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ARM7 based Smart ATM Access System

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Abstract – ARM7 Based Smart ATM System is designed to add more security to the ATM systems by using biometric, OTP and Accelerometer sensor. In our proposed system, Bankers will collect the customer's fingerprints and mobile number while opening the account then only customers can access the ATM machine. The primary step of this project is to verify currently scanned finger print with the fingerprint which is registered in the bank. If it finds as a valid then ATM machine, will ask 4 digit pin which is fixed. If the 4 digit code matches with entered pin then system will automatically generates another different 4 digit code i.e. OTP. And that code will be message to the customer registered mobile number. Here customer has to enter this code again. After entering OTP, System will check whether entered code is valid or not. And if it is valid, the customer is allowed for further accessing. Also Accelerometer sensor is used in order to provide security for the ATM machine.

Index Terms – *ATM, OTP, Fingerprint, Accelerometer sensor*
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I. INTRODUCTION

An Automated Teller Machine (ATM) is a computerized telecommunications device that enables the clients of any financial institution to perform financial transactions like withdrawal, balance enquiries. ATMs are located not only in banks premises but also in other places where people need cash frequently like shopping malls, airports & railway stations, hotels and restaurants. They are scattered throughout the cities, allowing the clients to access their accounts easily. Usually to perform a transaction a customer has to use an ATM card which is issued by the respective financial institution and a personal identification number (PIN) is given along with each card for authorization of the customer's account.

Nowadays, crimes at ATMs have become an alarming issue. Security for the customer's account is not guaranteed by PIN. Many people, who aren't familiar with the concept of PIN, are unlikely to memorize and recognize it. There are many people, who mistrust PIN, such as, if they have lost their card, they would feel unsafe that their account could be accessed by others and they would lose all their money.

To enhance security and authentication of the customer's account, the concept of using the fingerprint instead of card is proposed, since biometric fingerprint is unique for each and every human being and it has more authentication than the PIN. To Furthermore to increase Security, Mobile OTP (One Time Password) is generated. If customer enters valid OTP bank transactions are allowed.

II. CHARACTERISTICS OF SYSTEM

The security to the ATM machine is enhanced by using ARM7 microcontroller which acts as an interface between ATM and customer.
The characteristic of the system as follows:
ARM7 Microcontroller: It controls all the peripherals which are connected to it, such as LCD, biometric, accelerometer sensors.
Biometric Identification: In order to gain access to the ATM machine, first the biometric of the customer is verified with server data which is collected by the bank while customer opening the account.

GSM Module: It is used to further enhance the security by sending OTP to the customer registered mobile number.
Sensors: To provide security to the ATM machine, temperature sensor and accelerometer sensors are used.

III. HARDWARE DESIGN AND SOFTWARE DESIGN

Hardware design refers to identification of physical components and their interrelationship. Software design is the process of implementing software solutions to one or more problems. The important part of software design is the software requirement analysis. The details of hardware and software design are as follows.

A. Hardware Design
The LPC2148 chip is used as the core of hardware. The modules such as LCD, keyboard, alarm, biometric recognition, Sensors, GSM are connected with the LPC2148 chip. The modules of the system as follows:
LCD module: It is used to display visual information.LCD requires 3 control lines from the microcontroller Enable, Read/Write, Register Select.

1) Enable (E)
This line allows access to the display through R/W and RS lines. When this line is low, the LCD is disabled and ignores signals from R/W and RS. When (E) line is high, the LCD checks the state of the two control lines and responds accordingly.

2) Read/Write (R/W)
This line determines the direction of data between the LCD and microcontroller. When it is low, data is written to the LCD. When it is high, data is read from the LCD.

3) Register Select (RS)
With the help of this line, the LCD interprets the type of data on data lines. When it is low, an instruction is being written to the LCD. When it is high, a character is being written to the LCD.

Keyboard module: It can be used for inputting passwords.
Alarm: This is the output device, which we are using to indicate the two of the security threats naming Fire and Accelerometer Sensor.

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Accelerometer Sensor: It is used for sensing the position of ATM. If in case of robbery, the position of ATM is changed then this sensor will automatically shut down shutter of ATM center.

Fingerprint recognition module: R305 fingerprint module is used for recognition of fingerprints. This module uses optical sensor for capturing and detecting of fingerprint images.

GSM Module: A GSM module exposes an interface that allows sending and receiving messages over the modem interface.
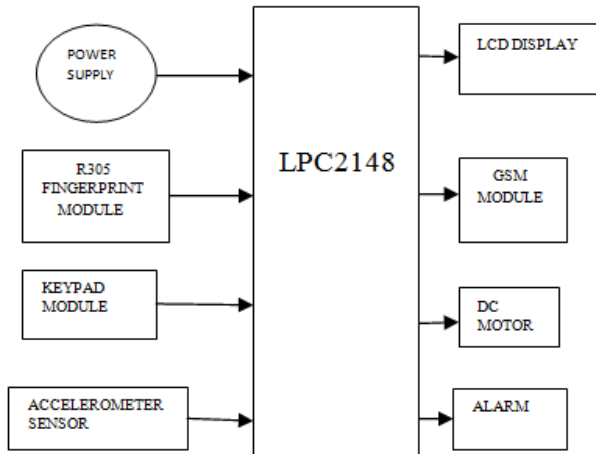

Figure 1: The Block Diagram of Hardware

Microcontroller (LPC2148): LPC2148 is the widely used IC from ARM-7 family. LPC2148 is manufactured by Philips and it is pre-loaded with many inbuilt peripherals making it more efficient and a reliable option for the beginners as well as high end application developer.

R305 Finger print module: This is a finger print sensor module with TTL UART interface for direct connections to microcontroller UART or to PC through MAX232. The user can store the finger print data in the module and can configure it in 1:1 or 1: N mode for identifying the person. The finger print module can directly interface with 3v3 or 5v Microcontroller. A level converter is required for interfacing with PC serial port.
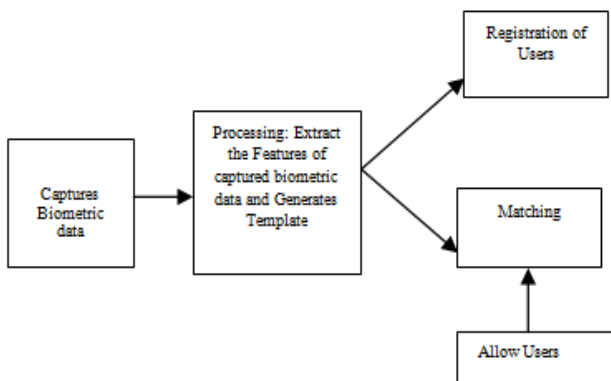

Figure 2: Fingerprint Recognition Process

Fingerprint processing involves functions such as enroll, search, and verify.

Enrollment: In enrollment when user place is finger it acquires a fingerprint image from the sensor, enrolls and saves it in SRAM.

The image is processed, enhanced, and compressed to create a fingerprint template.

Search: Compares a raw user image to a list of previously enrolled templates, through a series of processes.

Verification: verification involves verifying and validating a user's identity by comparing a raw user image to a previously enrolled template via real-time, closed-loop pattern-matching algorithms
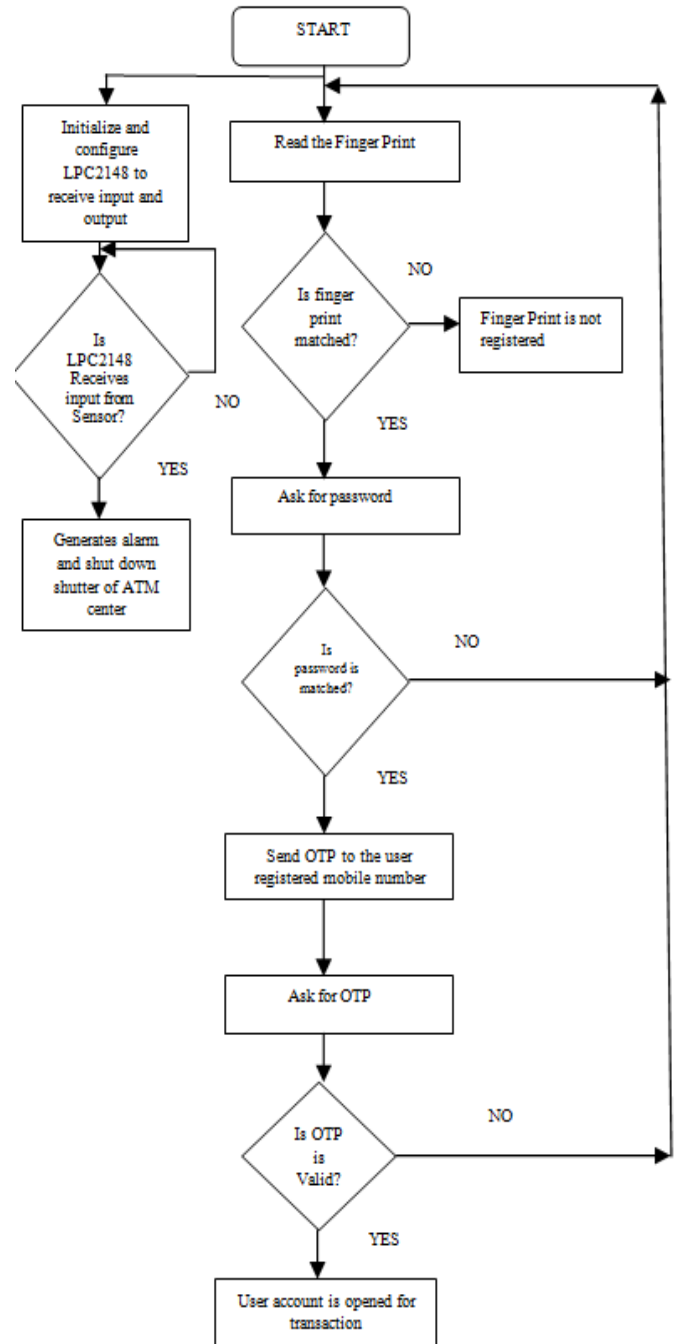
B. Software Design

Figure 3: Overall flow chart of software

Working of the system:

The working of the system starts with biometric, when user enter to the ATM center he has to place his finger on the R305 biometric module, The system compares this fingerprint with bank server which already collected while user opens the

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account, if it is valid the system ask for 4 digit PIN, if user enter the correct PIN number ,the system generates the OTP and sends the OTP to the user registered mobile number ,then system ask for OTP which is sent to the mobile number, if user enters the valid OTP then user account is opened for transaction.

Further to provide security to the ATM machine accelerometer sensors are used if position of ATM changes then LPC2148 microcontroller generates the alarm and closes the shutter of the ATM terminal.

IV.   RESULTS AND CONCLUSIONS

The Implementation of ATM security by using fingerprint recognition and GSM modem took advantages of the stability and reliability of biometric characteristics. Additional, the system also contains the original verifying methods which were inputting owner's password which is send by the controller. The security features were enhanced largely for the stability and reliability of owner recognition. The whole system will be built on the technology of embedded system which makes the system more safe, reliable and easy to use. Additional, system also contains security of ATM itself which is Accelerometer Sensors, which use a micro-machined acceleration sensing element with a DC response to measure inclination relative to gravity. As position of ATM machine change, The DC motor closes shutter of ATM centre. Biometrics offers greater security and convenience than traditional methods of personal recognition. In others, it is the only viable approach. Users of the ATM need to understand the level of security guaranteed through the use of biometric systems and the difference that can exist between the perception and the reality of the sense of security provided. The biometric system is one part of an overall identification or authentication process, which provides more security to the ATM transactions.

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