one ridge pixel neighbor identified as ridge endings. However, the entireminutia thus detected is not genuine due to image processing artifacts and the noise in the fingerprint image[9]

VI(E). Post Processing:

In this stage, typically, genuine minutiae are gleaned from the extracted minutiae using a number of heuristics. For instance, too many minutiae in a small neighborhood may indicate noise and they could be discarded. Very close ridge endings oriented anti-parallel to each other may indicate spurious minutia generated by a break in the ridge due either to poor contrast or a cut in the finger. Two very closely located bifurcations sharing a common short ridge often suggest extraneous minutia generated by bridging of adjacent ridges as a result of dirt or image processing artifacts[3]&[9].

VII. Future Scope Of Our System-

Nothing is perfect in this world but there are always chances of betterment and evolution of any system or product. Hence in our project “MULTILEVEL SECURITY SYSTEM FOR BANK LOCKER” we are looking towards the following future additions and amendments for making this system more efficient , reliable and building solid relationship between customers and their bank or users and locker service providers organizations.

a. Face recognition systems addition.
b. Voice recognition systems addition.
c. GSM module for OTPS and two step verification through mobile of user.
d. Data encryption.
e. IRIS scanners can also be added.
f. Multi-biometrics can be used for ultimate authentication.
g. Allowing access to more than one person to the same locker. If the user want to do so in case of any emergencies provided that the other person data is stored in security system’s database.

We are also considering about the care of disabled persons who cannot provide fingerprints for security clearance. For them we can provide face detection or voice detection or both to ensure that they do not face any unease in clearing the security checks .

VIII. Expected Result:

Since from the beginning only we have tried and attempted to provide satisfactorily reliable measures for security and healthy monitoring of the bank lockers or any locker which is connected with our security system. Hence , we expect our system to produce the following results before opening the locker room’s main door:

a. Successful scanning of an authorized RFID tag and producing the matched result message on LCD.
b. Successful fingerprint scanning of authorized user and validating it by displaying message on LCD for proceed to next checkpoint.
c. Last checkpoint having password insertion
   And if password is incorrect then activating the alarm after three incorrect password insertion attempts.
d. The bank locker is continuously monitored by an IR sensors and a temperature sensor for ensuring that the locker is not under any type of mishandling or undesIRed activity specially during those hours when users or customers are not allowed to access the locker room. If found such activity then the alarm will get activated immediately.

IX. Conclusion-

This paper is written in order to develop and demonstrate the idea of enhancing and providing a much better security system for BANK LOCKERS as compared to today's traditional method of bank lockers which are operated through conventional keys. We have adapted the biometrics authentication system along with password and RFID Tags which performs better than old key-locker security methods. Also the temperature and IR sensor is used for monitoring of the lockers to detect any unusual behavior of users with the lockers. However, in future improvising of reliability and robustness of authentication and monitoring system can always be focused more and more.

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