Fingerprint Based Biometric Voting Machine



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DECLARATION

We hereby declare that this project is based on the results found by ourselves. Materials of work found by other researcher are mentioned by reference. This project, neither in whole nor in part, has been previously submitted for any degree.

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We take this opportunity to thank all our lecturers who have directly or indirectly helped to complete our project.

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ABSTRACT

Electronic voting machines are getting popular day by day to conduct election in heavily populated countries. Bangladesh has almost 104.1 million voters. Among them 50.42% are male and 49.58% female voters and their biometric information. To make proper use of this information in election for faster and transparent voting process, a fingerprint enabled voting machine has become a necessity. Currently available EVMs have some issue with their security, vulnerability and power backup. This paper is about the design and construction of a fingerprint enabled electronic voting machine with greater security and power backup compared to the existing EVMs of this type. The proposed design ensures accuracy, transparency, security and faster result processing in election.

Fingerprint devices for voting machines and other existing identity documents are discussed and implemented in this project. The user has to show his voter ID card whenever he goes to the polling booth to poll his vote. This is a time-consuming process as the person has to check the voter ID card with the list he has, confirm it as an authorized card and then allow the person to poll his vote. Thus, to avoid this kind of problems, we have designed a fingerprint-based voting machine where the person no needs to carry his ID which contains his entire details.

The person at the polling booth has to show his finger. This fingerprint reader reads the details from the finger. This data is passed to the controlling unit for the verification. The controller reads the data from the reader and compares this data with the already existing data. If the data matches with the already stored information, the person is allowed to poll his vote. If not, a message is displayed on LCD display and the person is not allowed to poll his vote. After polled all data has been saved automatically. So that when this person tries to double vote this time the voting machine not allowed him to poll. The polling mechanism carries out manually using the switches. LCD is used to display the related messages.

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1. 1. Introduction to Biometric Voting Machine

We all are quite familiar with Electronic Voting Machines, where vote registered automatically and no need to use ballot paper to vote in election. Today security is a major concern and it also needs to be ensured that someone can't vote twice. So, this problem can be solved by introducing Fingerprint Based Voting, where a person can be authorized based on his fingerprint. This will also stop illegal voting. So today we are building Fingerprint Based Biometric Voting Machine using Arduino.

The project demands the user to submit his fingerprint at the polling booth. The project uses the fingerprint technology and embedded systems to design this application. The main objective of this project is to design a system that asks the user to show his fingerprint as an identity proof. The system reads the data from the fingerprint and verifies this data with the already stored data in its database.

If the details present in the data base it matches with the stored data, the system allows the person to enter in to the booth and poll his vote. If the details of the finger do not match with the stored data, the system immediately activates the display and the security authorities can come and take the further action. This project is a device that collects data from the fingerprint image and codes the data into a format that can be understood by the controlling section. This system also collects information from the master device and implements commands that are directed by the master.

The objective of the project is to develop a Microcontroller Based security and alert system. It consists of a fingerprint reader, microcontroller, the interfacing unit to allow the communication between the microcontroller and fingerprint module, and the LCD.

1. 2. Background of the project

Public opinion is the most important determinant to establish a government and voting is the process through which people display their opinion and help to setup a democratic government. So, the voting system should be reliable, accurate and it must be secure. In the traditional elections a voter used to cast his vote by using ballot paper. This is a long-time consuming process; it's really takes long time and the probability of error is very high. This situation remains till the scientists discovered the different types of electronic voting machine. The electronic voting systems are utilized much more as a device to help people to cast their opinion and vote. To let the exercising of the right, just about all voting machine all over the globe consist of voter identity and authorization, the voting and saving of the votes cast, counting the votes and finally give the election final results.

The using of fingerprint as an ID is an excellent strategy considering that just about every person in the globe is born with unique fingerprint even twins born with totally different fingerprints. The fingerprint is naturally unchangeable throughout life. The representation scheme of the fingerprints either based on global or local information such as ridges ends and ridges branches (minutiae). In this project matching algorithm combine extracting of local and global information going to be design. This matching algorithm is necessary in two stages of the electoral where the first for people registration to identify the right to elect and later on, at voting time, to allow voters to cast their vote by confirming if the man or woman meets all the requirements required to vote and that known as authentication.

1. 3. Justification of the Project

Fingerprint electronic voting system has provided a range of advantages to the voting process. It assists perform voting in much more successful and efficient, such as minimizing the cost of the ballot's printing and employing more staff. Fingerprint election system also can make voting tallies faster as well as much more effectively than tired polling staff; they minimize human being mistakes in voting final result as well as minimize the expenses of the election. The significant advantages of electronic election might be reviewing in the following points: much more participation, fast process, lower costs, and precision placing and better access and versatility for the disable.

Essential reason fingerprint readers are widely used is, they offer a fast, simple, powerful, and secure access by means of a person with the good access rights can authenticate. The advocate of electronic voting provides that the comfort, flexibility, speed, cost effectiveness, and versatility and these are the main advantages of the electronic voting machine. Considering that this system has every one of these properties, it can be used almost everywhere, by the government authorities, organizations, courts, shopping malls even in the colleges and universities.

The matching fingerprint image going to be designed in this project will support the system with additional advantages. The fingerprint matching combine both local and global information are used for the purpose of fingerprint feature extraction.

1. 4. Embedded System

An embedded system can be defined as a computing device that does a specific focused job. Appliances such as the air-conditioner, VCD player, DVD player, printer, fax machine, mobile phone etc. are examples of embedded systems. Each of these appliances will have a processor and special hardware to meet the specific requirement of the application along with the embedded software that is executed by the processor for meeting that specific requirement.

The embedded software is also called “firm ware”. The desktop/laptop computer is a general-purpose computer. It is used variety of applications such as playing games, word processing, accounting, software development and soon.

Embedded systems do a very specific task; they cannot be programmed to do different things. Embedded systems have very limited resources, particularly the memory. Generally, they do not have secondary storage devices such as the CDROM or the floppy disk. Embedded systems have to work against some deadlines. A specific job has to be completed within a specific time. In some embedded systems, called real-time systems, the deadlines are stringent. Missing a deadline may cause a catastrophe-loss of life or damage to property.

Embedded systems are constrained for power. As many embedded systems operate through a battery, the power consumption has to be very low. Some embedded systems have to operate in extreme environmental conditions such as very high temperatures and humidity.

The program instructions for embedded systems run with limited computer hardware resources, little memory and small or even non-existent keyboard or screen.

2. 1. Biometric Identification

Biometrics is a method of recognizing a person based on physical or behavioral characteristics. The word biometric came from the term of biological behavior. Biometrics now days consider as a very vital component used as personal identification, considering that the biometric identifiers impossible to be shared between people or lost and the individual's identity can be represented by them. Biometric identification indicates to use of eye, fingerprint, faces of the human been as well as speech characteristics. The common biometric identification that used is

- Facial recognition.
- Fingerprints.
- Finger geometry (the size and position of fingers).
- Iris recognition.
- Vein recognition.
- Retina scanning.
- Voice recognition.
- DNA matching

In this system we have used thumb impression for voter identification or authentication. Every person has an individual unique thumb impression and it helps with accuracy. In a constituency the thumb impression of the database is created for all the voters through this the illegal and repetition of votes is checked.

One of the most important parts of biometric process is the use of fingerprint. It is a very complicated issue, because of variations in unique impressions even in the same finger.

2. 2. Fingerprint Identification

Fingerprint technology is one of the most popular biometric modalities to verify the identity of individuals. Fingerprint recognition is a term called for the electronic method of identifying or verifying fingerprint images belong to humans. Fingerprints are considered most important forms of biometrics that have been used in order to check the individuals' identity.



The fingerprints have been classified upon their visual pattern into three definite classes for all fingerprints:

1. Loops,
2. Arches and
3. Whorls.



1. Loops



2. Arches

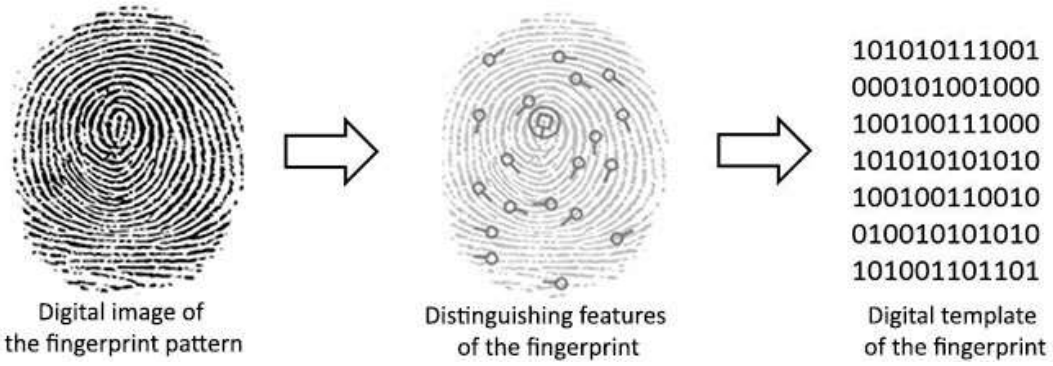


3. Whorls

Each fingerprint type is subdivided into smaller classes. Arch is the first type of fingerprint 5% of people has his type of fingerprint, it divided into two types either plain arch or tented arch. The second type of fingerprint known as loop fingerprint, 60% of people has this type of fingerprint. It also subdivided into two types either radial loop or ulnar loop. The third type of fingerprint known as whorl, 35% of people has this type of fingerprint. This type is subdivided into plain whorl, central pocket whorl, and double loop whorl and accidental.

2. 3. Fingerprint Reader

An electronic device that records a digital image of the fingerprint pattern is known as a fingerprint reader. The captured image is known as a live scan which is then digitally processed. The distinguishing features are extracted and a fingerprint biometric template is created. This biometric template is stored and will be used for matching later.



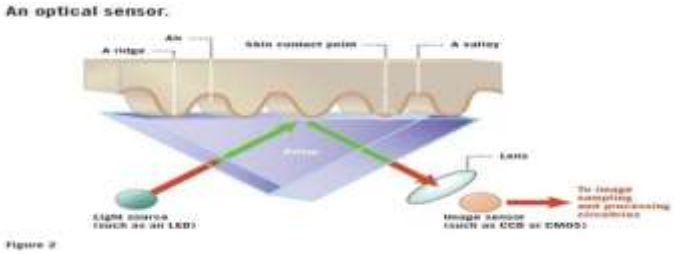
A fingerprint scanner has many advantages over traditional identification mechanisms and provides businesses with a higher level of security. Organizations experience various benefits by incorporating a fingerprint reader such as reliable background checking of employees, secured access to facilities and assets and protection of confidential data. There are many types of fingerprint sensor technologies. The main three types of fingerprint sensor technologies are

1. Optical fingerprint
2. Capacitive based fingerprint
3. Multispectral imaging

In this project we used optical fingerprint sensor technology.

2. 4. Optical Scanner Working Principle

Optical scanners are the common types of fingerprint scanners that use an LED light to illuminate the finger. The sensor detects and creates the fingerprint image by determining the light and dark areas created by the fingerprint ridges. The scanning process starts when the individual places his finger on the glass plate that is known as a touch surface.



Optical sensors mostly use two types of detectors - charge-coupled-devices (CCD) and CMOS based optical imagers. The CCD detectors are very sensitive to low light levels and are thus able to make excellent grayscale pictures. An inverted image of the finger is generated where the darker areas represent more reflected light and the lighter areas represent less reflected light. The darker areas are actually ridging of the finger and the lighter areas are the valleys between the ridges.

Prior to comparing the individual's fingerprint with the stored template, the scanner processor ensures that a clear image has been captured by the CCD. It checks for various attributes such as the average pixel darkness or the overall values in a sample. The scan will be rejected by the processor if the overall image is too dark or too light. In such a case, the exposure time is adjusted by the scanner to allow more or less light and will try to scan the fingerprint again. When the darkness level is adequate, the scanner will check the image definition to determine the sharpness of the fingerprint scan. The scanner processor looks for many horizontal and vertical straight lines moving across the image. A line that runs perpendicular to the ridges and made up of sections that alternate between very dark and very light pixels implies that the fingerprint image has a good definition. The scanner processor proceeds to compare the captured fingerprint with the stored template if it finds that the captured image is crisp and properly exposed.

Charge coupled devices are however relatively expensive to fabricate and moreover fingerprint recognition does not require low-light sensitivity or grayscale imaging. On the other hand, CMOS based optical imagers can be manufactured at a lower cost. The CMOS imagers are manufactured in quantity and some of the image processing steps are built into the chip which attributes to its lower cost.

2. 5. Factors that affect the image quality in optical sensors

The quality of fingerprint image captured by optical sensors may get affected by many real-world factors. These factors may include stray light from another source or surface contamination such as fingerprint impression left behind by a previous user. Other factors that affect image quality are oil, dirt, condensation or ice and any scratches on the surface.

Compared to other scanner types, it is relatively easy to deceive optical scanners with impostor fingerprints by presenting a convincing picture of a fingerprint. Optical scanner manufacturers have thus introduced a variety of techniques that can validate a live finger. One such technique is electro-optical imaging that enhances optical sensors and improves its resistance to deception. In electro-optical imaging, a voltage is placed across a light-emitting polymer film. When the individual places his finger on the sensor, the fingerprint ridges present a ground to the polymer surface that creates a small current and generates light. This produces a high contrast image as the valleys of the fingerprint remain dark and the polymer is directly linked with the optical detector.

3. 1. Circuit component

- Arduino
- Fingerprint Sensor Module
- Push Buttons Switch
- LEDs -2 (Signal Lamp)
- 1K Resistor -3
- 2.2K resistor
- Power Supply
- Connecting Wires
- Buzzer
- 16x2 LCD Display

3. 2. Arduino

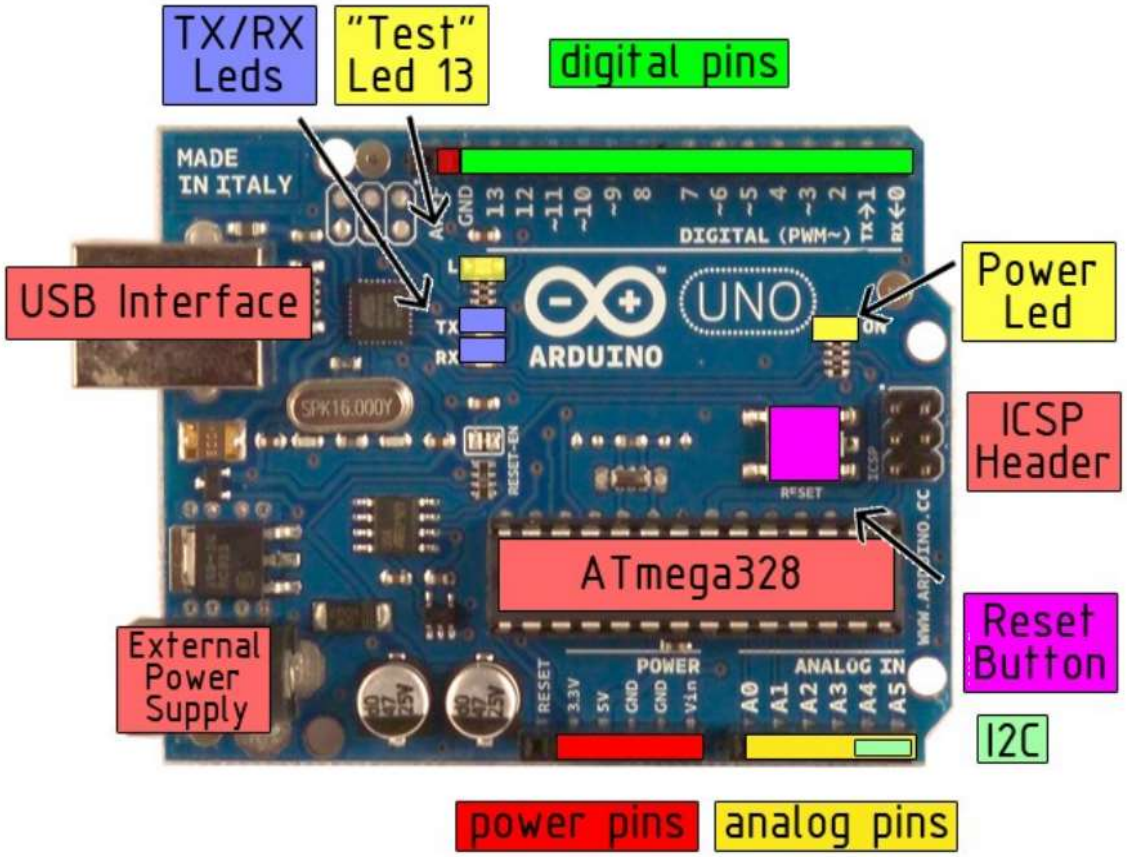
Arduino is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.



ARDUINO UNO

Technical specifications Arduino

- Microcontroller: Microchip ATmega328P
- Operating Voltage: 5 Volts
- Input Voltage: 7 to 20 Volts
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 20 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by boot loader
- SRAM: 2 KB
- EEPROM: 1 KB
- Clock Speed: 16 MHz
- Length: 68.6 mm
- Width: 53.4 mm
- Weight: 25 g



General Pin functions Arduino

LED: There is a built-in LED driven by digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.
VIN: The input voltage to the Arduino/Genuino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). We can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
5V: This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 20V), the USB connector (5V), or the VIN pin of the board (7-20V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage the board.
3V3: A 3.3volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
GND: Ground pins.
IOREF: This pin on the Arduino/Genuino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs to work with the 5V or 3.3V.
Reset: Typically used to add a reset button to shields which block the one on the board.

Special Pin Functions of Arduino

Each of the 14 digital pins and 6 analog pins on the Arduino can be used as an input or output, using pin Mode (), digital Write (), and digital Read () functions. They operate at 5 volts.
Each pin can provide or receive 20 mA as recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50k ohm. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller. The Arduino has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default, they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analog Reference () function. In addition, some pins have specialized functions:

- **Serial** / UART: pins 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB- to-TTL Serial chip.
- **External Interrupts**: pins 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
- **PWM** (Pulse Width Modulation): 3, 5, 6, 9, 10, and 11 can provide 8-bit PWM output with the analog write function.
- **SPI** (Serial Peripheral Interface): 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication using the SPI library.
- **TWI** (two wire interface) / I²C: A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.
- **AREF** (Analog reference): Reference voltage for the analog inputs.

3. 3. Fingerprint Sensor Module

Fingerprint sensor module or fingerprint scanner is a module which captures finger's print image and then converts it into the equivalent template and saves them into its memory on selected ID (location) by Arduino. Here all the process is commanded by Arduino like taking an image of fingerprint; convert it into templates and storing location etc.



Fingerprint processing includes two parts, fingerprint enrollment and fingerprint matching (the matching can be 1:1 or 1: N). When enrolling, user needs to enter the finger two times. The system will process the two-time finger images, generate a template of the finger based on processing results and store the template. When matching, user enters the finger through optical sensor and system will generate a template of the finger and compare it with templates of the finger library.

For 1:1 matching, system will compare the live finger with specific template designated in the Module; for 1: N matching, or searching, system will search the whole finger library for the matching finger. In both circumstances, system will return the matching result, success or failure.

This is a figure print sensor module with TTL UART interface for direct connections to microcontroller UART or to PC through MAX232 / USB-Serial adapter. The user can store the fingerprint data in the module and can configure it in 1:1 or 1: N mode for identifying the person. The FP module can directly interface with 3v3 or 5v Microcontroller. A level converter (like MAX232) is required for interfacing with PC serial port.

Optical biometric fingerprint reader with great features and can be embedded into a variety of end products, such as: access control, attendance, safety deposit box, car door locks

Features:

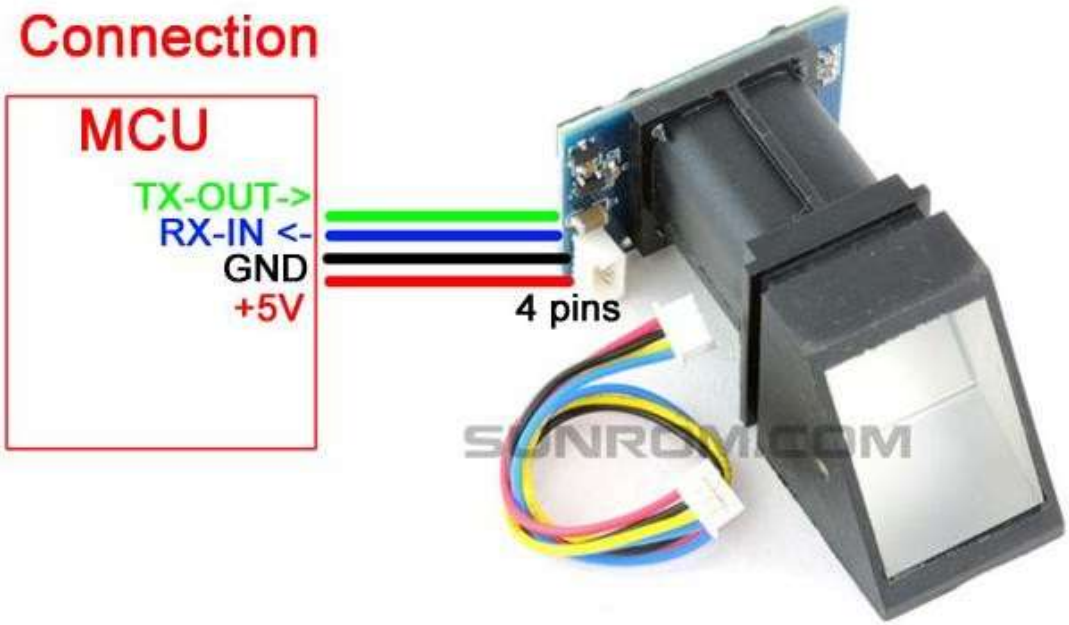
- Integrated image collecting and algorithm chip together, ALL-in-One
- Fingerprint reader can conduct secondary development, can be embedded into a variety of end products
- Low power consumption, low cost, small size, excellent performance
- Professional optical technology, precise module manufacturing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

Specifications:

- Voltage supply: DC 3.6 to 6.0V
- Current supply: <120mA
- Backlight color: green
- Interface: UART
- Bad rate: 9600
- Safety level: five (from low to high: 1,2,3,4,5)
- False Accept Rate (FAR): <0.001% (security level 3)
- False Reject Rate (FRR): <1.0% (security level 3)
- Able to store 127 different fingerprints
- Fingerprint sensor type: Optical
- Sensor Life: 100 million times
- Static indicators: 15KVBacklight: bright green
- Interface: USB1.1/UART (TTL logical level)
- RS232 communication baud rate: 4800BPS~115200BPS changeable
- Dimension: 55*32*21.5mm
- Image Capture Surface 15—18(mm)
- Verification Speed: 0.3 sec
- Scanning Speed: 0.5 sec
- Character file size: 256 bytes
- Template size: 512 bytes
- Storage capacity: 250
- Security level: 5 (1, 2, 3, 4, 5(highest))
- False Acceptance Rate (FAR) :0.0001%
- False Rejection Rate (FRR): 0.1%
- Resolution 500 DPI
- Voltage: 3.6-6.0 VDC
- Working current: Typical 90 mA, Peak 150mA
- Matching Method: 1: N
- Operating Environment Temperature: -20 to 45° centigrade.

Connection of fingerprint to Microcontrollers

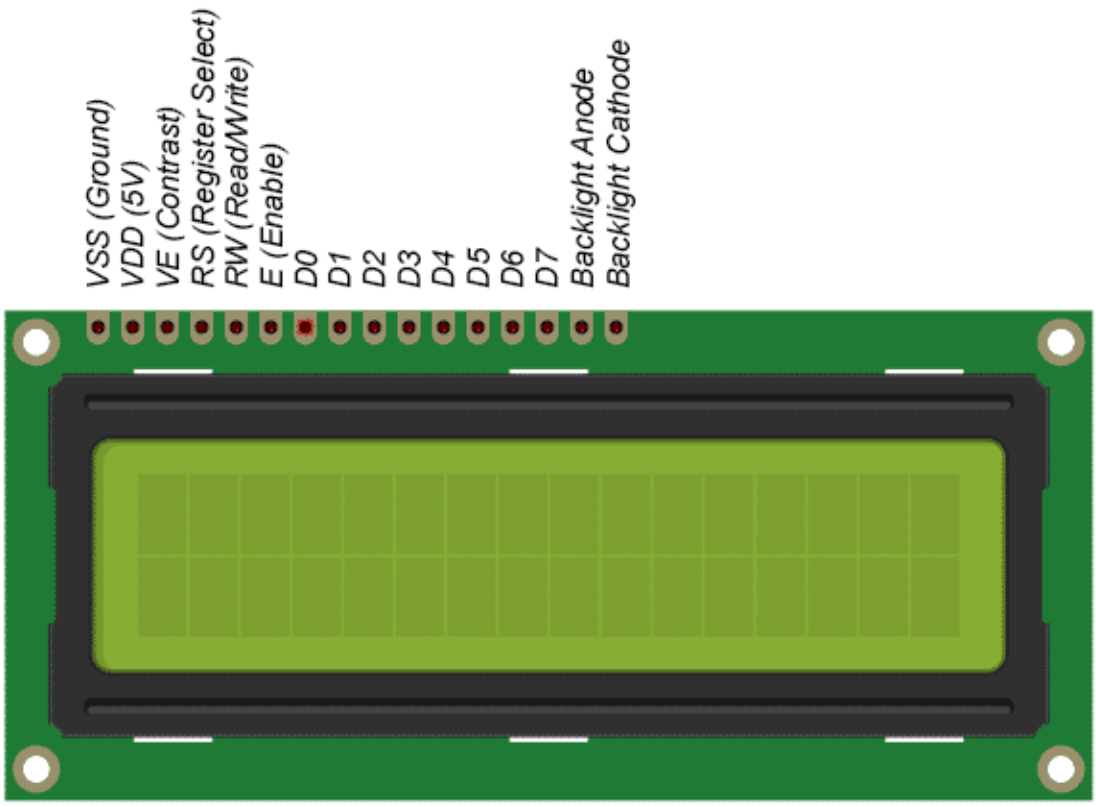
The fingerprint sensor can be wired as below. Do not follow color code of connector provided.
The corner pin is +5V as shown below in red line, then is Ground (GND), Then TXD which goes to MCU's RX-IN, and last pin is RXD which goes to MCU's TX-OUT pin.



3. 4. LCD Display

LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. To establish a good communication between human world and machine world, display units play an important role. They are an important part of embedded systems. A display is made up of millions of pixels. The quality of a display commonly refers to the number of pixels; for example, a 4K display is made up of 3840 x2160 or 4096x2160 pixels. A pixel is made up of three sub pixels; a red, blue and green commonly called RGB.

Display units - big or small, work on the same basic principle. Besides complex display units like graphic displays and 3D displays, one must know working with simple displays like 16x1 and 16x2 units. The 16x1 display unit will have 16 characters and are in one line. The 16x2 LCD will have 32 characters in total 16 in 1st line and another 16 in 2nd line.



Pin function of LCD Display

Pin No	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	Vcc
3	Contrast adjustment; the best way is to use a variable resistor such as a potentiometer. The output of the potentiometer is connected to this pin. Rotate the potentiometer knob forward and backwards to adjust the LCD contrast.	Vo / VEE
4	Selects command register when low, and data register when high	RS (Register Select)
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given; Extra voltage push is required to execute the instruction and EN (enable) signal is used for this purpose. Usually, we make it en=0 and when we want to execute the instruction, we make it high en=1 for some milliseconds. After this we again make it ground that is, en=0.	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Backlight VCC (5V)	Led+
16	Back light Ground (0V)	Led-

3. 5. Push Button Switch

A push button switch is a small, sealed mechanism that completes an electric circuit when it presses on it. When it's on, a small metal spring inside makes contact with two wires, allowing electricity to flow. When it's off, the spring retracts, contact is interrupted, and current won't flow.



We use these little buttons on everything! These Miniature Single Pole Single Throw switches have a good click to them and are breadboard friendly. Perfect as a tactile reset switch. These momentary buttons are rated up to 50mA.

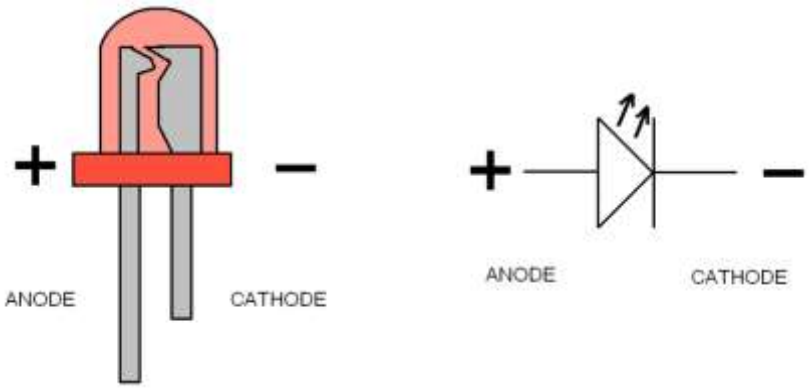
3. 6. LED

An LED is a small component that gives light. A light-emitting diode (LED) light is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. This effect is called electroluminescence.



Connection of a LED

The LED has two pins called anode and cathode. The anode is the longest pin. This is the pin you connect to the most positive voltage. The cathode is the pin that connects to the most negative voltage. This must be needed to connect correctly for the LED to work.



3. 7. Resistor

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses.



Resistors can be fabricated in a variety of ways. The most common type in electronic devices and systems is the carbon-composition resistor. Fine granulated carbon (graphite) is mixed with clay and hardened. The resistance depends on the proportion of carbon to clay; the higher this ratio, the lower the resistance.

Another type of resistor is made from winding Nichrome or similar wire on an insulating form. This component, called a wire wound resistor, is able to handle higher currents than a carbon-composition resistor of the same physical size. However, because the wire is wound into a coil, the component acts as an inductors as well as exhibiting resistance. This does not affect performance in DC circuits, but can have an adverse effect in AC circuits because inductance renders the device sensitive to changes in frequency.

When building Arduino projects, we use resistors to limit the amount of current going to certain components in the circuit, such as LEDs and integrated circuits. To calculate the resistance, we should use a modified version of Ohm's Law.

In the following equation, R is resistance; V_{SUPPLY} is the voltage supplied from the power source (this is 5V for a standard Arduino digital pin, but could be more or less if the V_{IN} pin is used); $V_{FORWARD}$ is the voltage required by the component, and I is the current required by the component:

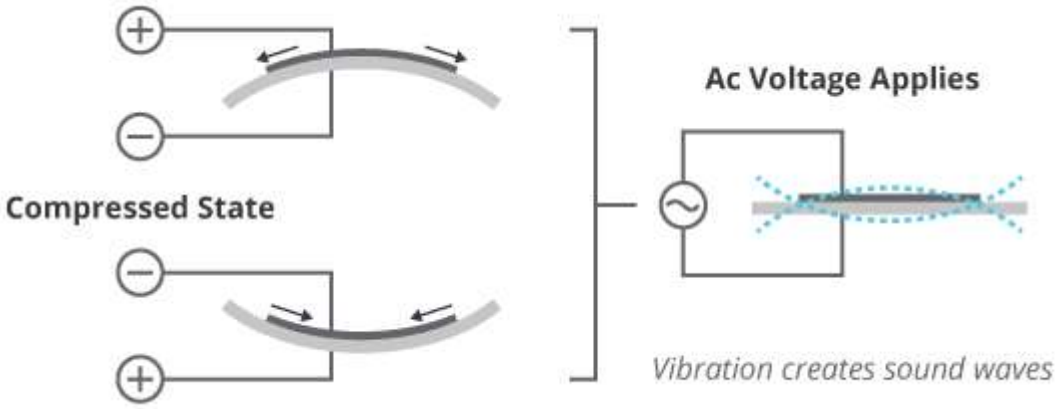
$$R = \frac{V_{Supply} - V_{Forward}}{I}$$

3. 8. Buzzer

A buzzer or beeper is an audio signaling device which we used many purposes especially in electronics circuit. Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke. A buzzer is basically a tiny speaker that can connect directly to an Arduino. From the Arduino, it makes sounds with a buzzer by using tone. In here we used Piezo buzzer.



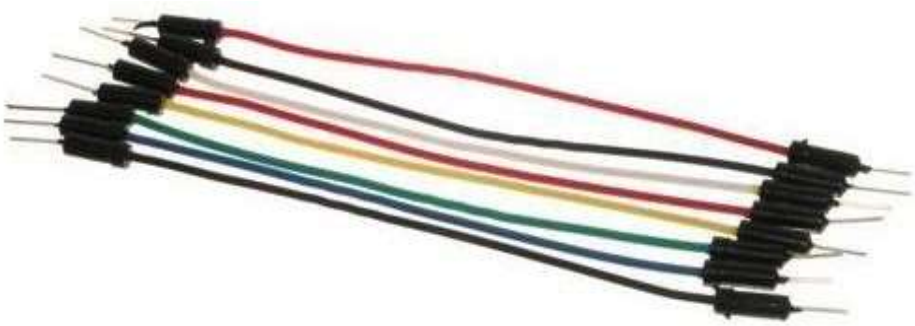
Working Principle of Piezo Buzzer



When an alternating voltage is applied to the Piezo ceramic element, the element extends and shrinks diametrically. This characteristic of piezoelectric material is utilized to make the ceramic plate vibrate rapidly to generate sound waves.

3.9. Connecting wires

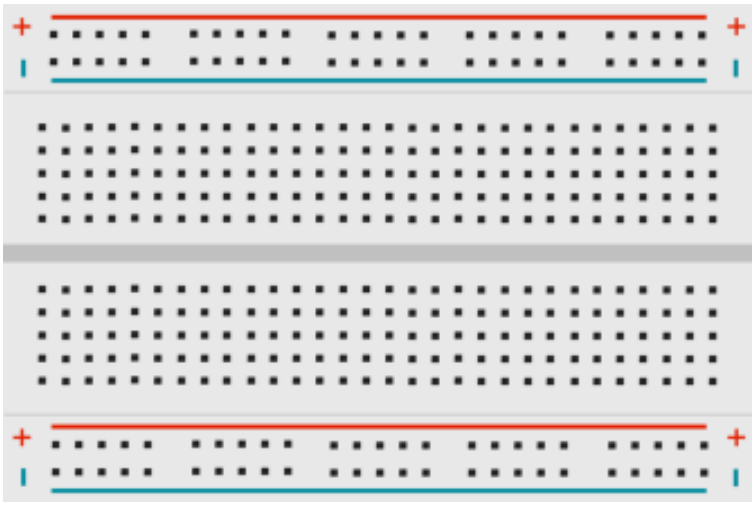
Connecting wires allows an electrical current to travel from one point on a circuit to another because electricity needs a medium through which it can move. Most of the connecting wires are of copper or aluminum. But in bread board of electronics circuit the wire we used is called jump wire.



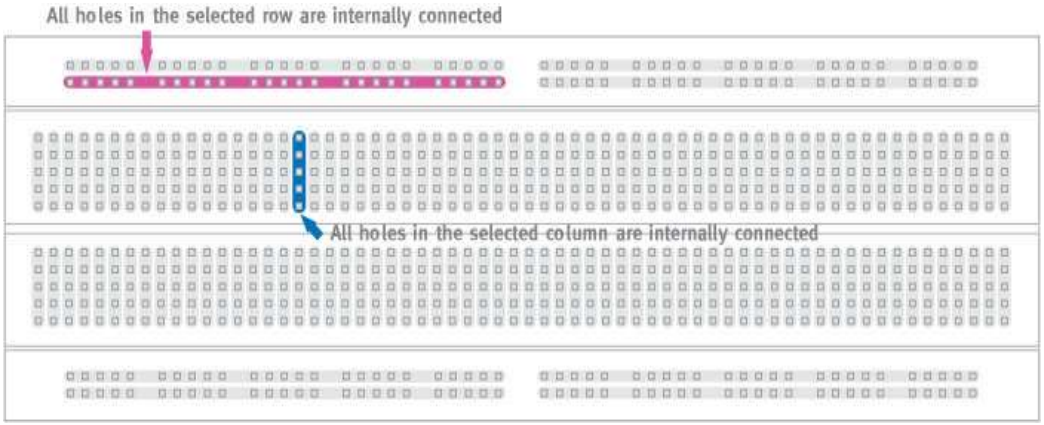
A jump wire (also known as jumper wire, or jumper) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

3. 10. Breadboard

A breadboard is a simple device designed to create circuits without the need for soldering. A breadboard is a widely used tool to design and test circuit. We do not need to solder wires and components to make a circuit while using a breadboard. It is easier to mount components & reuse them. Since, components are not soldered we can change our circuit design at any point without any hassle.



Most electronic components in electronic circuits can be interconnected by inserting their leads or terminals into the holes and then making connections through wires where appropriate. The breadboard has strips of metal underneath the board and connects the holes on the top of the board. The metal strips are laid out as shown below. Note that the top and bottom rows of holes are connected horizontally and split in the middle while the remaining holes are connected vertically.



4. 1. Working Principal

Working of this biometric voting system for election is a little bit complex for beginners. First of all, user needs to select the voter number from 01 to 99. Because voting machine highest voter capacity is 99. Then need to select the candidate number from one to six. Here highest 6 candidate can be selected.

To proper image every time need to scan twice. First presiding officer fingerprint need to scan. Then voter fingerprint. First need to input the serial number by in order, starting from 1 and end up 99. Then voter can scan his or her finger. After completing to scan the all voter we can go for poll.

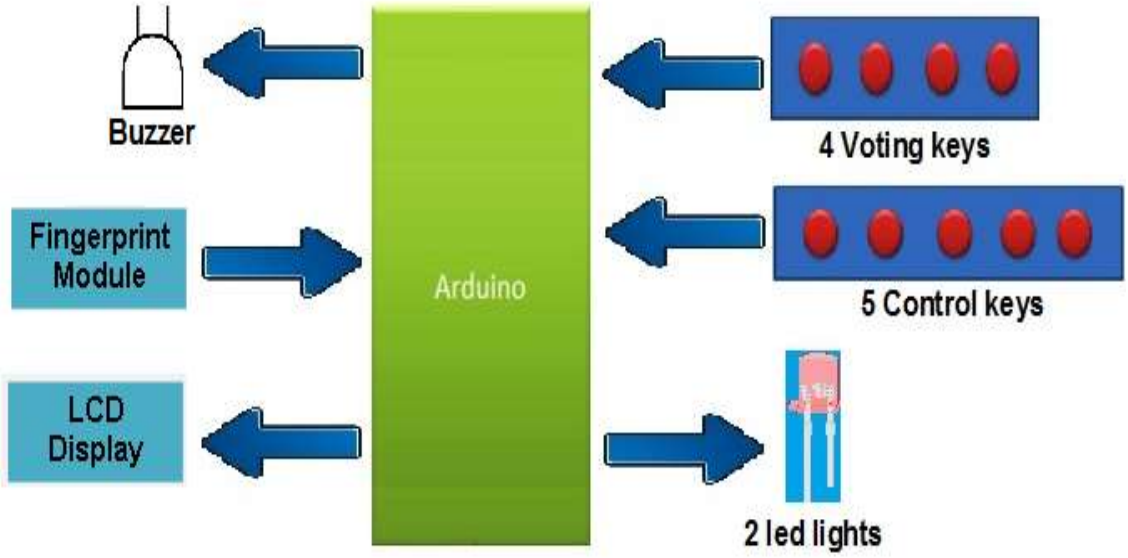
Now user needs to put his finger on finger print module. Then LCD will ask to remove the finger from finger print module and again ask for placing the finger. Now user needs to put his finger again on finger print module. Now finger print module takes an image and converts it into templates and stores it by selected serial number in to the finger print module's memory. Now voter will be registered and he or she can vote. By same method all the voter can be registered in to the system.

For voting after placing a finger over fingerprint module fingerprint module captures finger image find its finger image is present in the system or not. If finger image detected then LCD will show authorized voter. It means the user is authorized to vote. And then the system moves to next stage for voting. Now green LED will glow it means voter can vote for their candidates by pressing the candidate button. For confirming voter need to press the button twice.

Now if the same voter wants to vote again then the system will show "sorry already voted". Means same voter can't vote again and buzzer will beep for 5 seconds. If any non registered user wants to vote then finger print module will not detect its ID into the system and LCD will show "invalid finger".

4. 2. Block Diagram

The following block shows the biometric voting machine with the help of Arduino. The hardware requirements of this voting machine are power supply, fingerprint module, LCD display and Arduino. This project is designed by a prototype of a product, biometric voting machine, it allows voters and this product can make easy for registered voters.

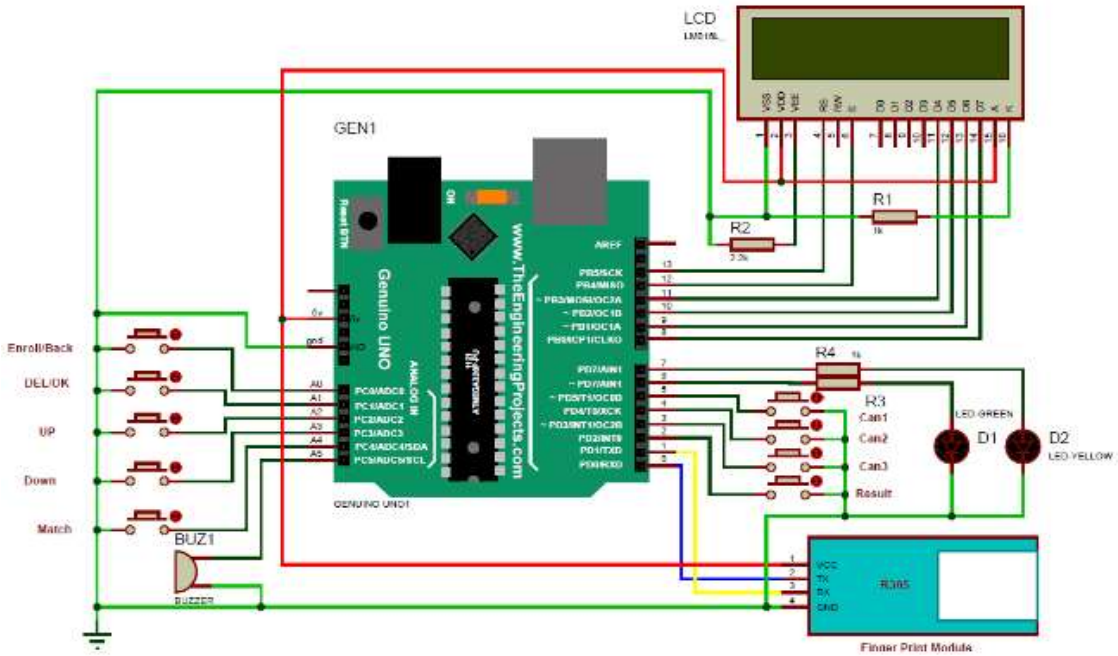


In the block diagram shows that fingerprint module, controls key, voting keys are input module to the Arduino. And LCD display, signal lights and buzzer are the output module from the Arduino.

4. 3. Circuit Diagram

Circuit diagrams are used for the design (circuit design), construction (such as PCB layout), and maintenance of electrical and electronic equipment. It is a graphical representation of an electrical circuit.

In this project also there is a circuit diagram. It will help the project to proper function. The circuit diagram of the fingerprint based biometric voting machine is in below



4. 4. Circuit Description

1. Fingerprint based voting machine project is which contains Arduino for controlling the whole process of the project.
2. A buzzer for alert, LEDS for indication and LCD for instruct voter and Showing the Result.
3. The push buttons are directly connected to pin no. of arduino A0,A1,A2,A3,A4,2,3,4,5
4. Buzzer Connected to pin no. A5 Respect to GND.
5. Fingerprint Sensor is Connect
   Vcc to 5v
   Tx to pin no. 0
   Rx to pin no. 1
   GND to GND
6. Green LED is Connected to pin no. 6 Respect to GND through a 1K Resistor Red LED is Connected to pin no. 7 Respect to GND through a 1K Resistor.
7. LCD pin no. RS,EN D4,D5,D6 and D7 are connected to pin no. 13,12,11,10,9 and 8 of Arduino.
   LCD pin no. VDD: Connected to 5V
   VSS: Connected to GND
   VEE: Connected to GND through a 2.2k Variable Resistor.
   A/Led+ Connected to 5V
   K/Led- Connected to GND Through a 1k Resistor.

4. 5. Design Description

1, Fingerprint Voting System Design Has been Implement input Device and output device With the Arduino technology. Input device are Fingerprint sensor and voting and controlling switches. Output device are LCD disply. LED light and Buzzer.

2, If voter fingerprint (Thumb) stored then voting time the voting option will appear and display shows “please give your vote” and the green signal lamp will be light.

3, If attempt false vote display shows “ Invalid Finger ” If voter Repeats to vote display shows “ Sorry Already Voted ” at the same time red signal light Will be flashing and buzzer will be Ringing.

5. 1. Program Sequence

The software application and the hardware implementation help the microcontroller read the data from the fingerprint verify the data with the already stored data and take the next action. The system is totally designed using fingerprint module and embedded systems technology.

The controlling unit has an application program to allow the microcontroller interface with the fingerprint module, the reader reads the data from the tag, passes the data to the microcontroller and the controllers verifies this data with the already existing data in the controller's memory and then implement the commands directed by the controller section. The performance of the design is maintained by controlling unit.

5.2. FlowChart

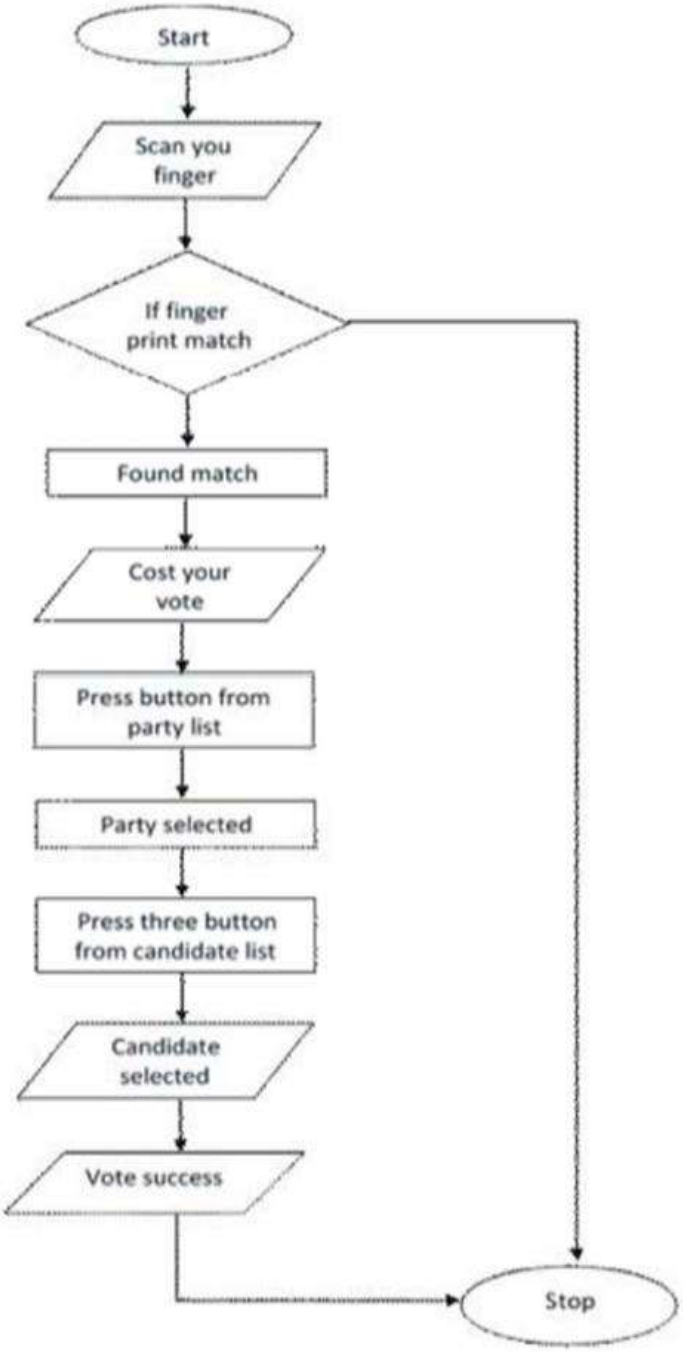


Fig. 4: Flowchart of the Fingerprint Voting System

1

5. 3. Program Code

In a program, we have used Adafruit Fingerprint Sensor Library for interfacing fingerprint module with Arduino board. You can check the complete Code below. Here we are explaining main functions of the Arduino Program.

After it, in void loop() function, we have waited for check key and press Match key to start the finger print to take input and compare captured image id with stored IDs. If a match occurs then proceed with next step.

```
void loop()
{
 lcd.setCursor(0,0);
 lcd.print("Press Match Key ");
 lcd.setCursor(0,1);
 lcd.print("to start system");


 digitalWrite(indVote, LOW);
 digitalWrite(indFinger, LOW);
 if(digitalRead(match)==0)
 {
 digitalWrite(buzzer, HIGH);
 delay(200);
 digitalWrite(buzzer, LOW);
 digitalWrite(indFinger, HIGH);
 for(int i=0;i<3;i++)
..... .....
..... ....
```

Given void check Keys () function is used for checking Enroll or DEL key is pressed or not and what to do if pressed. If the ENROL key pressed the Enroll () function is called and DEL key press then delete () function is called.

```
void checkKeys()
 {
```

```
if(digitalRead(enroll) == 0)
 {
  lcd.clear();
  lcd.print("Please Wait");
  delay(1000);
  while(digitalRead(enroll) == 0);
  Enroll();
   }

    else if(digitalRead(del) = = 0)
     {
      lcd.clear();
      lcd.print("Please Wait");
     delay(1000);
     delet();
     }
}
```

Given function is used for entering ID to be deleted and calling uint8_t deleteFingerprint(uint8_t id) function that will delete finger from records.

```
void delete()
{
     int count=0;
     lcd.clear();
     lcd.print("Delete Finger ");
     lcd.setCursor(0,1);
     lcd.print("Location:");
     while(1)
      {
         lcd.setCursor(9,1);
```

```
        lcd.print(count);
        if(digitalRead(up) = = 0)
         {
            count++;
            if(count>25)
            count=0;
            delay(500);
         }
.... .....
..... .....
```

Given function is used for delete finger print from the record of selected ID.

```
uint8_t deleteFingerprint(uint8_t id)
{
  uint8_t p = -1;
  lcd.clear();
  lcd.print("Please wait");
  p = finger.deleteModel(id);
  if (p == FINGERPRINT_OK)
  {
     Serial.println("Deleted!");
     lcd.clear();
     lcd.print("Figer Deleted");
     lcd.setCursor(0,1);
     lcd.print("Successfully");
    delay(1000);
   }
   else
    {
       Serial.print("Something Wrong");
```

```
      lcd.clear();
      lcd.print("Something Wrong");
      lcd.setCursor(0,1);
      lcd.print("Try Again Later");
     delay(2000);
     return p;
  }
 }
```

Given Function is used to taking finger print image and convert them into the template and save it by selected ID into the finger print module memory.

```
uint8_t getFingerprintEnroll()
 {
    int p = -1;
    lcd.clear();
    lcd.print("finger ID:");
    lcd.print(id);
    lcd.setCursor(0,1);
    lcd.print("Place Finger");
   delay(2000);
   while (p != FINGERPRINT_OK)
   {
     p = finger.getImage();
```

....

....

Given function is used for voting and display results:

```
void Vote()
{
```

```
  lcd.clear();
  lcd.print("Please Place");
  lcd.setCursor(0,1);
  lcd.print("Your Vote");
 digitalWrite(indVote, HIGH);
 digitalWrite(indFinger, LOW);
 digitalWrite(buzzer, HIGH);
 delay(500);
 digitalWrite(buzzer, LOW);
 delay(1000);
 while(1)
 {
       if(digitalRead(sw1)==0)
```

....

....

Check the Full Code and demonstration Video Below.

Code

```
#include<EEPROM.h>
 #include<LiquidCrystal.h>
LiquidCrystal lcdd(13,12,11,10,9,8);

#include<Adafruit_Fingerprint.h>
 uint8_t id;
Adafruit_Fingerprint finger = Adafruit_Fingerprint(&Serial);
#define enroll 14
#define del 15
#define up 16
```

```
#define down 17
#define match 18
#define indVote 6

#define sw1 5
#define sw2 4
#define sw3 3
#define resultsw 2
#define indFinger 7
#define buzzer 19
#define records 25
 int vote1,vote2,vote3;

 int flag;

void setup()
{
   delay(1000);
   pinMode(enroll, INPUT_PULLUP);
   pinMode(up, INPUT_PULLUP);
   pinMode(down, INPUT_PULLUP);
   pinMode(del, INPUT_PULLUP);
   pinMode(match, INPUT_PULLUP);
   pinMode(sw1, INPUT_PULLUP);
   pinMode(sw2, INPUT_PULLUP);
   pinMode(sw3, INPUT_PULLUP);
   pinMode(resultsw, INPUT_PULLUP);
   pinMode(buzzer, OUTPUT);
   pinMode(indVote, OUTPUT);
   pinMode(indFinger, OUTPUT);
```

```
lcd.begin(16,2);
 if(digitalRead(resultsw) ==0)
 {
  for(int i=0;i<records;i++)
     EEPROM.write(i+10,0xff);
  EEPROM.write(0,0);
  EEPROM.write(1,0);
  EEPROM.write(2,0);
  lcd.clear();
  lcd.print("System Reset");
  delay(1000);
 }

  lcd.clear();
  lcd.print("Voting Machine");
  lcd.setCursor(0,1);
  lcd.print("by Finger Print");
  delay(2000);
  lcd.clear();
  lcd.print("Circuit Digest");
  lcd.setCursor(0,1);
  lcd.print("Saddam Khan");
 delay(2000);

if(EEPROM.read(0) == 0xff)
 EEPROM.write(0,0);

  if(EEPROM.read(1) == 0xff)
 EEPROM.write(1,0);
```

```
 if(EEPROM.read(1) == 0xff)
 EEPROM.write(1,0);

//finger.begin(57600);
Serial.begin(57600);
lcd.clear();
lcd.print("Finding Module");
lcd.setCursor(0,1);
delay(1000);
if (finger.verifyPassword())
{
  //Serial.println("Found fingerprint sensor!");
  lcd.clear();
  lcd.print("Found Module ");
  delay(1000);
 }
 else
 {
 //Serial.println("Did not find fingerprint sensor :(");
 lcd.clear();
 lcd.print("module not Found");
 lcd.setCursor(0,1);
 lcd.print("Check Connections");
 while (1);
 }

 lcd.clear();
 lcd.setCursor(0,0);
 lcd.print("Cn1");
```

```
lcd.setCursor(4,0);
lcd.print("Cn2");
lcd.setCursor(8,0);
lcd.print("Cn3");
lcd.setCursor(12,0);
lcd.print("Cn4");


lcd.setCursor(0,1);
 vote1=EEPROM.read(0);
 lcd.print(vote1);
 lcd.setCursor(6,1);
 vote2=EEPROM.read(1);
 lcd.print(vote2);
 lcd.setCursor(12,1);
 vote3=EEPROM.read(2);
 lcd.print(vote3);
 delay(2000);
}

 void loop()
  {
   lcd.setCursor(0,0);
   lcd.print("Press Match Key ");
   lcd.setCursor(0,1);
   lcd.print("to start system");
   digitalWrite(indVote, LOW);
   digitalWrite(indFinger, LOW);
   if(digitalRead(match)==0)
   {
```

```
digitalWrite(buzzer, HIGH);
delay(200);
digitalWrite(buzzer, LOW);
digitalWrite(indFinger, HIGH);
for(int i=0;i=0)
{
    lcd.clear();
    lcd.print("Place Finger");
    delay(2000);
    int result=getFingerprintIDez();
    if(result>=0)
  {
     flag=0;
       for(int i=0;i<records;i++)
        {
          if(result == EEPROM.read(i+10))
           {
             lcd.clear();
              lcd.print("Authorised Voter");
              lcd.setCursor(0,1);
              lcd.print("Please Wait....");
              delay(1000);
              Vote();
              EEPROM.write(i+10, 0xff); flag=1; return;
            }
          }

          if(flag == 0)
          {
           lcd.clear();
```

```
                lcd.print("Already Voted");
                //lcd.setCursor(0,1);
                //lcd.print("")
                digitalWrite(buzzer, HIGH);
                delay(5000);
                digitalWrite(buzzer, LOW);
                return;
                  }
                }
              }
              lcd.clear();
            }
            checkKeys();
delay(1000);
 }

 void checkKeys()
  {
    if(digitalRead(enroll) == 0)
    {
     lcd.clear();
     lcd.print("Please Wait");
     delay(1000);
     while(digitalRead(enroll) == 0);
     Enroll();
     }

      else if(digitalRead(del) == 0)
      {
       lcd.clear();
```

```
 lcd.print("Please Wait");
 delay(1000); delet();
 }
}

void Enroll()
{
   int count=0;
   lcd.clear();
   lcd.print("Enter Finger ID:");

   while(1)
    {
     lcd.setCursor(0,1);
      lcd.print(count);
       if(digitalRead(up) == 0)
      {
        count++;
        if(count>25)
        count=0;
        delay(500);
       }

       else if(digitalRead(down) == 0)
       {
        count--;
        if(count<0)
        count=25;
        delay(500);
       }
```

```
            else if(digitalRead(del) == 0)
            {
                 id=count;
                 getFingerprintEnroll();
                 for(int i=0;i<records;i++)
                {
                  if(EEPROM.read(i+10) == 0xff)
                  {
                    EEPROM.write(i+10, id);
                    break;
                  }
                }
                return;
             }

               else if(digitalRead(enroll) == 0)
            {
                return;
          }
     }
}

 void delet()
  {
     int count=0;
     lcd.clear();
     lcd.print("Enter Finger ID");

     while(1)
     {
```

```
lcd.setCursor(0,1);
 lcd.print(count);
 if(digitalRead(up) == 0)
 {
  count++;
  if(count>25)
  count=0;
  delay(500);
 }

 else if(digitalRead(down) == 0)
{
  count--;
  if(count<0)
  count=25;
  delay(500);
 }
 else if(digitalRead(del) == 0)
 {
       id=count;
      deleteFingerprint(id);
      for((int i=0;i<records;i++)
      {
        if(EEPROM.read(i+10) == id)
       {
         EEPROM.write(i+10, 0xff);
         break;
        }
      }
     return;
```

```
        }
          else if(digitalRead(enroll) == 0)
        {
           return;
        }
      }
    }
uint8_t getFingerprintEnroll()
{
  int p = -1;
  lcd.clear();
  lcd.print("finger ID:");
  lcd.print(id);
  lcd.setCursor(0,1);
  lcd.print("Place Finger");
  delay(2000);
  while (p != FINGERPRINT_OK)
  {
   p = finger.getImage();
   switch (p)
   {
   case FINGERPRINT_OK:
    //Serial.println("Image taken");
    lcd.clear();
    lcd.print("Image taken");
    break;
    case FINGERPRINT_NOFINGER:
     //Serial.println("No Finger");
     lcd.clear();
     lcd.print("No Finger");
```

```
      break;
    case FINGERPRINT_PACKETRECIEVEERR:
      //Serial.println("Communication error");
      lcd.clear(); lcd.print("Comm Error");
      break;
    case FINGERPRINT_IMAGEFAIL:
      //Serial.println("Imaging error");
      lcd.clear();
      lcd.print("Imaging Error");
      break;
    default:
     //Serial.println("Unknown error");
     lcd.clear();
     lcd.print("Unknown Error");
     break;
   }
 }

 // OK success!

p = finger.image2Tz(1);
 switch (p) {
 case FINGERPRINT_OK:
   //Serial.println("Image converted");
   lcd.clear();
   lcd.print("Image converted");
   break;
  case FINGERPRINT_IMAGEMESS:
   //Serial.println("Image too messy");
   lcd.clear();
```

```
    lcd.print("Image too messy");
    return p;
   case FINGERPRINT_PACKETRECIEVEERR:
    //Serial.println("Communication error");
          lcd.clear();
    lcd.print("Comm Error");
    return p;
   case FINGERPRINT_FEATUREFAIL:
    //Serial.println("Could not find fingerprint features");
         lcd.clear();
    lcd.print("Feature Not Found");
    return p;
  case FINGERPRINT_INVALIDIMAGE:
   //Serial.println("Could not find fingerprint features");
        lcd.clear();
   lcd.print("Feature Not Found");
   return p;
 default:
   //Serial.println("Unknown error");
        lcd.clear();
   lcd.print("Unknown Error");
   return p;
}
//Serial.println("Remove finger");
lcd.clear();
lcd.print("Remove Finger");
delay(2000);
p = 0;
while (p != FINGERPRINT_NOFINGER) {
  p = finger.getImage();
```

```
 } //Serial.print("ID ");
 //Serial.println(id);
 p = -1;
//Serial.println("Place same finger again");
lcd.clear();
    lcd.print("Place Finger");
    lcd.setCursor(0,1);
    lcd.print(" Again");
while (p != FINGERPRINT_OK) {
 p = finger.getImage();
 switch (p) {
 case FINGERPRINT_OK:
 //Serial.println("Image taken");
 break;
case FINGERPRINT_NOFINGER:
 //Serial.print(".");
 break;
case FINGERPRINT_PACKETRECIEVEERR:
  //Serial.println("Communication error");
   break;
case FINGERPRINT_IMAGEFAIL:
  //Serial.println("Imaging error");
  break;
default:
  //Serial.println("Unknown error");
  return;
 }
}

// OK success!
```

```
p = finger.image2Tz(2);
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!
 //Serial.print("Creating model for #"); //Serial.println(id);

 p = finger.createModel();
 if (p == FINGERPRINT_OK) {
    //Serial.println("Prints matched!");
 } else if (p == FINGERPRINT_PACKETRECIEVEERR) {
```

```
  //Serial.println("Communication error");
  return p;
  } else if (p == FINGERPRINT_ENROLLMISMATCH) {
  //Serial.println("Fingerprints did not match");
  return p;
} else {
  //Serial.println("Unknown error");
  return p;
}

//Serial.print("ID "); //Serial.println(id);
p = finger.storeModel(id);
 if (p == FINGERPRINT_OK) {
 //Serial.println("Stored!");
 lcd.clear();
 lcd.print("Stored!");
 delay(2000);
} else if (p == FINGERPRINT_PACKETRECIEVEERR) {
 //Serial.println("Communication error");
 return p;
} else if (p == FINGERPRINT_BADLOCATION) {
   //Serial.println("Could not store in that location");
   return p;
} else if (p == FINGERPRINT_FLASHERR) {
   //Serial.println("Error writing to flash");
   return p;
}
else {
  //Serial.println("Unknown error");
  return p;
```

```
 }
}

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)
  {
  lcd.clear();
  lcd.print("Finger Not Found");
  lcd.setCursor(0,1);
  lcd.print("Try Later");
  delay(2000);
  return -1;
  }
  // found a match!
  //Serial.print("Found ID #");
  //Serial.print(finger.fingerID);
  return finger.fingerID;
  }
```

```
uint8_t deleteFingerprint(uint8_t id)
{
  uint8_t p = -1;
  lcd.clear();
  lcd.print("Please wait");
  p = finger.deleteModel(id);
  if (p == FINGERPRINT_OK)
  {
     //Serial.println("Deleted!");
     lcd.clear();
     lcd.print("Figer Deleted");
     lcd.setCursor(0,1);
     lcd.print("Successfully");
    delay(1000);
   }

   else
   {
    //Serial.print("Something Wrong");
  lcd.clear();
     lcd.print("Something Wrong");
     lcd.setCursor(0,1);
     lcd.print("Try Again Later");
     delay(2000);
     return p;
   }
 }

 void Vote()
 {
```

```
lcd.clear();
lcd.print("Please Place");
lcd.setCursor(0,1);
lcd.print("Your Vote");
digitalWrite(indVote, HIGH);
digitalWrite(indFinger, LOW);
digitalWrite(buzzer, HIGH);
delay(500);
digitalWrite(buzzer, LOW);
delay(1000);
while(1)
{
     if(digitalRead(sw1)==0)
    {
       vote1++;
       voteSubmit(1);
       EEPROM.write(0, vote1);
       while(digitalRead(sw1)==0);
       return;
     }
     if(digitalRead(sw2)==0)
    {
      vote2++;
      voteSubmit(2);
      EEPROM.write(1, vote2);
    while(digitalRead(sw2)==0);
    return;
   }
   if(digitalRead(sw3)==0)
   {
```

```
vote3++;
   voteSubmit(3);
   EEPROM.write(2, vote3);
while(digitalRead(sw3)==0);
return;
}
if(digitalRead(resultsw)==0)
{
      lcd.clear();
      lcd.setCursor(0,0);
      lcd.print("Can1");
      lcd.setCursor(6,0);
      lcd.print("Can2");
      lcd.setCursor(12,0);
      lcd.print("Can3");
      for(int i=0;i<3;i++)
     {
       lcd.setCursor(i*6,1);
       lcd.print(EEPROM.read(i));
     }
     delay(2000);
  int vote=vote1+vote2+vote3;
 if(vote)
 {
   if((vote1 > vote2 && vote1 > vote3))
   {
    lcd.clear();
    lcd.print("Can1 Wins");
   delay(2000);
   lcd.clear();
```

```
 }
 else if(vote2 > vote1 && vote2 > vote3)
 {
  lcd.clear();
  lcd.print("Can2 Wins");
  delay(2000);
  lcd.clear();
}
else if((vote3 > vote1 && vote3 > vote2))
{
  lcd.clear();
  lcd.print("Can3 Wins");
  delay(2000);
  lcd.clear();
  }

 else
  {
     lcd.clear();
     lcd.print(" Tie Up Or ");
     lcd.setCursor(0,1);
     lcd.print(" No Result ");
     delay(1000);
     lcd.clear();
   }

  }
    else
     {
        lcd.clear();
```

```
            lcd.print("No Voting....");
            delay(1000);
            lcd.clear();
           }
           vote1=0;vote2=0;vote3=0;vote=0;
            lcd.clear();
            return;
           }
    }
    digitalWrite(indVote, LOW);
  }

  void voteSubmit(int cn)
 {
   lcd.clear();
   if(cn == 1)
         lcd.print("Can1");
   else if(cn == 2)
        lcd.print("Can2");
   else if(cn == 3)
        lcd.print("Can3");
   lcd.setCursor(0,1);
   lcd.print("Vote Submitted");
  digitalWrite(buzzer , HIGH);
  delay(1000);
  digitalWrite(buzzer, LOW);
 digitalWrite(indVote, LOW);
 return;
}
```

6.1 Individual (Voter) Verification

The ability of the voting system to makr a voter sure that his/her vote has been cast and tallied as intended by him/her (Demirel, Henning, Ryan, Schneider, & Volkamer, 2011; Warrer, 2005).

6.2 Eligibility Verification

The ability to convince people that tallied votes belong to eligible voters and there is at most one vote per single eligible voter (Kremer, Ryan, & Smith, 2010).

6.3 Integrity (Accuracy)

Vote Captured as Intended: Vote captured by voting system should be identical to the voter selectiom.

Vote Cast as Intended: Vote should be processed by the system correctly as intended by the voter.

Vote Counted as Cast: Tally result should correspond to cast votes.

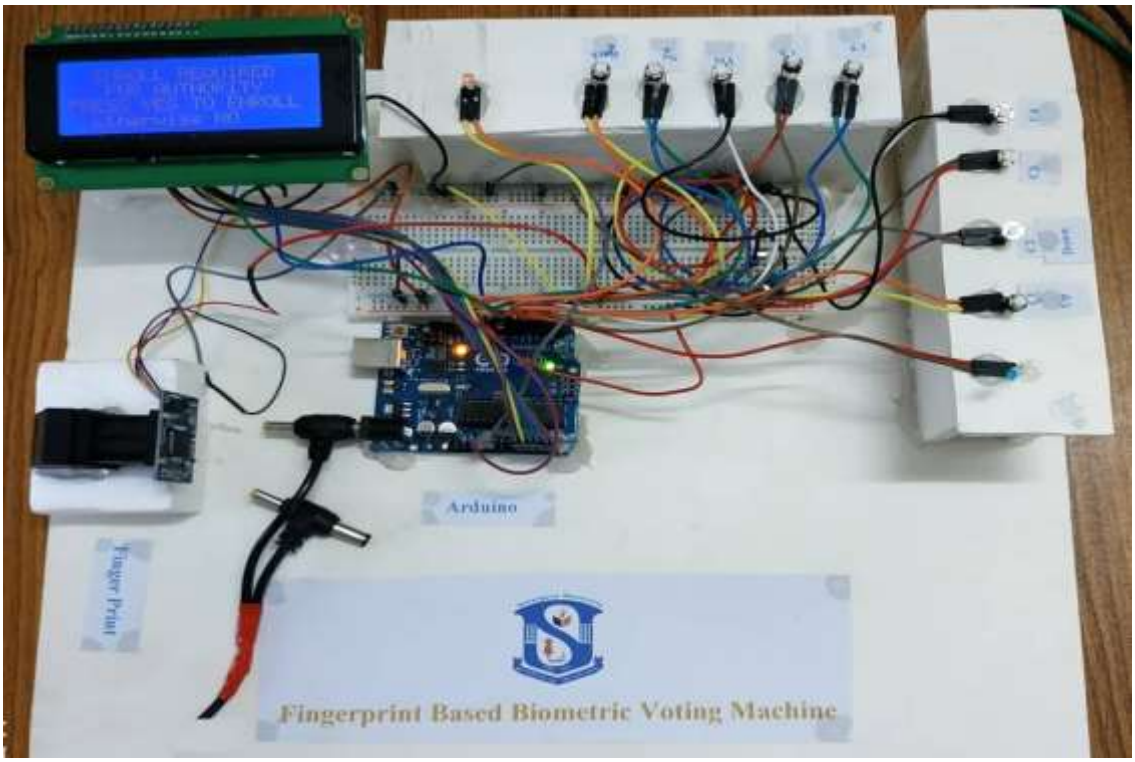
6.4 Privacy

Anonymity: It is not possible to know which voter has cast a particular vote (Langer, Jonker, & Pieters, 2010).

Receipt Freeness: It is not possible for a vote to present evidence about his/her selection (Langer, Jonker & Pieters, 2010).

Coercion Resistance: There is no way for a third party to control voter selection (Demirel, Henning, Ryan, Schneider & Volkamer, 2011).

7. 1. Real photograph of the project



7. 2. Advantage

The project has been introduced to realize and defeat the problems that occur in many electronic voting systems. The reason behind this project is to create fully secure, efficient, accurate and reliable electronic voting system using fingerprint technology. The main advantage of the fingerprint based biometric voting machine is below

1. Prevent unauthorized use or access.
2. The system is highly reliable and secure.
3. In the long run the maintenance cost is very less.
4. It is possible to get instantaneous results with high accuracy.
5. No chance for double voting.
6. No chance for illegal voting.
7. Eliminate the burden and carrying the NID card.
8. Very low power consumption.
9. It is economical.
10. Less paper and filling required.
11. Less man power required.

7. 3. Scope of Future Development

In this universe nothing is perfect made by human. There is always a chance to improve. There is a say belong to Winston Churchill state, “To improve is to change; to be perfect is to change often”. Therefore, improvement always has to be done in order to make a system to be perfect. In this project there are some scopes of development.

In big elections there are huge number of people want to cast their votes, in order to avoid the congestion at the voting point there is need to provide number of fingerprint scanner and also personal computers, each one will be connected to the main server in order to allow many people to poll.

The collection of fingerprints of all the voters is little difficult. The best way we can collect the fingerprint from NID server.

Those who have no finger or hand cannot poll his or her vote. So, for the disable people need to alternative option or alternative booth for their poll.

The personal details of the voter does not verifying in this system other then fingerprint.

It could be interfaced with printer or PC to get the hard copy of the result almost instantly from the machine itself.

7. 4. Conclusion

Fingerprints considered as one of the most popular biometric methods used for human recognition. For that reason, fingerprint voting system has been made and the person ID has been replaced with his fingerprint. This fingerprint voting system is implemented and evaluated successfully. The evaluation of the system is made using different PCs with different specifications in order to stand on system strength and weaknesses. The final result of the fingerprint voting system was amazingly significant and computable with other voting system.

The main and the most challenge part in this project is the fingerprint identification process. The system must be able to read human fingerprint in any condition with an accuracy of more than 97% using fingerprint detection.

The project can be used for voting since it overcome all the draw backs of ordinary voting machine also provide additional security. But this machine has some limitation. If we overcome this limitation in future, we can easily use a friendly voting machine.

As a conclusion the project fingerprint based biometric voting machine is considered one of the most important parts of every project. A lot of research method has and technologies have been including in this project.

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