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FINGERPRINT BASED SECURITY SYSTEM FOR ATM

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Abstract – *This paper deals with the drawback of identification and verification of a person is a common thing which may include door-lock system, safe box and vehicle control or even at accessing bank accounts via ATM etc which is necessary for securing personal information. The conventional methods like ID card verification or signature does not provide perfection and reliability. The systems employed at these places must be fast enough and robust too. Use of the ATM (Automatic Teller Machine) which provides customers with the convenient banknote trading is facing a new challenge to carry on the valid identity to the customer. Since in conventional identification methods with ATM, criminal cases are increasing making financial losses to customers. Authors design a simple fingerprint recognition system using Atmega 328p as core controller. The system uses R305 fingerprint scanner to capture fingerprints. This system can be employed at any application with enhanced security because of the uniqueness of fingerprints. It is convenient due to its low power requirement and portability.*

Key Words: Fingerprint module, Arduino UNO MCU (Microcontroller), Arduino IDE Software, Liquid crystal display (LCD)

1. INTRODUCTION

Biometrics is a technology that helps to make our data tremendously secure, distinguishing all the users by way of their personal physical characteristics. Biometric information can be used to accurately identify people by using their fingerprint, voice, face, iris, handwriting, or hand geometry and so on. Using biometric identifiers offers several advantages over traditional and current methods. Tokens such as magnetic stripe cards, smart cards and physical keys, can be stolen, lost, duplicated, or left behind passwords can be shared, forgotten, hacked or unintentionally observed by a third party. There are two key functions offered by a biometric system. One method is identification and the other is verification.

Fingerprint technology is the most widely accepted and mature biometric method and is the easiest to deploy and for a higher level of security at your fingertips. It is simple to install and also it takes little time and effort to acquire one's fingerprint with a fingerprint identification device. Thus fingerprint recognition is considered among the least intrusive of all biometric verification techniques.

The present scenario to operate an ATM is with digital locks that have keys. Individually biometrics lags behind in providing hundred percent protections. To provide perfect security and to make our work easy we are using two different technologies i.e. Biometrics with Embedded system. First of all we are gathering the information related to Fingerprint enrollment phase.

To initiate the application, the fingerprint of the person is entered and it is stored into database as a template. To login into application, user has to scan his/her fingerprint, if it matches with the pre-stored images then the person has to enter the unique id which is given to him to access his ATM. If an unauthorized person tries to login then the user will be alarmed with the help of a buzzer which is linked with the controller. An authorized user is given 3 chances to re-enter the id if he/she forgets.

Although fingerprint images are initially captured, the images are not stored anywhere in the system. Instead, the fingerprints are converted to templates from which the original fingerprints cannot be recreated, hence no misuse of system is possible. In the verification, the system compares the input fingerprint to the fingerprint stored in the database of a specific user to determine if they are from the same finger (1:1 match). In identification, the system compares the input fingerprint with the prints of all registered users in the database to determine if the person is already known under a replica or false identity (1: N match).

2. HARDWARE DESIGN

To implement the proposed security for ATM terminals with the use of fingerprint recognition, we use the different hardware and software platforms. The circuit diagram implementation of the whole setup is given below.

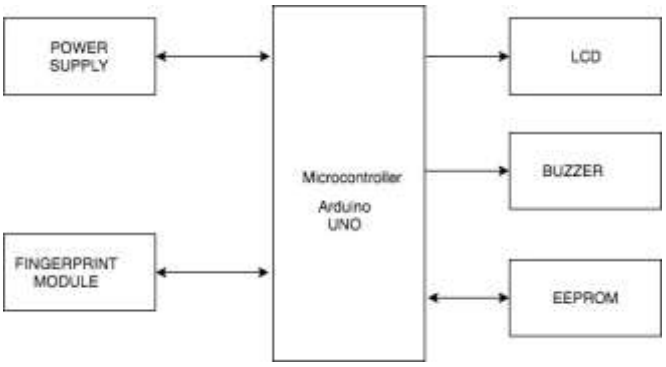


Fig – 1: Overview of the system

2.1 Microcontroller (Atmega328p)

The Atmega328 is a single-chip microcontroller created by Atmel in the megaAVR family (later Microchip Technology acquired Atmel in 2016). It has a modified Harvard architecture 8-bit RISC processor core.

2.2 Fingerprint Module (R305)

Integrated image collecting and algorithm chip together, ALL-in-One, fingerprint reader can conduct secondary development, can be embedded into a variety of end products, low power consumption, low cost, small size, excellent performance, professional optical technology, precise module manufacturing techniques, good image processing capabilities, can successfully capture image up to resolution 500 dpi.

Fig – 2 : Fingerprint Module

2.3 Motor Drive

L293D IC is same like an H bridge circuit with two channels. It has two half H bridge circuits residing in it. You can use it to drive uni polar, bi polar stepper motors, dc motors or even servo motors. The individual two channels can be stand alone to drive solenoids/relays. A single channel can be used to drive a dc motor in forward (clock wise) or back word (anti clock wise) direction. Hence we can drive two dc motors with L293D. It can also be used to output a PWM(pulse width modulation) signal. The IC came in two different versions L293 and L293D. Both have same number of operational pins with same pin names. But differ in voltage and current supply and control specifications.

2.4 User Interface

The user interface makes the communication between user and the system model easier. It includes a display unit and a function keyboard. For displaying the status of the process running in system and instructional steps for the user, we interfaced 16 x 2 LCD matrix with microcontroller through GPIO pins of port 1.

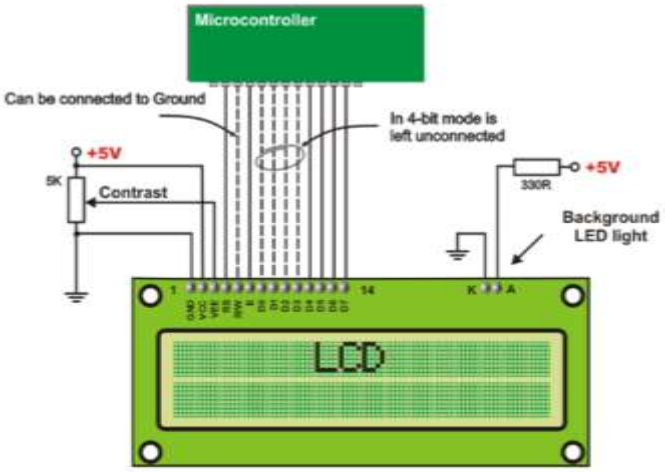


Fig – 3: Interfacing of 16 x 2 LCD with microcontroller

3. CIRCUIT AND WORKING OF ARDUINO BASED FINGERPRINT SENSOR SYSTEM

12V power is the main source of energy supply required for this system, which is given to the VIN pin of Arduino board. The solenoid electric lock itself consumes 12V supply, however Arduino microcontroller (MCU) requires only 5V which can be easily supplied from the inbuilt 5V regulator from the Arduino Uno Board. And, the other common 12V supply is externally supplied to the system.

3.1 Arduino Uno MCU board for Arduino Fingerprint Sensor system

Arduino Uno MCU board is based on ATmega328/ATmega328P acts like a CPU of the system Arduino Fingerprint Sensor Lock the figure of which is shown in figure 4. This board comprises multiple features. There are 14 digital input/output (I/O) pins, six analogue inputs, 32k flash memory, 16MHz crystal oscillator, a USB connection, power jack, ICSP header and reset button. We can use any of its features through Arduino IDE software through proper programming.

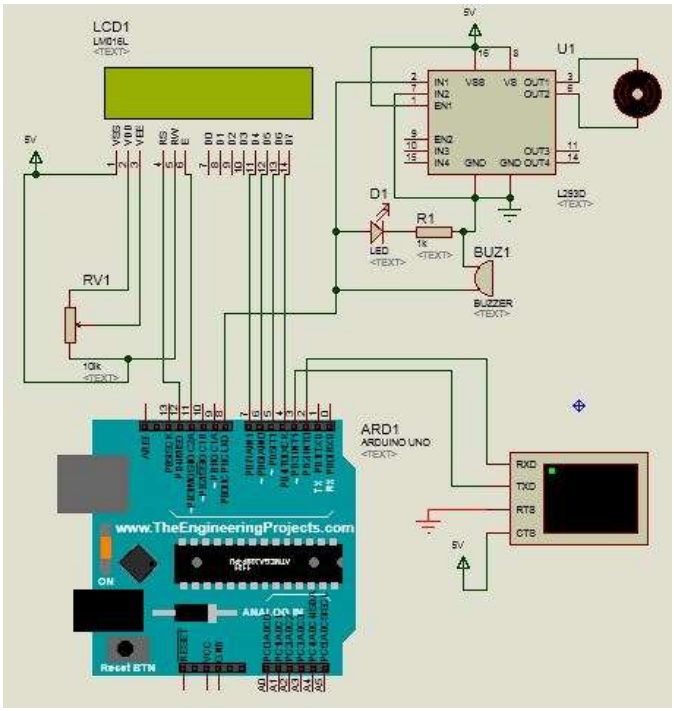


Fig – 4: Circuit Diagram

3.2 Fingerprint sensor module for Arduino Fingerprint Sensor system

The RX and TX pin of fingerprint sensor module R305 is connected across D3 an D2 pin of arduino board respectively as shown in circuit diagram . Since this module is constructed using UART technology, it is easy to interface sensor directly with the MCU or also to the PC using max232/USB serial adaptor. The information collected from the fingerprint can be collected in the module. During the process of identification, the data can be configured in either 1:1 or 1:N module. In order to ensure serial communication, two pins of R305 sensor; TX and RX are connected across digital pins 2 and 3 of Arduino Uno.

3.3 Connectivity to LCD(Liquid crystal display)

The 16*2 LCD1 acts as a display media to distribute corresponding messages when the system is executed. In this type of particular IC, each character is made of 57 dotmatrix. The connection between LCD and Arduino Uno is done in following pattern:

1) LCD pins 3, 4, 5 and 6 are configured in control mode and are linked to preset pin (VR1) as output, pin 12, GND and pin 11 of Arduino Uno respectively.

2) The four data pins of LCD; pins 11, 12, 13 and 14 are coupled to pins 7, 6, 5 and 4 of Arduino respectively.

3) The Preset VR1 is used to adjust the contrast of the LCD display.

4. SOFTWARE OF FINGERPRINT SENSOR BASED ATM SYSTEM

The core section includes the software part utilizes two different programs-enroll and fingerprint. getFingerprintEnroll(int,id), Adafruit Fingerprint (& mySerial) and getFingerprintEnroll(id) are some of the different functions syntax used in those programs. These are in-built functions found in library and they pass arguments when these functions are called at different locations of programs.

Once the enroll part of the program has been uploaded in the Arduino Uno, go through the Arduino IDE and then open the serial monitor by opening tabs like tools and then select serial monitor options. It is necessary to set the baud rate to a value lower than the serial monitor window to 38400. At the same time choose Newline option.

And now, one by one execute the instructions given on the serial monitor. Once you place a finger on the fingerprint module, type an ID number. It can be any whole number. Then when send key is entered, the corresponding ID number is transmitted to the main portion i.e. Arduino Uno form the serial monitor section. Thus sent information (fingerprint) is digitized and converted into storable form which is piled up in R305 module database.

This system can withstand a total of 200+ fingerprints which is remarkable. However, each fingerprint must have unique ID number assigned since this is the prime factor to be utilized in identification of the valid individuals name. The serial monitor assists the client in an effective way. Every real-time information of when to place the finger on the sensing module and when it is okay to remove, is all provided by the serial monitor which makes this project more user-friendly.

If you prefer to debug the system without implementing LCD display, initially upload the fingerprint program and then set the same settings as mentioned above for the serial monitor configuration. Here again the serial monitor performs the guide function. This technique of implementing circuit is employed to make necessary comparisons between the current sensed fingerprint sample with the samples already stored in the database. The programming flexibility feature permits customer to amend necessary changes in names and ID number by changing the code to a slight extent as per the requirement.

5. CONSTRUCTION AND TESTING OF FINGERPRINT SENSOR BASED ATM SYSTEM

To make this circuit more reliable and convenient, the design of PCB has been done as an Arduino Shield. Based on the requirements from the customer, further changes in the project can be done. To check if the PCB will work fine, a cable connector is used to perform test actions when connected with the Arduino.

It is to be ensured that the baud rate value listed in the program must be accurate. Its value does not affect the serial monitor but for sensitive device like R305 sensor, it must be precisely the value listed in the datasheet. However, this value may depend on the type of sensor used in the project. In the main code, this values are fed in the system as Serial.begin(38400) which represents the baud rate for serial monitor and finger.begin(57600) which represent the baud rate for sensor. The Arduino board must be reset beforehand to avoid any possible errors during validation of fingerprint.

5.1 Procedure For Configuring Fingerprint Sensor System

a) Write the software code.

b) Put the Library file in your Arduino IDE Library Folder of our computer.

c) Assemble the enrollment new user circuit shown below.

d) Upload the enroll.ino code to the arduino board.

e) Open the serial monitor either from menu or by pressing Ctrl+Shift+m key at once

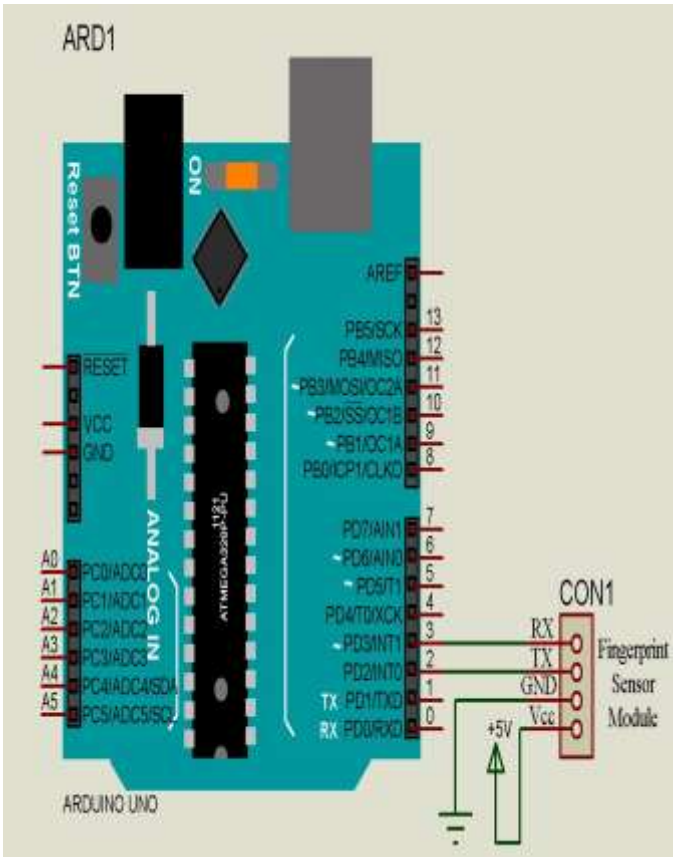


Fig – 5: Enrollment of the new user

Fig – 6: Enrolling code to Arduino

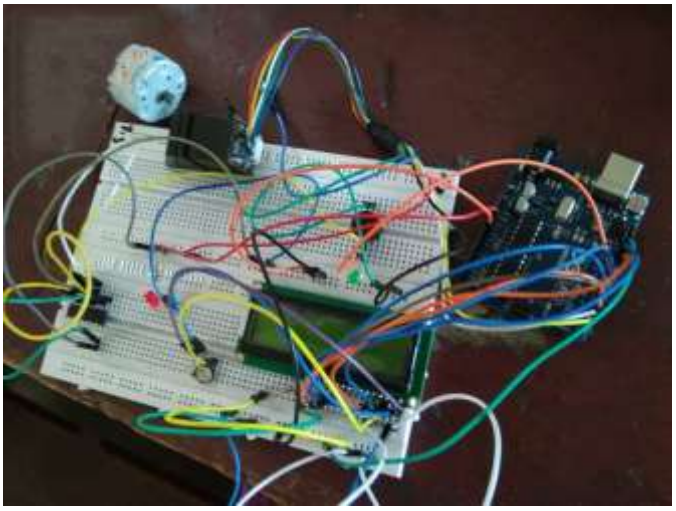
f) Adjust the Baud rate to 38400.

g) Enter the enroll ID followed by # (eg. #1), Put the finger on finger print sensor module and follow the instruction shown in serial monitor.

h) Open fingerprint.ino from the software folder and assign the user to their corresponding ID in the source code and upload it to the arduino board.

6. PROTOTYPE

The figure shows the basic arrangement of fingerprint based security system for ATM which includes fingerprint module, microcontroller, motor driver, motor, LCD display. The display shows the messages for fingerprint access and whether the fingerprint is matched. Accordingly a pulse will be given and motor rotates as, ATM security is accessed by fingerprint system.



7. CONCLUSION

After testing the system developed, we came to know that ATM prototype can be efficiently used with fingerprint recognition. Since, password protection is not bypassed in our system, the fingerprint recognition done and it yielded fast response and is found to be of ease for use. Fingerprint images cannot be recreated from templates, hence no one can misuse the system. Speed of execution can be enhanced with the use of more sophisticated microcontroller. The same hardware platform can be used with IRIS scanner to put forward another potential biometric security to the ATMs.

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