Implementation of Security System for Bank Locker Using Biometric Fusion

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Abstract: In physical world, many systems were available, which allows only the people who know the authentication key to access the Bank Lockers. We need to design the complex system as a means to increase the security. The complex systems will be difficult to hack or attack but may require heavy procedure to design and require more hardware and software resources. The existing systems are formed on Keypad method, Smart Card and Password method. In the proposed method we are introducing Biometric.

Keywords: Embedded systems, IOT, Finger print sensor, Servo Motor, LCD, Buzzer

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1. INTRODUCTION

In the world of reality**,** We are more likely dependent on the latest Technologies to build any of the system. Here we are using Embedded systems and IoT. With time changing technologies are constantly evolution takes place which is predominant for both individuals and Market growth.

Embedded systems are defined as many components fabricated on a small single chip which reduces the size, cost of the chip. Now-a-days we are more dependent on Embedded systems for every application we use. They are dedicated to perform specific tasks and also have lot of advantages like cost and size efficient. They are also benefiting from scale of economics.

IoT is the bypass of Internet of Things. It is the latest technology which is network between the devices or people. These objects may be embedded with software or networking or sensing devices. The latest emerging technology we are using everywhere in the world is Internet of Things. As the name suggests it is the communication between the devices using internet. **Internet of Things (IoT)** is described as networking of physical objects which contain electronics embedded within their architecture in order to communicate and sense interactions amongst each other or with regard to the external environment.

People are much worried about the safety of their valuable things like money, jewelry, site papers etc., So, in order to store all these valuables in a safe and secure place many systems came into existence. The systems implemented using passwords are very easy to hack or attack or forgetting the password may create a big problem.

The system implemented using smart card are very easy to use and maintain but it doesn't provide the secure up to the mark compared to trending technologies, the Smart cards may be broken or forgotten at home or may be stolen. So, beneficial to avoid all these situations and get out of all the problems we introduced the biometric system in our project which is the best method.

Biometric is explained as the statistical analysis of biological data. It differs from one individual to another and also very secure to use and maintain. Biometric not only have fingerprint but also involves iris identification, facial, voice and palm or finger vein patterns. Here, In our system we are using fingerprint as biometric.

2. LITERATURE SURVEY

In the existing system, they are built using components such as ARM Micro-controller, IR sensors, GSM Module and Bluetooth for recording and trailing the security information through Messages and Mails, At the same time RFID tags, Smart cards, Passwords and Keypads used for Authentication.

a) In GSM based bank locker security system, The PIR sensor is used for discerning the motion by scanning the differentiation between the heat emitted by the surrounding objects. Generally, the range of system will be from 6 meters to 30 feet.

b) IR based security alarm system can detect any moment and gives the alarm if any unauthorized person enters. This system is very helpful in Homes, Banks, Museums and Restricted Areas.

c) Keypad based system implemented for bank locker is easy to use and maintain that user don't need to carry any items and just need to typewrite the password or security pin to unlock.

There is also another model in keypad system where user needs to enter the transaction amount using the keypad if the transaction was successful then the information is sent to server through Bluetooth and user gets a success message for registered mobile number or else gets a warning or error message.

3.1 DESIGN AND IMPLEMENTATION

In this proposed system, we are using Biometric system i.e., fingerprint sensor which was the principal component

for the sake of security. Microcontroller used is Arduino-Nano, Buzzer, Liquid Crystal Display(LED), Servo Motor and Buttons.

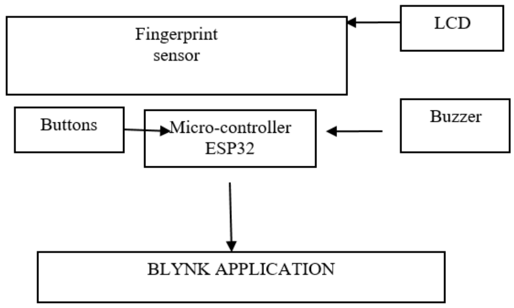


Fig 1 : Block Diagram

Working principle:

Finger print processing involves two main elements, fingerprint enrolment and fingerprint matching. There are two types of matching can be 1:1 or 1: N. When enrolling, user needs to enter the finger two times. The system will process the finger for two times, it also generates a precedent of the finger based on processing results and store the template. Here, user enters the finger through an optical sensor and the generated template of the finger are compared with templates of the finger library.

Working principle of the system, first step is to activate the power supply then the Micro-controller ESP32 and Liquid Crystal Display LCD will initialize. The second step is to connect the Wi-Fi for mobile to ESP32 and confirm that both connect to the same network. The LCD displays the commands what step to be followed next. After connecting to the Wi-Fi LCD displays the title of the project as "BANK LOCKER SECURITY SYSTEM". Here we are using fingerprint sensor for authentication of a person.

The LCD displays "Place a Finger". It shows that system is ready to accept the inputs. Now when we place a correct finger i.e., authorized finger then the bank locker will open with a buzzer indicating door is opened. If the finger placed is unauthorized then there may be no response from the system because as fingerprint sensor will be continuously sensing there will be infinity fingers placing on the sensor so there will be no unauthorized indication.

We are using BLYNK Application to see the status of the system if there is any change in the state of the system then we get notifications through Messages and Mails from ESP32.

3.2 HARDWARE ARCHITECHTURE

The hardware components used in the project are:

A. Micro-Controller ESP32:

ESP32 is considered as another type of Node MCU. ESP32 has no variations in its boards its only single model.ESP32 has inbuilt Wi-Fi and Bluetooth connection unlike Arduino. These facilities of ESP32 are more suitable for Projects like IoT and Embedded systems.

The advantages of ESP32 are its cost efficient, wireless network compatible and low power consuming device. The cost efficiency factor of ESP32 is because of its manufacture as its design is unique compared to Arduino. The programming language used in ESP32 is either C or C++ which are officially supported but there also exists other languages like python, Lua, JavaScript supported by this board.

Features of ESP32:

Wi-Fi	802.11b/g/n and
Bluetooth	v4.2 BR/EDR
Pins	48
CPU	Xtensa dual-core and ULP
Speed	160 or 240MHz
Memory	320k/B RAM, 448k/B ROM
Power Management	Internal low-dropout regulator
Security	All IEEE 802.11 are supported

B. Fingerprint Sensor:

Fingerprint sensor is a device with inbuilt fingerprint detection module that differentiate the fingerprints.

Fingerprint sensor provide more accessible and safer way to latch and unlatch the devices. Fingerprint sensors work for devices that require better performance and need more accuracy than regular passwords. In the process of getting authentication, Enrollment and matching are the two principal factors that form working principle of a fingerprint sensor. Before accessing any fingerprint sensor, you need to enroll your print into the device's database.

Here we are using multi-biometric fusion that means we can store many no.of fingerprints and in our system we can store up to 127 fingerprints.

C. Servo Motor:

Servo motors are controlled by sending an electrical pulse of different lengths, or works on the principle of pulse width modulation (PWM), through the control PIN.

Servo Motor is made of DC motor which is controlled by potentiometer. The three principal elements are minimum pulse, a maximum pulse, and a repetition rate.

A servo motor can usually only turn 90° in both directions with a total of 180° movement.

D. Buzzer:

When a voltage is applied an audio signaling device like a buzzer, the piezo-electric material deforms. This deformation in the buzzer causes beep sound. Buzzer consists of ferromagnetic disk and the beep sound caused is same as movement of ferromagnetic disk. The main function of this is to convert the signal from audio to sound.

E. Liquid Crystal Display:

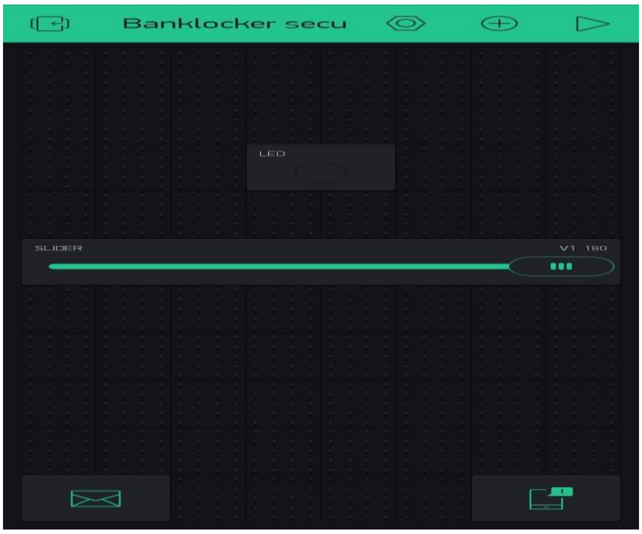
An electronic device used to display data is known as Liquid Crystal Display. In general, it includes 16 Columns & 2 Rows so it can display 32 characters in total and every character will be made with 5×8 Pixel Dots. So, the total pixels within this LCD are calculated as 1280 pixels.

F. Blynk Application:

Blynk is an application associated with Internet of things (IoT) company which provides a finest platform for developing mobile applications used to connect electronic devices through Internet and remotely monitoring and controlling. Blynk was founded by Pavel Bayborodin, a user experience (UX) expert in mobile and automotive space.

G. Power Supply:

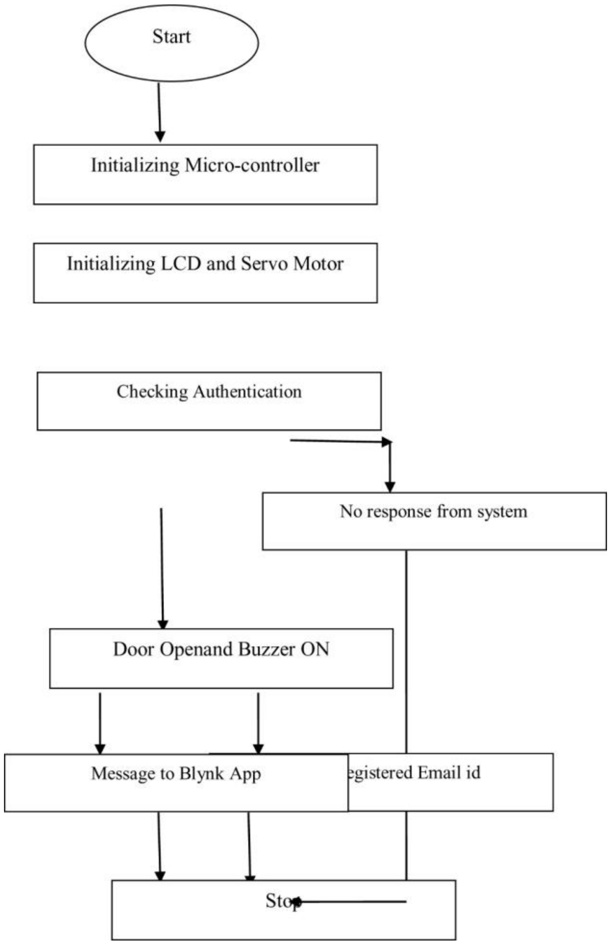
Power supply is the main functionality for the working of any project. The power supply supported by this Micro-Controller is 600mA.The elements are not straightly connected to the Microcontroller because if the voltage applied is greater than the threshold then the Micro-controller may crash. So, we are using power module which limits the power coming from the devices and send the desired voltage to the micro-controller needed for communication between devices.



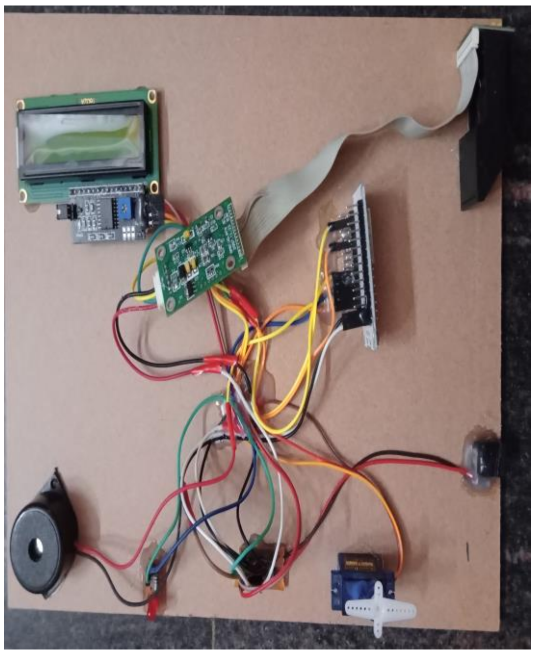
3.3 Flow Chart

The below figure shows the flow chart of bank locker security system which explains how the system works.

The specialty of this system is that Buzzer will be ON while door is opening, the aim behind this Buzzer is to indicate that door is opened which will be easy for Visually Impaired People to identify.



4.RESULTS



The above diagram is the Hardware kit which has the components of ESP32 Micro-controller, Fingerprint sensor, Servo Motor, Buzzer, LCD, Buttons, Power supply.

The components are not directly connected to the Micro-controller because when the Voltage is more than the threshold voltage then the micro-controller cannot withstand the power obtaining from the devices. So, we use a power module to limit the power and supply the desired voltage to the Microcontroller.

5.APPLICATIONS AND FUTURE SCOPE

This project is applicable at : In all banks for Cabinets, bank cash machines, Educational Institutions, can be used in jewelry shops, In all shopping malls, In all IT Sectors, In houses, Schools treasuries, College's treasuries and in all industries, All VIP vehicles, in hospitals, offices and Vehicle Security Applications.

FUTURE AMBIT

In addition to applications, the future ambit of our project is to develop smart bank Locker security systems using "Face Recognition", "Iris and Retina".

These are used for Scanning the visual identification of a person. In the upcoming days we can upgrade it for more security issues for related to Jeweler Shops, RBI(Reserved Bank of India), Planetary science, Defense, National Army, Hospitals etc., Instead of ESP32 the latest Chip model i.e., AVR MC is re-programmable, so we can upgrade it to many applications in future.

6.CONCLUSION

The principle focus of our project is to fabricate and implement the bank locker security system based upon Finger print sensor and Buzzer. For this project, we have done the research on some papers related to this project. In our project we introduced biometric based bank locker security system which provide enormity of security. If nay unauthorized user tries to access, will be unable to unlatch the locker. We are using fingerprint as the verification system so the duplication of fingerprint is considered as unauthorized. The system we introduced has many advantages like cost efficiency and easy to use. This system can be mounted anywhere and can be remotely monitored from anywhere, where you need enormity of security. Now-a-days cheap and best policy is the important factor needed for any project to implement in real world. This bank locker security system is very reliable and safe system.

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