Advanced electronic voting machine using fingerprint sensor and arduino

Submitted in fulfilled of the requirement for the award of
Bachelor of Engineering Degree in

Electrical and Electrical Engineering

By

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SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with Grade “A” by NAAC

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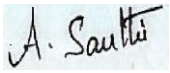
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the Bonafide work of **SNEHA A** (Register No.**37140082**) & **ARUNADEVI G** (Register No. **37140011**) who carried out the project entitled **"ADVANCED ELECTRONIC VOTING MACHINE USING FINGERPRINT SENSOR AND ARDIUNO"** under our supervision from December 2020 to April 2021.



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Submitted for Viva voce Examination held on_____

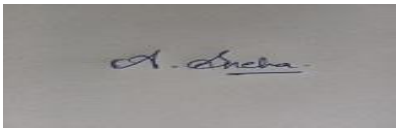
Name:

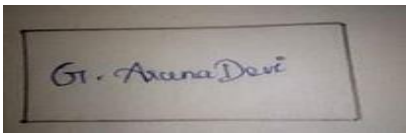
Signature:

Internal Examiner **External Examiner**

DECLARATION

We **SNEHA A** (Reg. No. 37140082) and **ARUNADEVI G** (37140011) hereby declare that Project Report entitled “Advanced Electronic Voting Machine Using Fingerprint Sensor and Arduino” done by us under the guidance of **Mrs. A. SANTHI MARY ANTONY** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering Degree in Electrical and Electronics Engineering.

1. 

2. 

DATE: 09.04.2019

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ACKNOWLEDGEMENT

We are pleased to acknowledge our sincere thanks to Board of Management of **SATHYABAMA** for their kind encouragement in doing this project and for completing it successfully. We are grateful to them.

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Abstract

Elections are a major and essential a part of democratic country and additionally rights of each person. option is one amongst the vital tasks in electing a government for any democratic country. biometric authentication system is secure, reliable and privacy protected for the aim of electronic mechanical device. This paper provides the planning of fingerprint primarily based electronic mechanical device. The developed system verifies the elector identity and additionally check whether or not the elector is authentic or not throughout election method. This work is targeted to switch the manual verification system with biometric verification system. The developed system additionally examines carefully whether or not the elector has voted once or additional. this technique doesn't need any third-party service for its operation. it's a cheap system, versatile and simple to control. completely different parts of the developed system are tested underneath numerous operational conditions. identity verification is secure and distinctive thus which may implement in mechanical device to realize high secure election. The projected methodology is to implement identity verification in mechanical device. Finally, the project aim is to switch manual verification to biometric verification. This paper is providing entire details concerning electronic voting machine with identity verification.

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CHAPTER 1

INTRODUCTION

1.1 GENERAL INFORMATION

Election could be a feature of democratic government within which individuals govern themselves and are ready to specific their selections relating to varied problems, like constitutional amendments, piece of legislation or selecting the correct person as their leader. A voting system is gift to layout the principles of the election. Political election is that the most typical style of election however there are many alternative fields wherever election is significant a part of their structure functions. Election is significant for business, informal organizations and non-profit organizations.

This study report primarily focuses on developing a model of embedded system that deals with fingerprint legal system which might facilitate in progression of election in sturdy and secure manner. The system integrates totally different hardware parts like micro-controller, fingerprint module, LEDs, switches that facilitates a perfect legal system. For the implementation of this method, DY50 fingerprint sensing element is employed to require user finger print image and store in internal memory, these pictures area unit more processed and analyzed exploitation Arduino. The computer program is enforced exploitation liquid crystal display screen, that is especially accustomed print user directions throughout the execution of the pick method and therefore the result.

1.2 PROBLEM DEFNITION:

In the recent times of modernization, privacy is a crucial issue everywhere the globe. In majority of democratic countries, government is elective through the method of option. the present system isn't terribly economical and reliable and additionally manual approaches are needed for verification, that consumes longer. At present, ballot unit and management are wanting to conduct the option. ballot unit is employed by the elector to

decide on the candidates whereas management unit is employed by the Polling officer to permit the user for option But within the existing system, prohibited balloting is feasible by the invalid elector, that is sensitive to security attack, which ends up that some folks lose their right in choosing the govt.

In projected system is privacy protected authentication system within which information of biometric identities is formed exploitation fingerprint templates.

1.3 LITERATURE SURVAY:

[1] Rahil Rezwan, "**Biometrically secured electronic voting machine**", To ensure a lot of security, finger prints of the citizen is employed because the main authentication resource. Arduino uno R3 with ATmega 32 microcontroller and fingerprint module and alphanumeric display area unit employed in mechanical device. For dominant the controller unit, that is arduino UNO R3 with ATMEGA 32 microcontroller, the code from Arduino developer is employed. The arduino board may be programmed with this code.

[2] A.M. Jagtap, "**Electronic voting system using biometrics, raspberrypi and TFT module**", In this system, we tend to are exploitation combination of hardware and software system. Raspberry Pi 3B+ (RPI) may be a hardware device connected to the Fingerprint Scanner, bit show. It stores the data on the cloud. This report describes the workability of assorted techniques of web and defines an enquiry schedule to prosecute if web vote is capable of development within the future.

[3] R.Prabha, "E-voting system using Arduino software", Arduino mega because the main unit of system, the sub unit interface to the Arduino embody the finger print module. It utilized a twin authentication technique victimization citizen's fingerprint and distinctive vote pin sent to the voter.

[4] Talib divan, “**A finger print matching technique using minute-based algorithm for voting system**”, Matching method three finger print matching techniques area unit compared to pick out applicable methodology. Security of overall procedure will be protected and therefore the votes area unit assisted with right data.

[5] Ahammad J Biswas, “**A secure and automated platform for fingerprint based electronic voting machine**”, In this EVM system, presently there area unit 2 push switches for characteristic 2 political parties or candidates. once the elector presses a specific switch (A/B) to vote for his candidate, EVM stores the vote for that candidate.

[6] Vinayachandra, K Geetha Poornima, M Rajeshwari and K Krishna Prasad, “**Arduino Based Authenticated Voting Machine (AVM) using RFID and Fingerprint for the Student Elections**”, The key elements of the machine-driven voting machine conferred during this paper are the two-one AVM unit and another computer program (UI). AVM consists of IoT-component like AN Arduino Mega Board, Fingerprint Scanner, RFID Reader, wireless local area network Interface, Buzzer, mini digital display Monitor, and momentaneous push buttons integrated victimization bread board and programming victimization Python programing language.

[7] Trupti umakant pavshere,, s.v mare, “**Secure E- voting system using biometric**”,

It is supported homographic property and blind signature arrange the recommend system is executed on embedded system that function a mechanical device. Propose a biometric-bodied designed that establish such challenges and pre serves transparency, secure and obscurity at the side of alternative necessary services, victimization techniques.

[8] Khasawneh, M.M. Malkawi, O.AL.Jarseh, “**A biometric secure e-voting system for election process**”, The basics of any electoral system is one person-one vote. It stands to reason that has to verify votes. the method is enrollment, verification, identification. The potency of the system depends

upon the computer programs its usability. this may for sure guarantee a safer choice technique.

[9] Mouad M.W.Alim, Vivek K, T.Gaikwad, "**Fingerprint recognition for person identification and verification based on minutia matching**", Minutia based mostly fingerprint matching is delineated hybrid methodology is employed for improvement. The planned system can execute an electronic mechanical device with security and privacy.

[10] Vijay Lakshmi Gupta, Shreya Gupta. Divya Srinivasbasra, "**Electronic voting machine using microcontroller**", To develop an electronic voting machine fingerprint detector using microcontroller. Microcontroller forms the management unit of the complete project. Verification is simpler and a lot of convenient. it's easier and safer. Verification is simpler and a lot of convenient. it's easier and safer.

[11] Abdulkadsh, Alkali,Emmumies, "**Biometric based fingerprint electronic voting machine**", It provides an inexpensive, regionally assembled simply reproduceable and extremely secure method. Biometric fingerprint recognition device used for storing and comparison fingerprint pattern.

1.4 ADVANTAGES:

I. safer than the prevailing methodology and can also avoid invalid votes throughout the election

II. Less time need for vote and entreaty

III. Less man power needed.

IV. Tamper-free & assures authentication: The system are fully centralized and valid voters are checked through biometric (unique) characteristics like finger prints so not one invalid vote can be casted.

CHAPTER 2
PRINCIIPLE AND OPERATION OF PROPOSED SYSTEM

2.1 CONCEPT EXPLANATION OF EXISTING SYSTEM:

The automated vote systems are developed before some years agone. the prevailing systems have alone been approved in some growth obtained countries. That too, not altogether developed countries. as a result of the protection has not however been totally preserved. we have a tendency to captive onto automation in the main to consider security. however, the prevailing systems didn't guarantee

The existing system isn't terribly efficient and reliable and conjointly manual approaches are needed for verification, which consumes longer. At present, balloting unit and management unit are wont to conduct the option. pick unit is employed by the elector to settle on the candidates whereas control unit is employed by the Polling officer to allow the user for option. But in the existing system, felonious option is feasible by the invalid elector, that is sensitive to security attack, which ends that some people lose their right in choosing the government.

2.2 CONCEPT EXPLANATION OF PROPOSED SYSTEM:

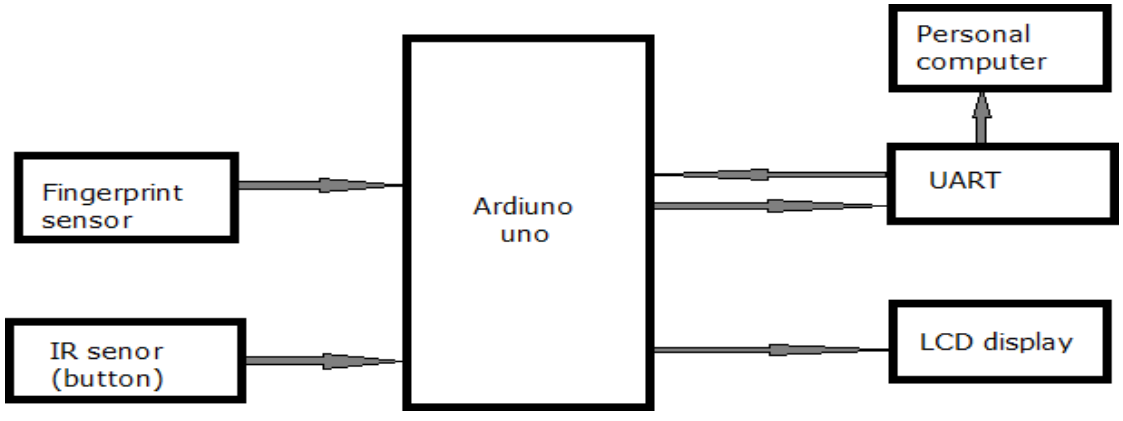

Fig 2.1. Block diagram of proposed system

The projected technique drafting board of choice method is all eligible voters' details are needed therefore it's to store in database. Once the voter's fingerprint is registered that voter is eligible to vote so, citizen will vote for desired candidate in election. The higher than figure is clearly explained the flow of proposed technique. To store the fingerprint details of citizen arduino led light has to be high. Then for store a fingerprint number must set for fingerprint model. The template stored in DY50 flash memory. this can be the enrollment method. Finally, registered voter is eligible to vote. Liquid crystal display screen displays the instruction for guide the voter to make a successful election.

four authority are fixed in hardware instead of button. Infrared sensing element is for choosing desired candidate during the election. after giving vote in the election the voter was not allowed to vote again. If it's happened the display will show invalid or it won't show candidates in the display. at the same time the number of voters count will increase and additionally it'll store in EEPORM memory of arduino. this can be the total method of projected technique. the method is consisting of enrollment, identification, verification. The proposed mechanical device technique is consisting of fingerprint module, it is used to scan voter's finger for enrollment and identification. Users finger has to match with database that is already keep. Result image of the module must send to the personal laptop for verification.

it's process of fingerprint templates. The enrollment section, the module scans a finger double to make identity. The image is extracted with the position and direction of finger alignment are available in database. If the fingerprint matches with database it will allow to vote. first method of the proposed system is to store the finger print value in database. the method is named as enrollment. using this information user will cast their votes. Identification is for identify the given fingerprint supported the info that is already keep.

If the fingerprint matches it'll enable you to vote otherwise it'll print as invalid. Verification is to verify whether or not the used is eligible for voting or not. One to 1 matching is used during this method. Finally, voters cast their vote and it'll be kept. The elements that are used in the project are arduino, fingerprint sensor, universal

asynchronous receiver and transmitter (UART), personal computer and these are the main components used in the proposed system. The specification about the components is described here.

2.3 ARDIUNO UNO:

Arduino is an open-source physical computing platform supported an easy I/O board and a development environment that implements the processing language. Arduino uno is a microcontroller board and totally it's 14 digital input and output pins, out of which 6 are often used for PWM outputs, 6 pins are analog inputs, 6 pins are analog inputs, a USB connection, a power jack, 16 MHz crystal oscillator. These are the description of arduino which is used in the proposed system. Arduino is composed of two major parts there are:

2.3.1 The Arduino Hardware:

Arduino is an ASCII text file physical computing platform supported an easy I/O board and a development atmosphere that implements the process language. Arduino uno may be a microcontroller board and altogether it's fourteen digital input and output pins, out of that vi is used for PWM outputs, six pins are analog inputs, a USB association, an influence jack, sixteen MHz oscillator. These are the outline of arduino that is employed within the projected system. Arduino consists of 2 major components there are:

2.3.2 The Arduino IDE:

The Integrated Development environment (IDE) is a special program running on laptop the pc that allows you to write sketches (a little computer program) for the ARDUINO board in an easy language, the sketch tells the board what to do.

Fig 2.2. Photo copy of Arduino uno

2.3.3 The Arduino Specification:

Table: 2.1. Technical specification

Microcontroller	ATMEGA328
Supply voltage	5V
Operating voltage	7 – 12V
Maximum supply voltage	20V
Digital I/O pins	14
Analog input pins	6
DC current for 3.3V Pin	50 mA
DC current per I/O pin	40 mA
Flash Memory	32 KB
SRAM	2KB
EEPROM	1KB
Clock Speed	16 MHz

- The biggest advantage of Arduino is its able to use structure. As Arduino comes in a complete package form which includes the 5V regulator, a burner, an oscillator, a micro-controller, serial communication interface, light emitter Diode (LED) and headers for the connections.
- The Arduino is programmed by a USB cable, not a serial port. This feature is

useful, because several modern computers don’t have serial ports.

- Another huge advantage of Arduino is its library of examples present inside the code of Arduino.
- The Arduino is a multiplatform environment; it will run on Windows, Macintosh, and Linux.
- The Arduino is an open-source hardware and code.

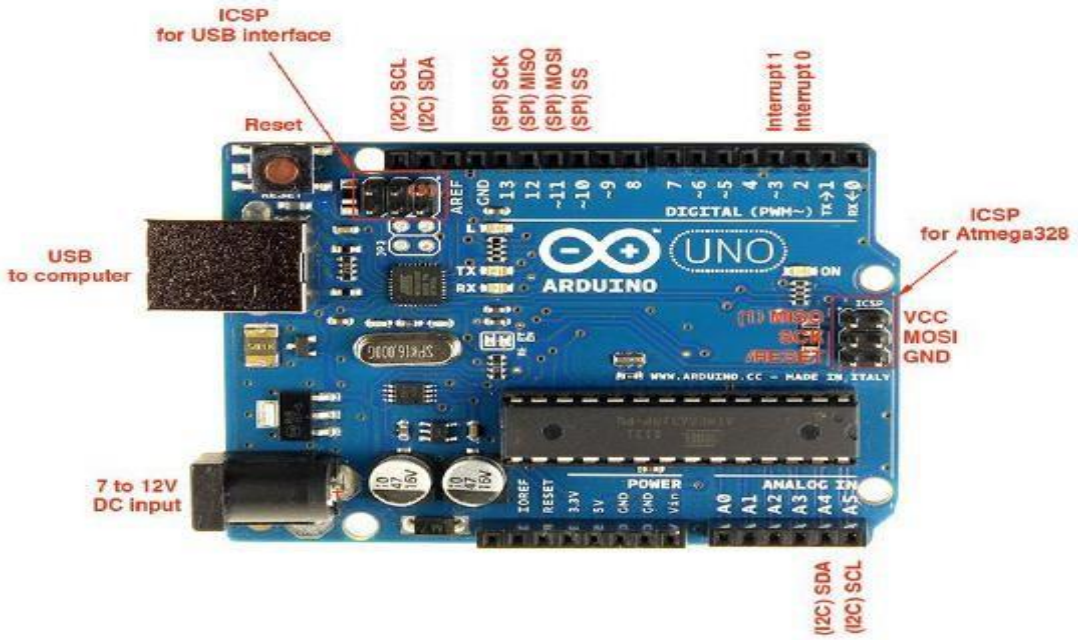

Fig 2.3 Arduino uno

2.4 Liquid crystal oscillator - LCD:

The liquid crystal display is employed during this projected technique to appear at standing of the vote. The options of liquid show area unit sixteen character * 2-line show, it's wont to produce interface between user and microcontroller. Liquid crystal displays unit economical, simply programmable, have no limitation of displaying special and even custom characters not like in seven segments. liquid show attracts its definition from its name itself. liquid crystal display uses a liquid to provide a noticeable image. LCDs area unit economical, simply programmable, haven't any limitation of displaying special and even custom characters not like in seven segments.

Lcd consists of the many layers that embrace a pair of polarized panel filters and electrodes. light-weight is projected from a lens on a layer of liquid. this mixture of colored light with the gray-scale image of the crystal (formed as electrical flows through the crystal) forms the colored image.

This image is then displayed on the screen. The principle behind the LCD's is that once associate electrical current is applied to the liquid molecule, the molecule tends to straighten. This causes the angle of sunshine, that's passing through the molecule of the polarized glass and additionally cause a modification inside the angle of the very best polarizing filter. As a result, slightly light-weight is allowed to pass the polarized glass through a selected space of the display. Thus, that specific space will become dark compared to completely different. The display works on the principle of obstruction light-weight.

while constructing the LCD's, a mirrored mirror is organized at the rear. Associate in Nursing conductor plane is formed of indium-tin chemical compound that is unbroken on prime and a polarized glass with a polarizing film that is additionally additional on all-time low of the device. the entire region of the digital display needs to be embedded by a typical conductor and higher than it ought to be the liquid matter. Next involves the second piece of glass with a conductor within the variety of the parallelogram on the bottom and on top is another polarizing film. It should be thought-about that each of the items are kept at right angles.

Once there is no current, the light passes through the front of the liquid crystal display it will be mirrored by the mirror and bounced back. as a result of the conductor is connected to electric battery this from it will cause the liquid crystals between the common-plane conductor and additionally the conductor formed style of a parallelogram. straighten Thus, the sunshine is blocked from passing through. Shown in fig2.3.

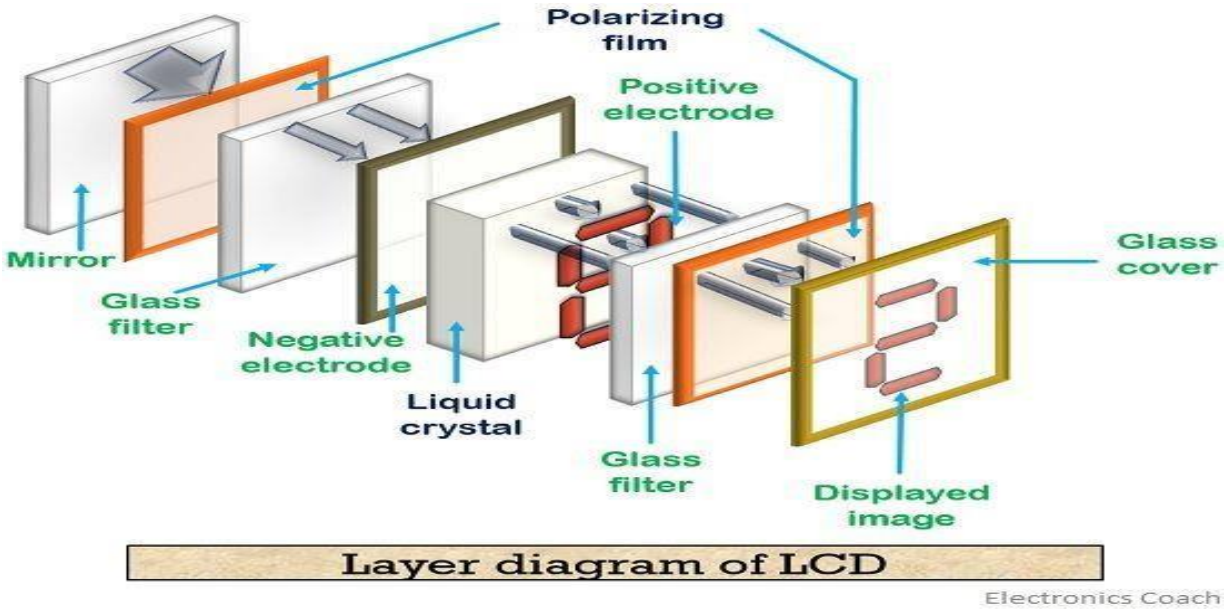

Fig 2.4. layer diagram of LCD

2.4.1 pin details:

- PIN no 1 - Vss to ground
- PIN no 2 – Vcc to +5v power
- PIN no 3 – Vee to ground
- PIN no 4 – Register selection to PIN 12 of Arduino uno
- PIN no 5 – read and write (RW) to ground
- PIN no 6 – enable to PIN 12 of arduino uno
- PIN no 11 – D4 to PIN no 11 of Arduino uno
- PIN no 12 – D5 to PIN no 10 of Arduino uno
- PIN no 13 – D6 to PIN no 9 of Arduino uno
- PIN no 14 – D7 to PIN no 8 of Arduino uno

2.5 Fingerprint Module:

The fingerprint voting system is also a model for image Embedded system. It integrates hard-ware specifically fingerprint detector (DY50), liquid crystal display for the

display, switches, push but-tons for the triple-crown implementation of assorted inputs and outputs functions. These hardware elements are later embedded with process unit i.e., ARM based mostly micro-controller, Arduino device that is programed in C-programming language to store data, execute all completely different user input commands and manufacture results supported user inputs. further over microcontroller operates in dynamic due to management all corresponding hardware peripherals. associate degree optical biometric fingerprint (DY50) is utilized to input and browse the fingerprint data. It uses TTL serial and would possibly hook up with a microcontroller to send data, observe prints, hash and search. The module has nonvolatile storage of its own and may store 162 fingerprints in it.

Fig 2.5. Fingerprint module

Fingerprint identification is additionally referred to as dactyloscopy. Fingerprint identification is the method of comparison 2 samples of friction ridge skin impression from human fingers, palm or toes. these days fingerprints area unit thought-about being one among the oldest and widespread among alternative biometric technologies.

The major hardware used in this method includes of fingerprint device as shown in figure three, conjointly called biometric authentication module. This device produces a digital print of the ridges within the skin of the fingers that might be unambiguously outlined for authentication.

The major application of biometric authentication for this study purpose is to scan the fingerprint of users in order that every image will be uniquely outlined and keep in its

internal memory. These distinctive pictures of fingerprint area unit assigned with distinctive numerical values that may be simply be retrieved.

2.5.1 Technical Specification of DY50

Table 2.2 Technical Specification of DY50

Supply voltage	3.6 – 6.0 VDC
Operating current	120mA max
Peak current	150mA max
Fingerprint imaging time	<1.0 seconds
Signature file	256 bytes
Template file	512 bytes
Storage capacity	127 templates
Safety ratings	(1-5 low to high safety)
Interface	TTL Serial
Baud rate	9600,19200,28800,38400,57600
Working temperature rating	-20C to +50C
Full dimensions	56 * 20 * 21.5 cm

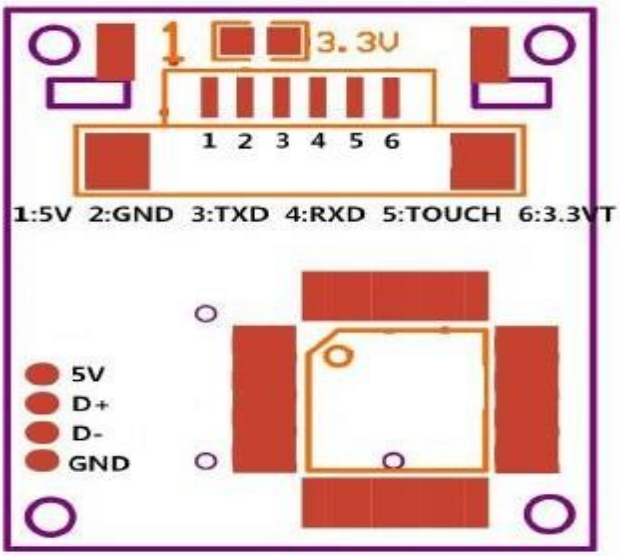

Fig 2.6 Fingerprint module

2.6 Infrared sensors:

An infrared sensor is AN device, that emits so as to sense some aspects of the environment. an IR detector will live the heat of AN object additionally as detects the motion. These sorts of sensors live only infrared light, instead of emitting it that's called passive IR sensing element. Usually, within the infrared spectrum, all the objects radiate some sort of thermal radiation. These sorts of radiations are invisible to our eyes, which can be detected by an infrared sensing element. The electrode is solely AN IR LED (Light Emitting Diode) and therefore the detector is solely AN IR photodiode that's sensitive to IR lightweight of the same wavelength as that emitted by the IR light-emitting diode. once IR light falls on the photodiode, the resistances and therefore the output voltages can change in proportion to the magnitude of the IR light received. IR signals aren't noticeable by the human eye. The IR radiation within the spectrum may be found within the regions of the visible & microwave. Usually, the wavelengths of those waves vary from zero.7 μm five to 1000μm. The IR spectrum may be divided into 3 regions like near-infrared, mid, and far-infrared. The close to IR region’s wavelength ranges from zero.75 – 3μm, the mid- infrared region’s wavelength ranges from three to 6μm & the so much IR region’s infrared radiation’s

Fig 2.7 IR sensor

2.7 Universal Asynchronous Receiver/Transmitter:

UART or Universal Asynchronous Receiver Transmitter is also a frenzied hardware associated with serial communication. The hardware for UART will be a circuit integrated on the microcontroller or a dedicated IC. this can be distinction to SPI or I2C, that are simply communication protocols. UART is one among the best and most typically used Serial Communication techniques. Today, UART is obtaining employed in several applications like GPS Receivers, Bluetooth Modules, GSM and GPRS Modems, Wireless Communication Systems, RFID primarily based applications etc.

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Fig 2.8 Universal Asynchronous Receiver Transmitter

CHAPTER 3

Software results

3.1 Arduino IDE:

The whole purpose of the "Arduino Platform" is to permit for simple and quick prototyping. having the ability to simply attach a show and be ready to display messages thereon in a very matter of minutes, rather than hours, simply surprisingly powerful and convenient once you have a concept in your head and just need to visualize if it works. When you want additional management and are literally thinking on changing your epitome into a true product, then yes, you would like to urge at heart into the microcontroller and obtain eliminate all the surplus fat, trim the circuit to simply the clean bones, optimize the code and build them simply graspable etc. For prototyping, the Arduino platform provides you loads of pre-wiring and free code libraries that may allow you to consider testing your plan rather than payment some time building supporting electronic equipment or writing plenty of low-level code.

Since the beginning of the Arduino, it's not a microcontroller any longer however a scheme and setting that is ported to completely different architectures. The key benefits to my information are:

I. **Debugging**: The Arduino atmosphere give best debugging atmosphere that is cross-platform and is accepted by each member of the family.

II. No technologist or selling flash by dirty ways that, with most of the businesses already providing on-board computer program still compared to tons of microcontroller (8051) transfer may be a click away.

III. when you do not ought to take datasheet out and figure what the design is what area unit the addresses of the microcontroller to write down straightforward functions like delay or interrupt.

IV. Style of the board is extremely fastidiously crafted for beginners be it retard Switch or ISP header to the polarity of power; the possibilities are steep that you simply would be blow it.

V. **Peripherals and standard Design**: Arduino system has fantastic standard design, you'll merely add the already designed shields to the board with none wire, simply plug and play with peripherals like motor defend, Bluetooth defend, Wi-Fi and what not already created

VI. **Libraries**: plenty of libraries and IC's have already been designed for a similar that is crucial plenty of times.

3.2 Process of matching fingerprint with database:

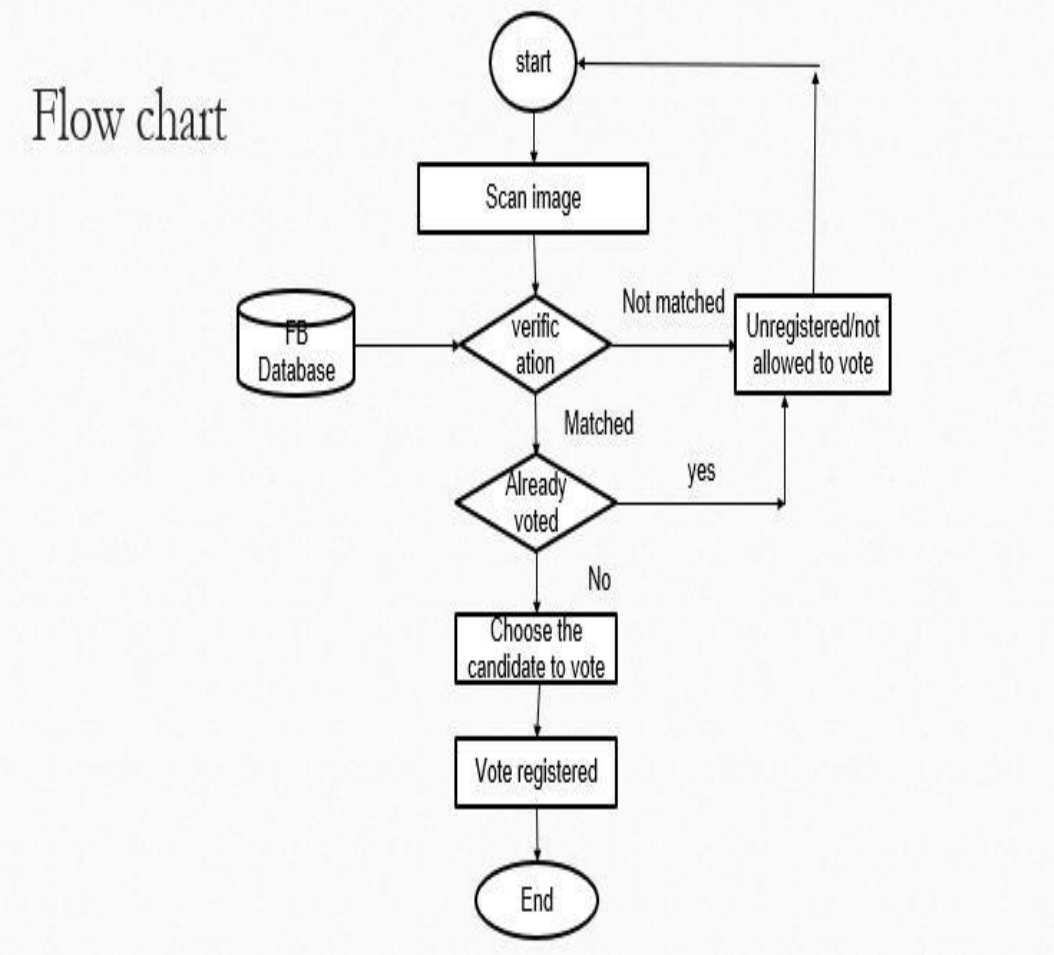


Fig 3.1. Flow chart for verification process

3.2.1 enrollment:

3.2.1.1 Code for enrollment:

Before beginning the whole method of the developed system, 1st we've got to make to create base of fingerprint templates of valid voters. R 305 fingerprint module is employed to require impression of finger. User has to enter identical finger twice to get one templet, that reduces the matter of alignment throughout verification method. every templet is known by completely different names of voters and hold on during this module. Hex codes are accustomed communicate with the module. when the pre-processing stage of making information, system is prepared to use.

```
#include <Adafruit_Fingerprint.h>
#include <SoftwareSerial.h>
#include <LiquidCrystal.h>
#include <SoftwareSerial.h>
int  getFingerprintIDez();

LiquidCrystal lcd(8,9,10,11,12,13); //

SoftwareSerial mySerial(17,14);//rx tx

Adafruit_Fingerprint finger = Adafruit_Fingerprint(&mySerial);

int admk=0;

int dmk=0;

int pmk=0;

int nota=0;

#define btn_1 4

#define btn_2 5

#define btn_3 6

#define btn_4 7
```

```
#define BUZZ 3
char otp_send_buff[]={'\0','\0','\0','\0','\0'};
char otp_enter_buff[]={'\0','\0','\0','\0','\0'};
int i=0,j=0,vote=0;
int tot_vote=0;
int ok_not=0;
void send_sms(void); // otp
char getkey();
void enter_otp();
void send_thanks(void);
void loop_finger();
void setup()
{
  Serial.begin(9600); delay(100);
  mySerial.begin(9600);Serial.begin(9600); delay(100);
  pinMode(BUZZ,OUTPUT); delay(100);
  pinMode(btn_1,INPUT); delay(100);
  pinMode(btn_2,INPUT); delay(100);
  pinMode(btn_3,INPUT); delay(100);
  pinMode(btn_4,INPUT); delay(100);
  lcd.begin(16, 2); delay(100);
  lcd.print("Invalid vote"); delay(100);
  while (!Serial);
  Serial.begin(9600);
```

```
  Serial.println("Finger detect test");
finger.begin(57600);
if (finger.verifyPassword()) {
    Serial.println("Found fingerprint sensor!");
  } else {
    Serial.println("Did not find fingerprint sensor :(");
    while (1);
  }
  Serial.println("Waiting for valid finger...");}
void loop()
{
  getFingerprintIDez();
  delay(50);
}
uint8_t getFingerprintID() {
uint8_t p = finger.getImage();
switch (p) {
    case FINGERPRINT_OK:
      Serial.println("Image taken");
      break;
    case FINGERPRINT_NOFINGER:
      Serial.println("No finger detected");
      return p;
    case FINGERPRINT_PACKETRECIEVEERR:
```

```
      Serial.println("Communication error");
      return p;
    case FINGERPRINT_IMAGEFAIL:
      Serial.println("Imaging error");
      return p;
    default:
      Serial.println("Unknown error");
      return p;
} // OK success!
p=finger. image2Tz();
     switch (p) {
      case FINGERPRINT_OK:
        Serial.println("Image converted");
        break;
     case FINGERPRINT_IMAGEMESS:
        Serial.println("Image too messy");
        return p;
      case FINGERPRINT_PACKETRECIEVEERR:
        Serial.println("Communication error");
        return p;
      case FINGERPRINT_FEATUREFAIL:
        Serial.println("Could not find fingerprint features");
        return p;
      case FINGERPRINT_INVALIDIMAGE:
```

```
    Serial.println("Could not find fingerprint features");
    return p;
  default:
    Serial.println("Unknown error");
    return p;
}
// OK converted!
p = finger.fingerFastSearch();
if (p == FINGERPRINT_OK) {
  Serial.println("Found a print match!");
} else if (p == FINGERPRINT_PACKETRECIEVEERR) {
  Serial.println("Communication error");
  return p;
} else if (p == FINGERPRINT_NOTFOUND) {
  Serial.println("Did not find a match");
  return p;
} else {
  Serial.println("Unknown error");
  return p;
}
  // found a match!
Serial.print("Found ID #"); Serial.print(finger.fingerID);
Serial.print(" with confidence of "); Serial.println(finger.confidence);
```

```
                }
                // returns -1 if failed, otherwise returns ID #
                int getFingerprintIDez() {
                  uint8_t p = finger.getImage();
                  if (p != FINGERPRINT_OK) return -1;
  p = finger.image2Tz();
                  if (p != FINGERPRINT_OK) return -1;
  p = finger.fingerFastSearch();
                  if (p != FINGERPRINT_OK) return -1;
                  // found a match!
                  Serial.print("Found ID #"); Serial.print(finger.fingerID); loop_finger();
                  Serial.print(" with confidence of "); Serial.println(finger.confidence);
                  return finger.fingerID;
                }
void loop_finger()
                {
 // if(Serial.available()>0)
  //{
   //char rec = Serial.read();
   // Finger_verification_calling();
    if(finger.confidence>10)
                    {
                      //Serial.read();
                     // Serial.read();
```

```
                    // Serial.read();
                     lcd.clear(); delay(100);
                     lcd.print("Finger verified");delay(100);
                     lcd.setCursor(0, 1);delay(100);
                     lcd.print(" Area Searching... ");delay(100);
                     send_sms();
                     lcd.setCursor(0, 1);delay(100);
                     lcd.print(" Finded success ");delay(3000);
                     enter_otp();
                   }
                  //}
                }
void enter_otp()
                {
                  j=0;
                  while(j<3)
                  {
                    lcd.clear(); delay(100);
                    lcd.print("Finding Parties ");delay(100);
                    lcd.setCursor(5, 1);delay(100);
                    i=0;
                    /*while(i<4)
                    {
                      otp_enter_buff[i++]=getkey();
```

```
  lcd.print(otp_enter_buff[i-1]);
}*/
delay(2000);
//Serial.print("Entered OTP: ");
//Serial.println(otp_enter_buff);
 if(1==1)
{
  if(2==2)
  {
    if(3==3)
    {
      if(4==4)
      {
        ok_not = 1;
      }
      else
      {
        ok_not = 0;
      }
    }
    else
    {
      ok_not = 0;
    }
```

```
                }
                else
                {
                  ok_not = 0;
                }
              }
              else
              {
                ok_not = 0;
              }
if(ok_not == 1)
              {
                lcd.clear(); delay(100);
                lcd.print("Details Received");delay(100);
                lcd.setCursor(0, 1);delay(100);
                lcd.print(" Ready to vote ");delay(2500);
                j=10; // otp matched ready to vote
              }
              else
              {
                j++;
                if(j>=3)
                {
                  digitalWrite(BUZZ,1);
```

```
      lcd.clear(); delay(100);
      lcd.print("Maximum try out");delay(100);
      lcd.setCursor(0, 1);delay(100);
      lcd.print(" Access denied ");delay(5000);
      digitalWrite(BUZZ,0);
    }
    else
    {
      lcd.clear(); delay(100);
      lcd.print("OTP not matched");delay(100);
      lcd.setCursor(0, 1);delay(100);
      lcd.print(" Try again  ");delay(2000);
    }
  }
 }
if(j==10)
 {
  lcd.clear(); delay(100);
  lcd.print("1.DMK");delay(100);
  lcd.setCursor(9, 0);delay(100);
  lcd.print("2.PMK");delay(100);
  lcd.setCursor(0, 1);delay(100);
  lcd.print("3.ADMK");delay(100);
  lcd.setCursor(9, 1);delay(100);
```

```
    lcd.print("4.NOTA");delay(100);
    vote = getkey();
    lcd.clear();
    if(vote=='1' || vote=='2' || vote=='3' || vote=='4')
    {
       tot_vote++;
      lcd.clear(); delay(100);
      lcd.print(" Thanks for vote ");delay(100);
      /*if(vote=='1')
{
digitalWrite(3,0);digitalWrite(4,1);digitalWrite(5,1);digitalWrite(6,1);
 }
           if(vote=='2')
     {
digitalWrite(3,1);digitalWrite(4,0);digitalWrite(5,1);digitalWrite(6,1);
     }
           if(vote=='3')
     {
digitalWrite(3,1);digitalWrite(4,1);digitalWrite(5,0);digitalWrite(6,1);
     }
           if(vote=='4')
     {
digitalWrite(3,1);digitalWrite(4,1);digitalWrite(5,1);digitalWrite(6,0);
     }*/
```

```
      lcd.setCursor(0, 1);delay(100);
      lcd.print("Total vote:");delay(100);
      lcd.print(tot_vote);delay(100);
      send_thanks();
    }
  }
  lcd.clear(); delay(100);
  lcd.print("Vote for nation"); delay(100);
}
void send_sms(void) // otp
{
  otp_send_buff[0] = (char)(random(1,4)+0x30);
  delay(100);
  otp_send_buff[1] = (char)(random(1,4)+0x30);
  delay(100);
  otp_send_buff[2] = (char)(random(1,4)+0x30);
  delay(100);
  otp_send_buff[3] = (char)(random(1,4)+0x30);
  delay(100);

  Serial.println("AT");
  delay(2000);
  Serial.println("AT+CMGF=1");
  delay(2000);
```

```
    Serial.println("AT+CMGS=\"+918903456276\"\r");
  delay(2000);
  Serial.println("Your OTP: ");
  delay(500);
  Serial.println(otp_send_buff);
  delay(500);
  Serial.println((char)26);
  delay(2000);
}
void send_thanks(void)
{
  Serial.println("AT");
  delay(2000);
  Serial.println("AT+CMGF=1");
  delay(2000);
  Serial.println("AT+CMGS=\"+918903456276\"\r");
  delay(2000);
  Serial.println("Thank you for vote.");
  delay(1500);
  Serial.println((char)26);
  delay(2000);
}
char getkey()
{
```

```
 int a=0;
 int b,c,d,e;
 char ret;
 while(a<1)
 {
   b = digitalRead(btn_1); delay(50);
   if(b==0)
   {
     ret = '1';
     while(digitalRead(btn_1));
     a++;
   }
c = digitalRead(btn_2); delay(50);
   if(c==0)
   {
     ret = '2';
     while(digitalRead(btn_2));
     a++;
   }
   d = digitalRead(btn_3); delay(50);
   if(d==0)
   {
     ret = '3';
     while(digitalRead(btn_3));
```

```
    a++;
   }
   e = digitalRead(btn_4); delay(50);
   if(e==0)
   {
    ret = '4';
    while(digitalRead(btn_4));
    a++;
   }
  }
return (ret);}
```

3.2.2 Identification:

This method is employed to examine the citizen identity and also the main target of this method is to spot that that citizen has accessed the system. once user place the finger on optical sensor of module then the options of that finger is extracted and match (1: n) with all templates that is antecedently hold on in information. If fingerprint is matched with any of the guides then info holds on model that template is employed for more process. once fingerprint isn't matched with any matching, citizen is asserted as invalid citizen, as that fingerprint template isn't kept within the database.

3.2.3 Verification:

Verification is that the method to visualize whether or not the user is valid for vote or not. One to at least one matching (1:1) is performed during this method [5]. It also can monitor that elector has voted once or a lot of. more than one vote by a similar candidate isn't allowed during this system. when identification, initial it's checked that the user has voted or not. If user has not voted then solely vote is allowed. during this method, what percentage item points area unit matched is

additionally checked. This shows the arrogance level of matching throughout verification.

3.2.3.1 Code for verification and identification:

```
#include <Adafruit_Fingerprint.h>

#include <SoftwareSerial.h>

#include <LiquidCrystal.h>

#include <SoftwareSerial.h>

int  getFingerprintIDez();

LiquidCrystal lcd(8,9,10,11,12,13); //

SoftwareSerial mySerial(17,14);//rx tx

Adafruit_Fingerprint finger = Adafruit_Fingerprint(&mySerial);

int admk=0;

int dmk=0;

int pmk=0;

int nota=0;

#define btn_1 4

#define btn_2 5

#define btn_3 6

#define btn_4 7

#define BUZZ 3

char otp_send_buff[]={'\0','\0','\0','\0','\0'};

char otp_enter_buff[]={'\0','\0','\0','\0','\0'};

int i=0,j=0,vote=0;
```

```
int tot_vote=0;
int ok_not=0;
void send_sms(void); // otp
char getkey();
void enter_otp();
void send_thanks(void);
void loop_finger();

void setup()
{
  Serial.begin(9600); delay(100);
  mySerial.begin(9600);Serial.begin(9600); delay(100);
  pinMode(BUZZ,OUTPUT); delay(100);
  pinMode(btn_1,INPUT); delay(100);
  pinMode(btn_2,INPUT); delay(100);
  pinMode(btn_3,INPUT); delay(100);
  pinMode(btn_4,INPUT); delay(100);
  lcd.begin(16, 2); delay(100);
  lcd.print("Invalid vote"); delay(100);

  while (!Serial);

  Serial.begin(9600);
  Serial.println("Finger detect test");
```

```
  finger.begin(57600);

  if (finger.verifyPassword()) {
    Serial.println("Found fingerprint sensor!");
  } else {
    Serial.println("Did not find fingerprint sensor :(");
    while (1);
  }
  Serial.println("Waiting for valid finger...");
}

void loop()
{
  getFingerprintIDez();
  delay(50);
}

uint8_t getFingerprintID() {
  uint8_t p = finger.getImage();
  switch (p) {
    case FINGERPRINT_OK:
      Serial.println("Image taken");
      break;
```

```
  case FINGERPRINT_NOFINGER:
    Serial.println("No finger detected");
    return p;
  case FINGERPRINT_PACKETRECIEVEERR:
    Serial.println("Communication error");
    return p;
  case FINGERPRINT_IMAGEFAIL:
    Serial.println("Imaging error");
    return p;
  default:
    Serial.println("Unknown error");
    return p;
}
// OK success!
p = finger.image2Tz();
switch (p) {
  case FINGERPRINT_OK:
    Serial.println("Image converted");
    break;
  case FINGERPRINT_IMAGEMESS:
    Serial.println("Image too messy");
    return p;
```

```
  case FINGERPRINT_PACKETRECIEVEERR:
    Serial.println("Communication error");
    return p;
  case FINGERPRINT_FEATUREFAIL:
    Serial.println("Could not find fingerprint features");
    return p;
  case FINGERPRINT_INVALIDIMAGE:
    Serial.println("Could not find fingerprint features");
    return p;
  default:
    Serial.println("Unknown error");
    return p;
}

// OK converted!
p = finger.fingerFastSearch();
if (p == FINGERPRINT_OK) {
  Serial.println("Found a print match!");
} else if (p == FINGERPRINT_PACKETRECIEVEERR) {
  Serial.println("Communication error");
  return p;
} else if (p == FINGERPRINT_NOTFOUND) {
  Serial.println("Did not find a match");
  return p;
```

```
  } else {
    Serial.println("Unknown error");
    return p; }

 // found a match!
  Serial.print("Found ID #"); Serial.print(finger.fingerID);
  Serial.print(" with confidence of "); Serial.println(finger.confidence);
}

// returns -1 if failed, otherwise returns ID #
int getFingerprintIDez() {
  uint8_t p = finger.getImage();
  if (p != FINGERPRINT_OK) return -1;

  p = finger.image2Tz();
  if (p != FINGERPRINT_OK) return -1;

  p = finger.fingerFastSearch();
  if (p != FINGERPRINT_OK) return -1;

  // found a match!
  Serial.print("Found ID #"); Serial.print(finger.fingerID); loop_finger();
  Serial.print(" with confidence of "); Serial.println(finger.confidence);
  return finger.fingerID;
```

```
}
void loop_finger()
{
    if(finger.confidence>10)
    {
      lcd.clear(); delay(100);
      lcd.print("Finger verified");delay(100);
      lcd.setCursor(0, 1);delay(100);
      lcd.print(" Area Searching... ");delay(100);
      send_sms();
      lcd.setCursor(0, 1);delay(100);
      lcd.print(" Finded success ");delay(3000);
      enter_otp();
    }
  //}
}

void enter_otp()
{
  j=0;
  while(j<3)
  {
    lcd.clear(); delay(100);
    lcd.print("Finding Parties ");delay(100);
```

```
lcd.setCursor(5, 1);delay(100);
i=0;
/*while(i<4)
{
  otp_enter_buff[i++]=getkey();
  lcd.print(otp_enter_buff[i-1]);
}*/
delay(2000);
//Serial.print("Entered OTP: ");
//Serial.println(otp_enter_buff);

if(1==1)
{
  if(2==2)
  {
    if(3==3)
    {
      if(4==4)
      {
        ok_not = 1;
      }
      else
      {
        ok_not = 0;
```

```
        }
       }
       else
       {
         ok_not = 0;
       }
      }
      else
      {
       ok_not = 0;
      }
    }
    else
    {
      ok_not = 0;
    }
if(ok_not == 1)
    {
      lcd.clear(); delay(100);
      lcd.print("Details Received"); delay(100);
      lcd.setCursor(0, 1);delay(100);
      lcd.print(" Ready to vote ");delay(2500);
      j=10; // otp matched ready to vote
    }
```

```
    else
    {
      j++;
if(j>=3)
      {
        digitalWrite(BUZZ,1);
        lcd.clear(); delay(100);
        lcd.print("Maximum try out");delay(100);
        lcd.setCursor(0, 1);delay(100);
        lcd.print(" Access denied ");delay(5000);
        digitalWrite(BUZZ,0);
      }
      else
      {
        lcd.clear(); delay(100);
        lcd.print("OTP not matched");delay(100);
        lcd.setCursor(0, 1);delay(100);
        lcd.print(" Try again  ");delay(2000);
      }
    }
  }
if(j==10)
  {
    lcd.clear(); delay(100);
```

```
    lcd.print("1.DMK");delay(100);
    lcd.setCursor(9, 0);delay(100);
    lcd.print("2.PMK");delay(100);
    lcd.setCursor(0, 1);delay(100);
    lcd.print("3.ADMK");delay(100);
    lcd.setCursor(9, 1);delay(100);
    lcd.print("4.NOTA");delay(100);
    vote = getkey();
    lcd.clear();
    if(vote=='1' || vote=='2' || vote=='3' || vote=='4')
    {
      tot_vote++;
      lcd.clear(); delay(100);
      lcd.print(" Thanks for vote ");delay(100);
       /*if(vote=='1')
      {
digitalWrite(3,0);digitalWrite(4,1);digitalWrite(5,1);digitalWrite(6,1);
      }
           if(vote=='2')
      {
digitalWrite(3,1);digitalWrite(4,0);digitalWrite(5,1);digitalWrite(6,1);
      }
           if(vote=='3')
      {
```

```
digitalWrite(3,1);digitalWrite(4,1);digitalWrite(5,0);digitalWrite(6,1);
      }
           if(vote=='4')
      {
digitalWrite(3,1);digitalWrite(4,1);digitalWrite(5,1);digitalWrite(6,0);
      }*/
      lcd.setCursor(0, 1);delay(100);
      lcd.print("Total vote:");delay(100);
      lcd.print(tot_vote);delay(100);
      send_thanks();
    }
  }
  lcd.clear(); delay(100);
  lcd.print("Vote for nation"); delay(100);
}
void send_sms(void) // otp
{
  otp_send_buff[0] = (char)(random(1,4)+0x30);
  delay(100);
  otp_send_buff[1] = (char)(random(1,4)+0x30);
  delay(100);
  otp_send_buff[2] = (char)(random(1,4)+0x30);
  delay(100);
  otp_send_buff[3] = (char)(random(1,4)+0x30);
```

```
  delay(100);
  Serial.println("AT");
  delay(2000);
  Serial.println("AT+CMGF=1");
  delay(2000);
   Serial.println("AT+CMGS=\"+918903456276\"\r");
  delay(2000);
  Serial.println("Your OTP: ");
  delay(500);
  Serial.println(otp_send_buff);
  delay(500);
  Serial.println((char)26);
  delay(2000);
}
void send_thanks(void)
{
  Serial.println("AT");
  delay(2000);
  Serial.println("AT+CMGF=1");
  delay(2000);
  Serial.println("AT+CMGS=\"+918903456276\"\r");
  delay(2000);
  Serial.println("Thank you for vote.");
  delay(1500);
```

```
  Serial.println((char)26);
  delay(2000);
}
char getkey()
{
  int a=0;
  int b,c,d,e;
  char ret;
  while(a<1)
  {
    b = digitalRead(btn_1); delay(50);
    if(b==0)
    {
      ret = '1';
      while(digitalRead(btn_1));
      a++;
    }
c = digitalRead(btn_2); delay(50);
    if(c==0) {
      ret = '2';
      while(digitalRead(btn_2));
      a++;
    }
 d = digitalRead(btn_3); delay(50);
```

```
  if(d==0) {
    ret = '3';
    while(digitalRead(btn_3));
    a++;}
 e = digitalRead(btn_4); delay(50);
  if(e==0) {
    ret = '4';
    while(digitalRead(btn_4));
    a++;
  }   }
 return (ret); }
```

After the method of verification vote is allowed to the user. within the method of election, mechanical device is built with the assistance of IR sensing element, buzzer and alphanumeric display screen. Push buttons is employed by the user to allow vote to the candidate. Arduino AT Mega 2560 microcontroller board is employed for the programming of mechanical device. Commands associated with voting machine on IDE platform are shown. One IR sensing element is allotted to every candidate United Nations agency is contesting the election. once pushbutton is pressed for vote then IR sensing element assures that pick is with success done. At constant time, liquid crystal display indicates that the casted vote by the user goes to that explicit candidate. All the votes are severally side per the candidates. One IR sensing element is additionally allotted to show the results.

CHAPTER 4

Hardware implementation and results

4.1 Experimental results:

The developed paradigm has been tested underneath totally different in operation conditions. The work is completed within the sequence begin from the primary stage that is pre-processing. The results of pre-processing stage are displayed on Serial Monitor. The system is programmed to show 3 statements in making the database. initial it shows, R 305 module is connected properly or not. when inserting identical finger twice on optical sensor of module it shows, each fingerprint is matched properly or not. when matching the fingerprints serial monitor displayed, templates are kept or not. alternative outcomes and directions associated with identification, verification and mechanical device are showed on 16 x two liquid crystal display and serial monitor each.

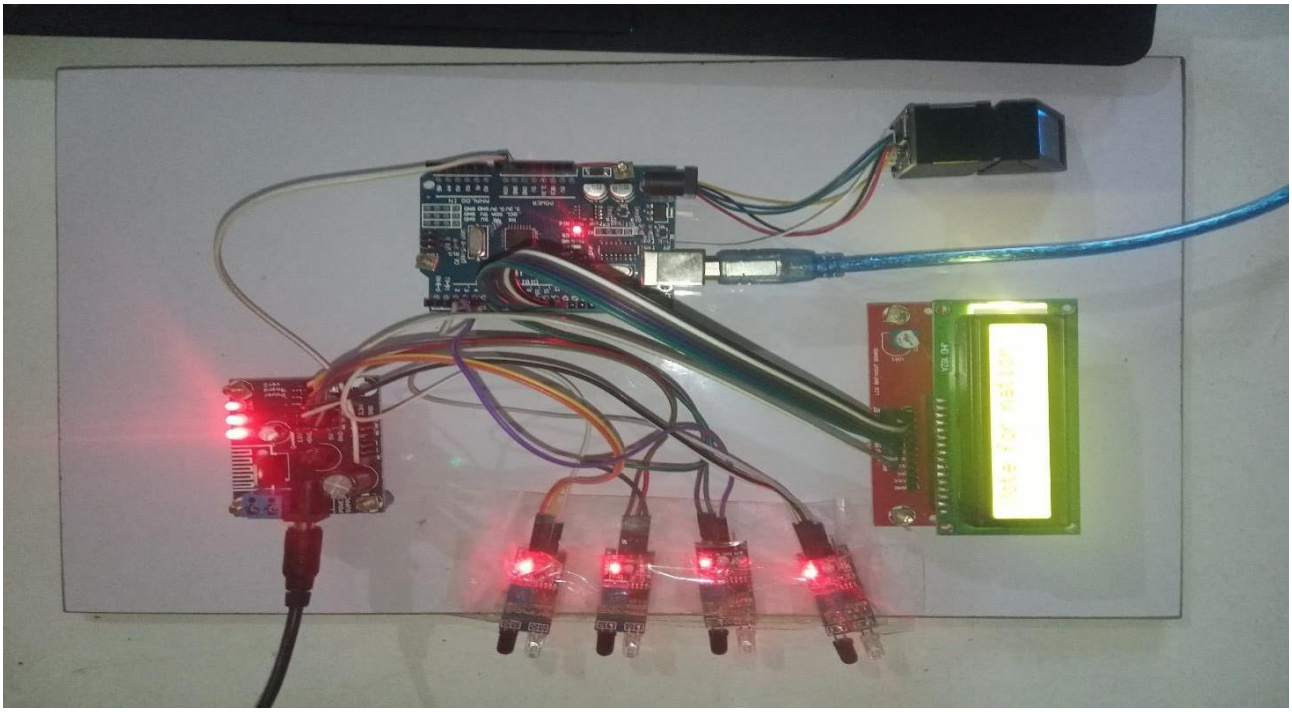


Fig 4.1 hardware

When finger is placed on fingerprint module throughout the method of Identification and verification, then serial monitor shows the name of example that is matched with placed finger and additionally provides the arrogance level supported trivialities points matched. If user has not voted, then only vote is allowed to the user otherwise not permissible for ballot. when the method of verification, ballot is to be done and also the liquid crystal display is employed to point out that the vote given by the user goes to that candidate when pressing the vote button (IR sensor).

4.1.1 Enrollment:

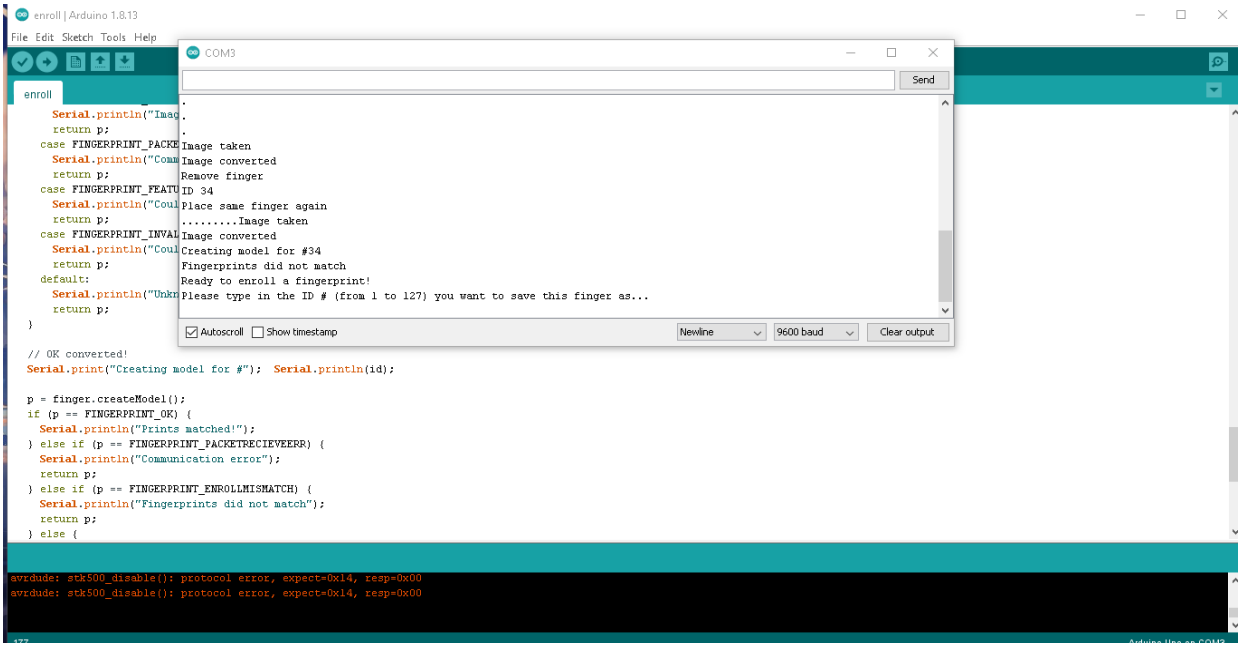


Fig 4.2. Enrollment results

4.1.2 Matching with database:

The eligibility of an elector to vote is proscribed to just one time for one balloting session, because the system is meant to deny balloting by aborting access to vote for constant finger image over once. The portion of the code that checks the standing of elector either has already voted or not is outlined within the void loop. The standing is

monitored by flag register, once the vote is casted the flag is assigned to zero whole number, therefore if constant user tries to vote for second time the flag value is evaluated before authorizing vote access to vote, and if flag has worth one, the procedure is aborted. Thus, the authenticity of the system is maintained.

Fig 4.3 verification results

4.1.3 Result:

After the method of verification pick is allowed to the user. within the method of election, mechanical device is made with the assistance of Infrared sensor and liquid crystal display screen. Push buttons is employed by the user to grant vote to the candidate. Arduino AT Mega 2560 microcontroller board is employed for the programming of voting machine. One IR detector is allotted to every candidate who is contesting the election. once IR sensor is ironed for pick then IR detector assures that pick is with success done. At an equivalent time, liquid crystal display indicates that the casted vote by the user goes to that explicit candidate. All the votes are individually supplemental per the candidates. One button is additionally allotted to show the results.

Fig 4.4. final result

CHAPTER 5

CONCLUSION AND FUTURE SCOPE

5.1 Conclusion:

A privacy protected fingerprint-based voting machine is developed in this paper. biometric authentication and verification through fingerprint templates are with success exhausted this image.

credibility of the elector is additionally monitored with the confidence level supported trivialities matching. prohibited ballot by the invalid elector is totally eliminated. The developed system is additionally programmed to calculate the results of option. Hence, the projected system can execute an electronic voting machine with security and privacy. From fig 4.2, fig 4.3, the projected methodology has executed.

Biometric identification and verification are one among the secure strategies, victimization these strategies the mechanical device results have been taken. From fig 4.2 the voter's figure has registered with success so citizen is eligible to vote. therefore, the developed model of fingerprint electronic voting machine can execute with security and privacy. For biometric verification fingerprint is employed in this projected methodology, this may not applicable for incapacitated and aged persons therefore future scope of this project are eye recognition rather than fingerprint biometric verification.

5.2 Future scope:

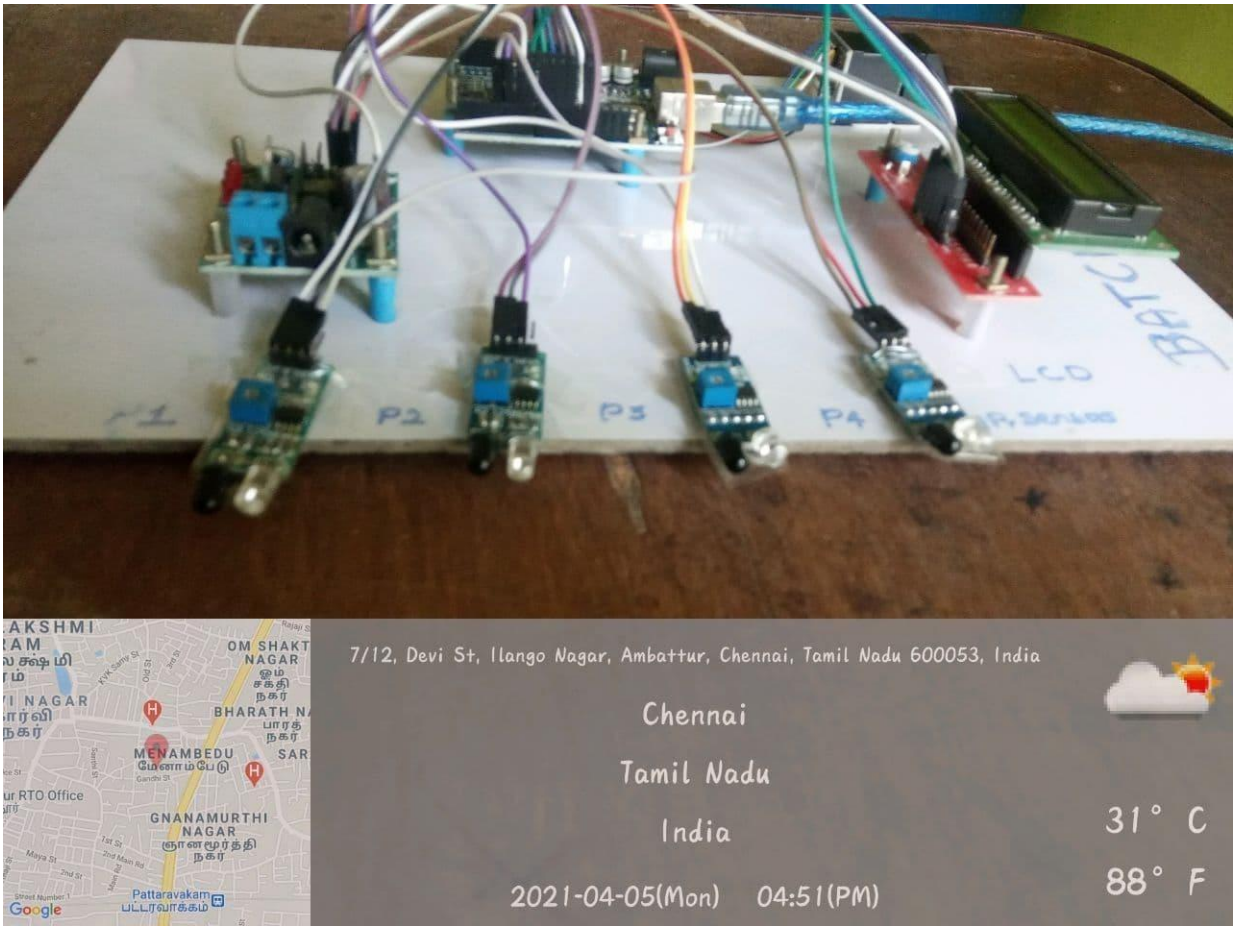
In future, the system is expanded by as well as the subsequent features to that as listed below:

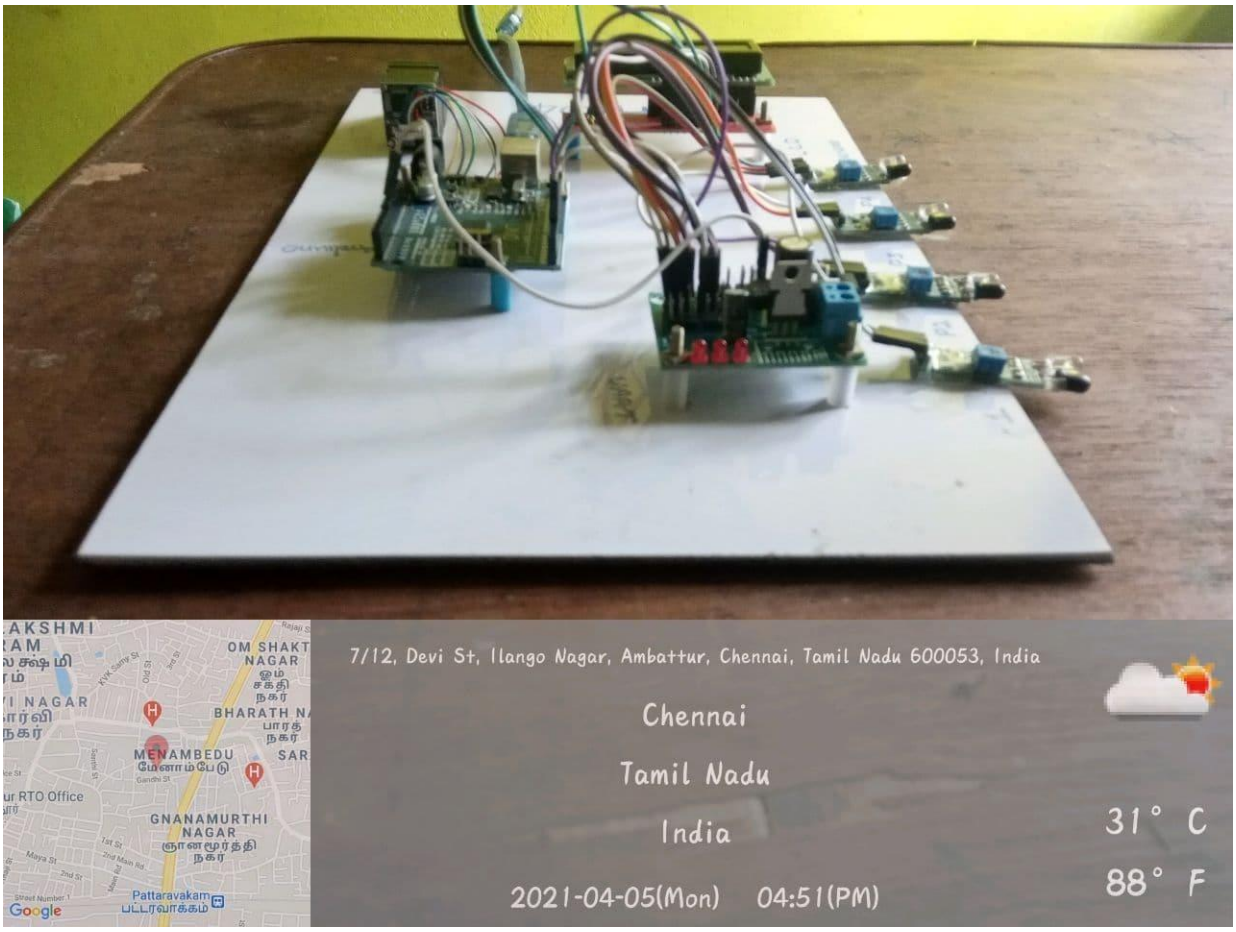
I. Implementation via neural network and fuzzy logic is tired order to reinforce the performance of fingerprint matching throughout identification and verification.

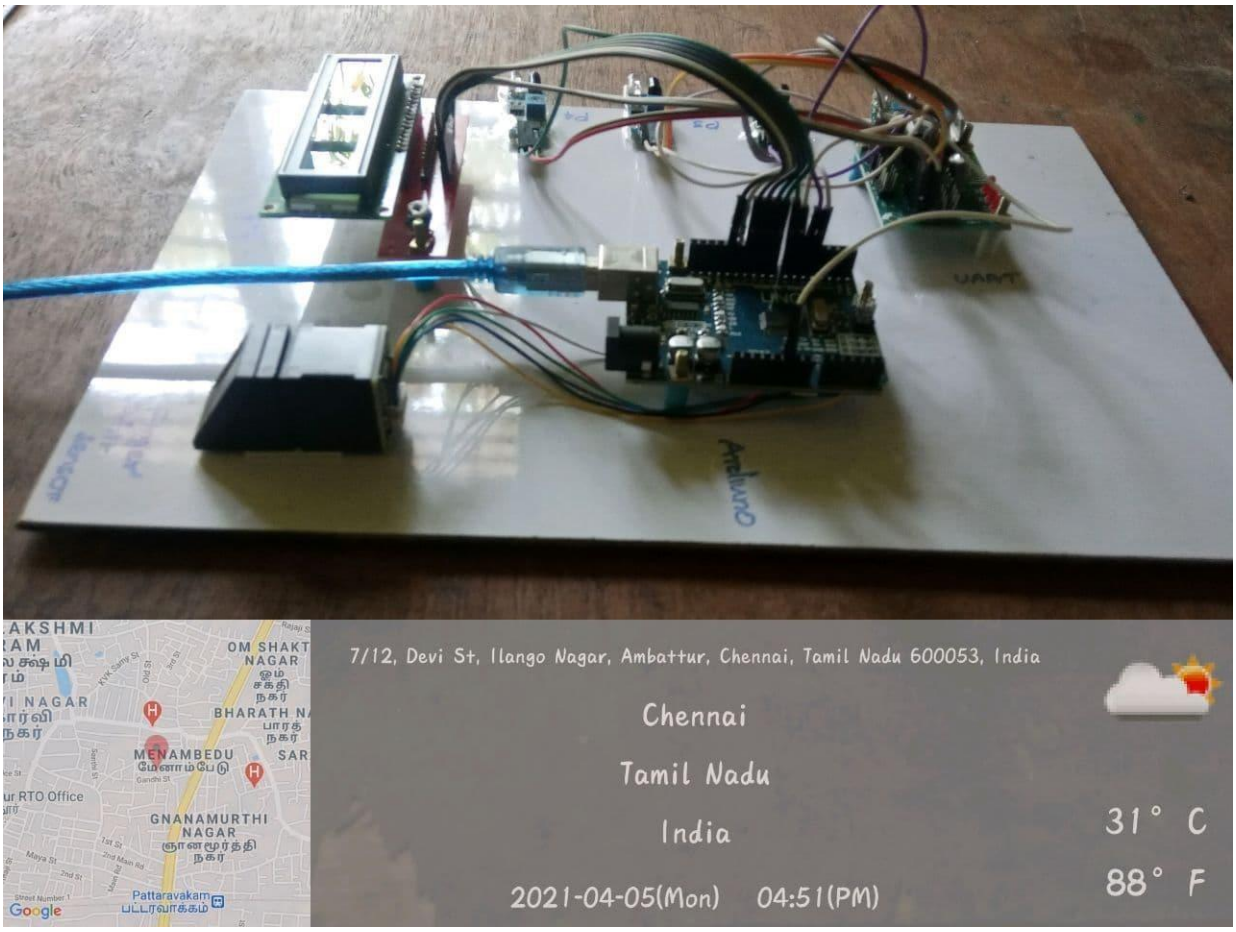
II. The developed model is tested with sizable number of databases, by matching with time quality supported minutiae points.

III. it's conjointly attainable to develop a high-resolution fingerprint matching framework that utilizes three levels of options.

Hardware - Geotagged images




OM SHAKT
NAGAR
ஓம்
சக்தி
நகர்
BHARATH NA
பாரத
நகர்
MENAMBEDU
மேனாம்பேடு
GNANAMURTHI
NAGAR
ஞானமூர்த்தி
நகர்
Patttaravakam
பட்டரவாக்கம்
Google
7/12, Devi St, Ilango Nagar, Ambattur, Chennai, Tamil Nadu 600053, India
Chennai
Tamil Nadu
India
2021-04-05(Mon) 04:51(PM)
31° C
88° F


Arduino
UART
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Chennai
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India
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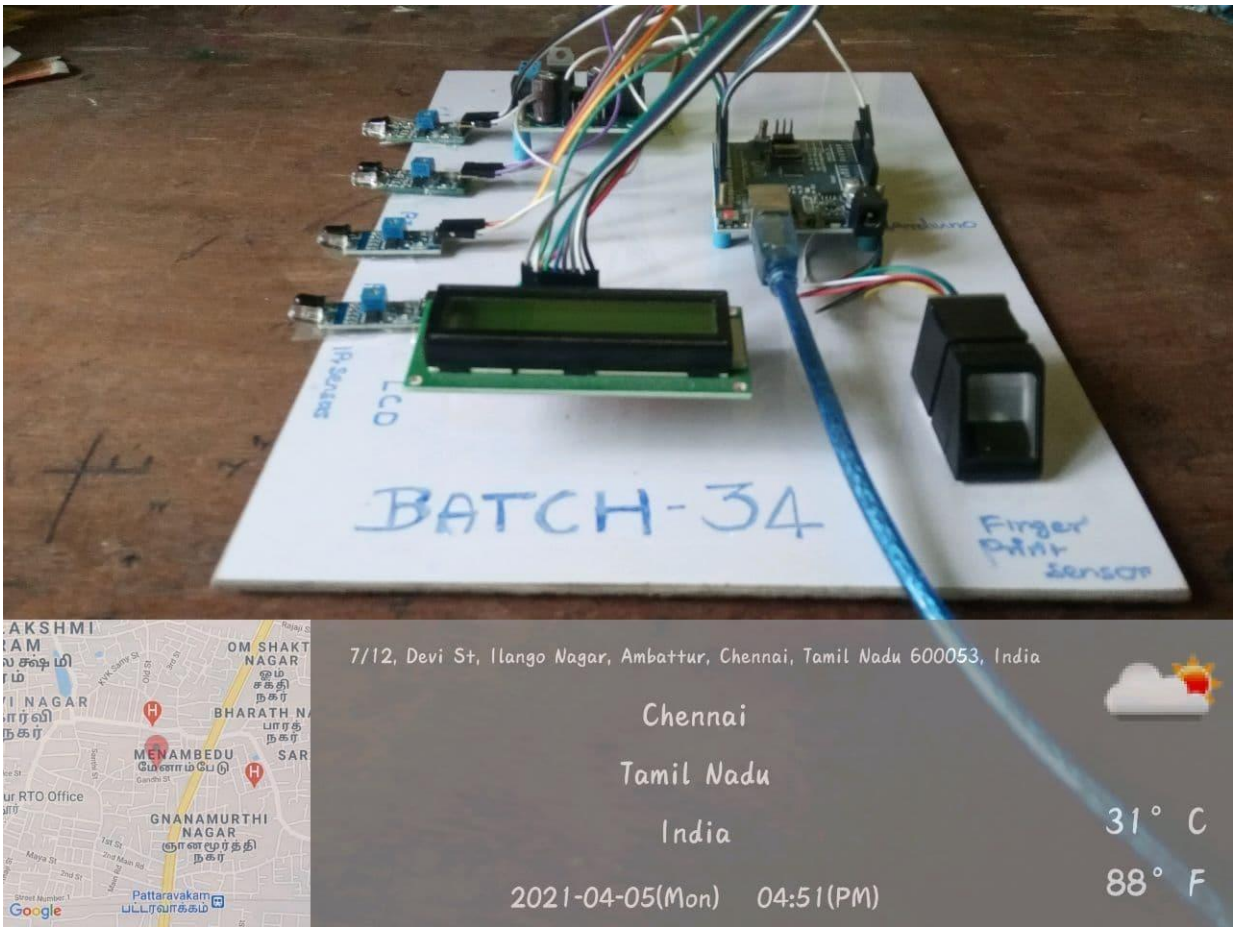
BATCH-34
Finger Print sensor
LCD
7/12, Devi St, Ilango Nagar, Ambattur, Chennai, Tamil Nadu 600053, India
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REFERENCES

[1] Mr.kalash Srivastava, M.P.S Chawla " Fingerprint based Electronic Voting Machine with Inbuilt Identification and Verification System(2018)", journal of Advances in electronic devices, vol.3, no.3,pp.3-13

[2] A.M.jagtap, Vishakha kesarkar, Anagha supekar" Electronic Voting System using Biometrics, Raspberry Pi and TFT module(2018)", IEEE Xplore, vol-3, no-4,pp-5386-9439

[3] Ifthekhar Ahammad, Pradip lal biswas, juwel Chowdhury, obaedur Rahim rizbhi, Sanjana sirah and ashraful isla, "Towards a secure and automated platform for fingerprint-based electronic voting machine(2019)", IEEE Xplore, vol.1,no.1,pp.34-41.

[4] Rahil rezwa,Huzaifa ahmed, M.R.N.Biplob, S.M.shuvo, MD.Abdur Rahman," Biometrically secured electronic voting machine(2017)",IEEE Region, vol.4,no.5,pp.21-23.

[5] R.Prabha, X.Trini, V.Deeika and C.Iswarya," A Survey on E-Voting System Arduino software(2016)", International Journal of Advanced Research in Electrical,vol.5,no.2,pp.36- 47.

[6] Vinayachandra, K Geetha Poornima,M Rajeshwari1,and K Krishna Prasad, "Arduino Based Authenticated Voting Machine (AVM) using RFID and Fingerprint for the Student Elections", Journal of physics, vol 5, no-3, pp.12-16.

[7] A. Tirupathi Rao; N. Pattabhi Ramaiah; V. Raghavendra Reddy; C. Krishna Mohan,"Nearest Neighbor Minutia Quadruplets Based Fingerprint Matching with Reduced Time and Space Complexity" IEEE 14th International Conference on Machine Learning and Applications (ICMLA), 9-11 Dec. 2015.

[8] Dibya Dahal ,"Electronic Fingerprint Voting System", Metropolia applied university, vol.6,no.7, pp.289-445

[9] Bhuvanapriya.R, Rozil banu.S, Sivapriya.P, Kalaiselvi.V.K.G,"Smart voting",IEEE,vol.10,no.9,pp.143-159.

[10] Scott Wolchok,Eric Wustrow,"Security Analysis of India's Electronic Voting Machines", IEEE,vol-4,no.8,pp.140-114.

[11] Vipul Awasthi; MPS Chawla, “Fingerprint analysis using minutiae extraction” School of Electronics, Devi Ahilya Vishwavidyalaya, Indore (M.P), 7 June. 2012.

[12] M. Adhiyaman; D. Ezhilmaran, "Fingerprint matching and similarity checking system using minutiae based technique”, IEEE International Conference on Engineering and Technology (ICETECH), 20-20 March 2015.