


# Fingerprint Voting System Using Arduino

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## Fingerprint Voting System Using Arduino

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**Abstract:** Fingerprint Voting System was implemented with the Arduino technology. In this System a voter can poll his vote easily. In this database server all voters' information was stored to register in this system, the voter should fill a registration form with the help of a user id and password. This information will be checked by the database server. Because all the information about the voter would be already there is anything wrong, the system will not allow the voter to poll his or her vote. This system is helpful to the voter's decreases the time of voting process also. It is more Secured way. Fingerprint is an important identity of the user. Fingerprint Voting System is user-friendly. It has simple architecture, responses very quickly manner, It reduce the polling time, Easy to carrying to polling center from the polling box, Reduce the staff of voting center, It provide easy and accurate counting without any troubles.

**Key words:** Fingerprint Voting System • Arduino • Sri Lanka Election

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### INTRODUCTION

Elections were a defining feature of democratic government, an electoral system is the set of rules that determines how elections and referendums were conducted and how their results were determined. Political electoral systems were organized by governments, while non-political elections may take place in business, non-profit organizations and informal organizations.

There were so many electoral systems in world. That was paper ballots, punch cards and Optical Mark Sense Ballots.

Some electoral systems elect a single winner to a unique position, such as prime minister, president or governor, while others elect multiple winners, such as members of parliament or boards of directors.

The fingerprint voting system is an electronic voting machine using human biometric system. It's reducing the staff and polling time from paper voting system.

In all the country votes were decided the feature. For that, we were introducing the new method of voting system to increase the standard of living. According to the current system, votes could be counted manually so

that there is more opportunity for occurring error, such as duplicates counting and completely missed counting. Sometimes votes were even manipulated and motivate by political parties which lead to inaccurate vote and it will distort the results of an election in favour of certain candidates. This device can be useful for easy to handle, reliability and accurate. Vote counting is one of the vital activities in the election process. Failure to complete the count could lead to impact on people attitude towards the current government so that the election counting should be transparent, accurate and reliable then only public will feel confidence in the elections each polling station has a list of all voters assigned to the station and only those listed may vote in that Polling station. Electronic Voting Machine is a basic electronic machine that can be used to store the votes. There were two different forms of voting currently existing in the world such as Distance voting and Presence voting. In distance voting voter cast his or her vote from a place other than a polling booth i.e. via mail or internet voting.

Therefore, security, confidentiality, reliability and accurate were the heart of computerized e-voting system where election data is recorded, stored and processed as

digital information in the modern era. There were different levels of e-voting security. Online voting process authentication can be done with fingerprint sensing at the time of voting. As a primary key of the system is in Silence is National identity which will make the system more secure because of that making use of the National identity card number which is unique for each person so that there can't be no duplicates voting. This entire system can be implemented using login which requires the Name of the candidate, National identity card number and the fingerprint scan. Valid voters will have their name, fingerprint and other details in the government database server for each state district wise. This will therefore ensure with the help of unique National identity card number and fingerprint scanner only legitimate users can cast their vote.

**Objective of the Research:** The fingerprint voting project demands the user to submit Fingerprint at the polling booth. The project uses the Fingerprint technology and Arduino Systems to design this application. The main objective of this project is to design a system that asks to user to show his/her Fingerprint as an identity proof. The system reads the data from the Fingerprint and verifies the data which is already stored data in the database. If the given details match with the database data, the system allows the person to cast their vote. If the given Fingerprint data does not match with the stored data, the system immediately activates the display and the security authorities can come and take the further action.

**Background of the Research:** This research was implemented using the Arduino. The system read the data from the Fingerprint module verify the data with the already stored data and take the next action. The system is totally designed using Arduino, Fingerprint module and pushbuttons.

The Arduino is control by program using C/C++ to allow the interface with the Fingerprint Module, the Arduino controller verifies this data with the already existing data in the controller's memory and then implement the commands directed by the controller section.

#### **Advantages of Fingerprint Based Voting System:**

- It provides chance to avoid invalid votes
- It reduces the polling time
- Easy to carrying to polling center from the polling box

- Reduce the staff of voting center
- It provides easy and accurate counting without any troubles
- Provisioning of voting preventive measures

**Problem Definition:** In 21<sup>st</sup> century society where electronic technology is growing at an ever increasing rate, it is difficult to understand why governments were not converting their paper based election systems to electronic form to guaranty "One Person – One Vote and to eliminate fraud and corruption.

An example of how a paper based voting system is with disabilities and vulnerable to corruption can be found in the elections, where the last election was invalidated due to fraudulent paper ballots used to stuff the ballot boxes and elect a president illegally. To repair this damage, it has already cost which could be a recurring cost if the fraud occurred again and it is difficult to bring charges against the people committing the crime due to lack of evidence and an audit trail that could be used as a "Chain of Evidence" by lawyers. Another example is when paper election ballots ran out at an American election and additional ballots were produced using a printer and make-shift process for creating the new ballots on white paper instead of the normal blue ballots. People rushed to obtain the new white ballots and quickly completed them and stuffed them into the ballot boxes in a manner that was not traceable and could have been fraudulently submitted, showing that even first world countries suffer from the use of paper based ballots.

**Introducing New Direction:** To eliminate the problems brought on by the use of paper ballots and integrate safety policies designed to root out fraud and scandal, while guarantying "One Person – One Vote", it is strictly that an electronic voting system be implemented. This system would provide ballot displays on a video screen instead of paper. Help screens would be available to the voter by simply clicking on a button, guaranty that all necessary ballot fields have been entered correctly – thereby eliminating data entry failures or votes being lost due to illegible hand writing or mistakes. But first, you must insure that the voter is who they claim to be and not a name found in the local cemetery or obituary column. Secondly, you must insure that the voter has not voted previously at another site in this election

**Existing System:** According to the constitution of 1978, Sri Lanka first used the past-the-post (PTP) system. That is the place where the candidate who is a wins by

getting the highest number of votes and secondly, is not worthy of anyone. In addition to a number of different districts, there was an action in the most electoral districts.

In the past, the first-past-the-post (FPTP) system of Sri Lanka has resulted in greater influences, the people were so frustrated. Sri Lanka currently utilizes a single ballot to elect its 225 Parliamentarians: 196 seats to 22 multi-member constituencies and 29 national seats. Each voter is allowed to select up to three candidates (without a rank ordering) from within their chosen party as their preferred representatives within their electoral district. Preference counting is the one of the most difficult counting. This system referred to internationally as 'open list' voting is referred to in Sri Lanka as 'preferential voting'. This system has become unpopular, in part due to a public perception that large electoral districts make MPs less accessible to the public and less concerned about local issues. Other concerns regarding election violence and campaign financing too have, often erroneously, become associated with and seen as ills of the current electoral system.

**Propose System:** The proposed system offline version electronic based fingerprint voting system using Arduino. In this system use fingerprint verification and the interface accepts voter's national ID card number, provides an interface to vote and display confirming status or error messages. The fingerprints for authentication because finger prints processing is faster and better than other biometric data and internationally very popular in the immigration system.

In here, there could be a dedicated team for this system in the election departments. Servers were placed at remote location from the boll booths. They were used to carrying out of the processing work such as finger print processing, image processing, transferring data between the client and the database generating reports sending message to voters.

There is a central database contains all the demographic and biometric data of every citizens of Sri Lanka. In order to reduce load on the central database there were sub databases in every district election office that will be located alongside the servers which will contain copies of data of the citizen that under in district All the sub databases retrieve data from central database only these people who come under its scope The data is periodically updated and is stored in volatile form so that it can be erased if and when necessary sab databases will retrieve only the data that is related to the voting process and exclude all their irrelevant in formation.

These databases will be used for generating reports and result of the electoral process. These data base make it possible to allow voting from anywhere provided that the voter is within electoral circuits.

In order to authenticate a person, require them to have a valid National Identity Card No. The number will be checked in local database first it is found then it will search the central database. If person's number is not found in the central database, then person will be devoid of faking part in the voting process on the other hand if the number is present in the central database then the data of that person will be cached to the sub database.

This record is extracted from the local database and sent to au then fixating servers for far their process for verification the person's finger print will be scanned at the client side and matched one to one at the servers with the data infracted from the local database. Figure 1 shows the block diagram of the proposed system.

**Literature Review:** Vishal Vilas Natu [1] proposed the voting system is completely depending on paper work and electronics machine. There is more paper work to save the information of voter and the voter must go to ballot box by carrying voter id for authentication. Once authentication is done by election executive then voter donate their vote by using electronic machine. The machine consists of list of candidate and presents multiple buttons in front of their particular name by pushing the button voter can donate their vote to candidate. To overcome this traditional election system there has to study of digital technology and their security.

Khasawneh, M., *et al.* said in paper-based elections voters cast their votes by simply depositing their ballots in sealed boxes distributed across the electoral circuits around a given country. When the election period ends, all these boxes are opened and votes are counted manually in presence of the certified officials. In this process there can be error in counting of votes or in some cases voters find ways to vote more than once. Sometimes votes are even manipulated to distort the results of an election in favour of certain candidates [2].

Viredra Kumar, *et al.* [3] proposed An Electronic Voting System that will automatically perform authentication, validation and counting with the help of UIDAI. The proposed electronic voting system can be implemented along with the traditional election system. The proposed an approach that will use the information provided by UIDAI in electronic voting system.

David Chaum [4] addressed the concepts of untraceable electronic mail and digital pseudonyms, which can apply for electronic voting for anonymity.

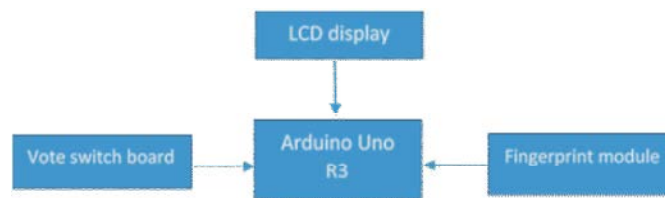


Fig. 1: Block diagram of proposed system

Virendra Kumar Yadav *et al.* [5], an approach that will use the information provided by UIDAI in smart voting system. The proposed system procedure is carried out in mainly few stages: registration, verification and validation. These stages of proposed system are illustrated.

D. Ashok Kumar *et al.* [6] made a comparative Study on Fingerprint Matching Algorithms for EVM. Then fingerprint is match voter can vote to candidate by using EVM. Fingerprint is secure method for EVM.

Jefferson D., *et al.* [7] reviewed and computer of critique and security communication in secure voting system. The web based voting system being built by Accenture. And in security the fingerprint technology are uses.

Qijun Zhao, *et al.* [8] proposed an adaptive pore model for fingerprint pore extraction. Sweat pores have been recently employed for automated fingerprint recognition, in which the pores are usually extracted by using a computationally expensive skeletonization method or a unitary scale isotropic pore model.

R. Moheb *et al.* [9] proposed an approach to image extraction and accurate skin detection from web pages. Their system to extract images from web pages and then detect the skin color regions of these images.

Manvjeet Kaur *et al.* [10] proposed a fingerprint verification system using minutiae extraction technique. Most fingerprint recognition techniques are based on minutiae matching and have been well studied.

Hoi Le and The Duy Bui, [11] proposed online fingerprint identification with a fast and distortion tolerant hashing method. They present a specific contribution by introducing a new robust indexing scheme that is able not only to fasten the fingerprint recognition process but also improve the accuracy of the system.

Mayank Vatsa *et al.* [12] proposed a combining pores and ridges with minutiae for improved fingerprint verification. This paper presents a fast fingerprint verification algorithm using level-2 minutiae and level-3 pore and ridge features. The proposed algorithm uses a two-stage process to register fingerprint images.

Umut Uludaga *et al.* [13] proposed a Biometric template selection and update: a case study in

fingerprints. Sweat pores have been recently employed for automated fingerprint recognition, in which the pores are usually extracted by using a computationally expensive skeletonization method or a unitary scale isotropic pore model.

Andrew Ackerman [14], the smart e-voting system has been done on fingerprints in humans. There are two fundamentally main goal that have risen from voting process first A person's fingerprint will not change the structure naturally after about one year after birth and second the fingerprints of individuals are different. Even the twins in fingerprints are not the same. In practice two humans with the same fingerprint have never been found.

## MATERIALS AND METHODS

The Fingerprint Voting System (FVS). Since the basis of any voting system is "One Person – One Vote", it stand to reason that must verify that a voter is who they claim to be and that they have not previously voted in this election at another site (to eliminate double voting). The main purpose of fingerprint voting system is to 'Preventing Fraudulent Voting'. This system has basically 5 types of modules. There were

- Fingerprint Enrolment
- Fingerprint verification
- Cast the votes
- Alert for wrong voting
- Generate final report

Finger print voting elections mean that people can trust the results because it allows for a process that is so auditable, transparent and secure. It's also helps reduce human error. Finger print voting and electronic counting means that people can get official election results within hours, instead of weeks. Again, this builds trust. Technology will be a useful way of improving voter education and registration, to increase engagement and voter turnout. It is very good at making voting more accessible, meaning it's easier for disable people to vote independently [16, 17].

One of the reasons this Finger print voting system has been complimented so highly is that it's designed around the idea that all parties, citizens and election commissions were able to audit the electoral process at every stage, including before an election has even begun.

Voter can vote the candidate only once, the system will not allow the candidate to vote for the second time. The number of candidate added to the system by the admin will be automatically deleted after the completion of the election. People can't misuse their votes.

This Fingerprint voting machine using Fingerprint is mainly an Arduino system that makes the things easy in the polling booths during the election time. The user, who wants to poll their vote, has to submit the identity proof at the counter at the polling booth. In the research project, the user no needs to carry with their sufficient material and voter card. Voter card is nothing but Fingerprint which stores the details of the person like the name of the user, address, national identity card number, mobile number for contact etc.

When the election time polling booths power unit is turned on, the ballot unit displays its "welcome to voting" message on LCD indicating that the machine is ready and waits for voter input. The mode of operation depends on command given by the user from the push buttons.

**Fingerprint Enrolment:** First time voter saves their fingerprint in enrolment processing. If enrolling mode command is given, the controller waits for input and activates the scanner to accept the fingerprint, displaying "Enrol a fingerprint!" on the LCD display. The candidate's finger print is scanned and convert image in the first time place the finger. Then second time ask to voter to place the same finger and create a unique template and check its match with first scan then two prints were matched store in given id. This unique id is stored in the Fingerprint module memory of the controller for the future reference. After all enrolments the system is ready for vote cast.

**Fingerprint Verification:** Before the vote casting voter has to check for validity to the voting. During this verification time ask to voter "Scan your finger" after the voter's fingerprint scanned, it is compared with the fingerprints already enrolled in the memory. If it is matched, then the message "Cast your vote." will be displayed on LCD. If the fingerprint did not match with already saved memory the LCD display a message "Did not match!" and not allowed to vote casting. If the voter already voted, in verification time the fingerprint matched and display message on LCD "Already voted!" and give red light alert.

**Cast the Votes:** After the verification the voter allowed to voting, in the first button pressed within five buttons which goes to party select, if a voter select a party then cannot select another party. Then pressed three buttons within another five buttons, its goes to which candidate select in that party. If voter press party selection button more than one time and candidate selection button more than three time, produce the alert message on LCD "No Access" and button pressed were not counted.

**Generate Final Report:** After finished vote casting to find who winner and which party is win in the election and counting the voting from report button pressed. For the security problem the system has report generate button inside the box. Its access only by admin. After the election finished all data delete from the machine after getting the back up.

Figure 2 shows the schematic diagram of the fingerprint voting system. It's used to develop the system easy manner.

Figure 3 explained the beginning stage of the fingerprint voting system develop used that schematic diagram.

#### Algorithm of Fingerprint Voting System:

Step 1: Start  
Step 2: Scan your Finger  
Step 3: Finger matched  
Step 4: Found match  
Step 5: Cast your vote  
Step 6: Press button from party list  
Step 7: Party selected  
Step 8: Press three button from candidate list  
Step 9: Candidate selected  
Step 10: Vote Success  
Step 11: Stop

**Arduino Uno:** The Arduino Uno is a microcontroller board (Figure 7) based on the ATmega328. It has 14 digital input/output pins, 6 analog inputs, a 16 MHz crystal oscillator, a usb port, a power slot, 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 AC-to-DC adapter or battery to get started. The Arduino different from all previous boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

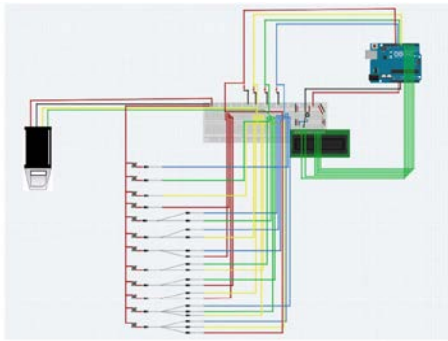


Fig. 2: System Design Schematic diagram

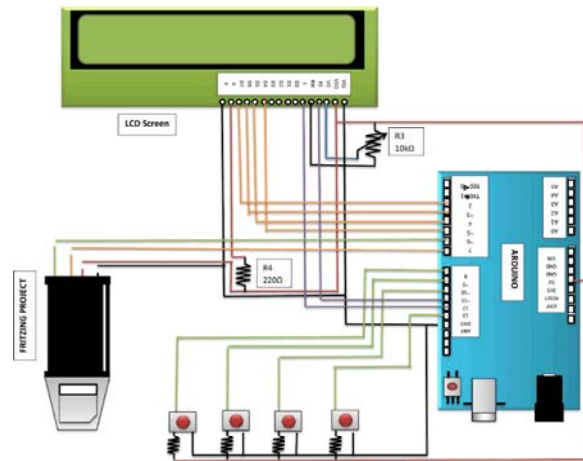


Fig. 5: Circuit diagram

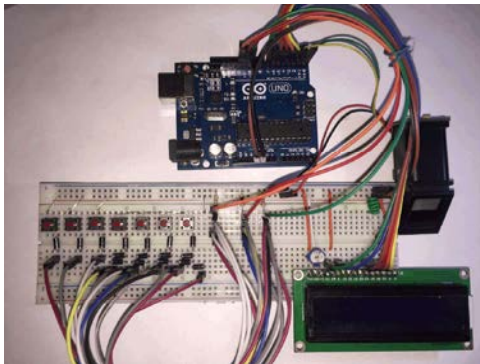


Fig. 3: GUI Design – Beginning step

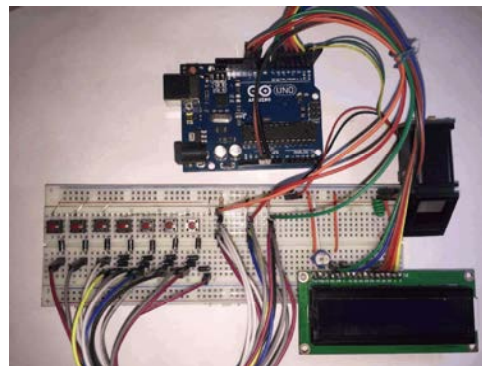


Fig. 6: Complete system – Beginning stage

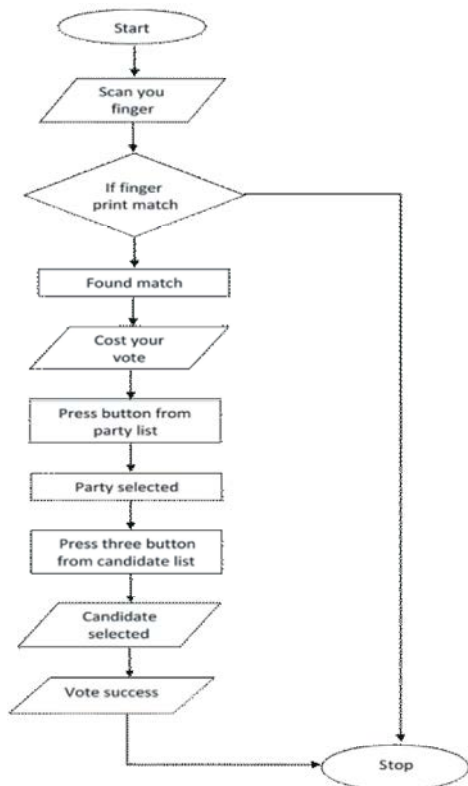


Fig. 4: Flowchart of the Fingerprint Voting System



Fig. 7: Arduino uno R3

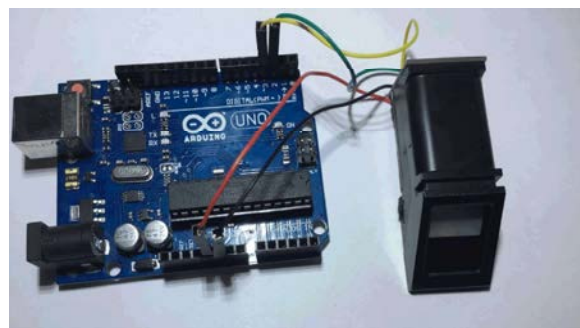


Fig. 8: Fingerprint module



Finger print module is an input device used for Fingerprint processing and captures a digital image of the fingerprint pattern. Fingerprint enrolment 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. The captured image is called a live scan. This live scan is digitally processed to create a biometric which is stored and used for matching. When matching, user enters the finger on 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. Many technologies have been used including optical, capacitive, RF, thermal. This is an overview of some of the more commonly used fingerprint sensor technologies.

**LCD Display:** In the Figure 9 display has an LED backlight and can display two rows with up to 16 characters on each row. You can see the rectangles for each character on the display and the pixels that make up each character. The display is just white on blue and is intended for showing text. LCD screen functions as interface between the user and Arduino, which displays messages that features the user to know when to register and to vote and also whether their vote is valid or not.

It's also displays "welcome" messages initially and "place your finger" message during enrolment, "identifying" message when controller is comparing the data base whether the user is valid were not, if valid displays "please vote" message, if not displays "no access" message and finally displays the result with party name with their respective number of votes.



Fig. 9: LCD display

Table 1: Connection of fingerprint module and Arduino

| Fingerprint Module | Arduino Board |
|--------------------|---------------|
| Green wire         | Digital Pin 2 |
| Yellow wire        | Digital Pin 3 |
| Red wire           | 5V            |
| Black wire         | GND           |

Table 2: LCD Display to Arduino Connection.

| LCD Display | Arduino Board             |
|-------------|---------------------------|
| VSS pin     | GND pin                   |
| VDD pin     | 5v pin                    |
| VO pin      | 10k potentiometer out pin |
| RS pin      | Digital pin 7             |
| RW pin      | GND pin                   |
| Enable pin  | Digital pin 6             |
| D4 pin      | Digital pin 5             |
| D5 pin      | Digital pin 4             |
| D6 pin      | Digital pin 3             |
| D7 pin      | Digital pin 2             |
| Anode pin   | 5v pin with 10k resistor  |
| Kathode pin | GND pin                   |

## RESULT AND DISCUSSION

First enrol the voter's finger and save the fingerprint by given id.

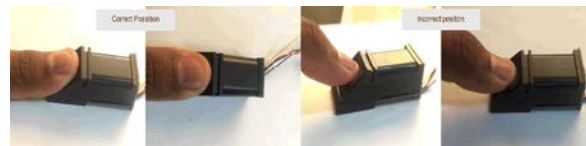


Fig. 10: Place the finger in fingerprint module

Figure 10 shows how to place finger on fingerprint module. The first two images were explained correct position and another two were wrong position of the fingerprint scanning.

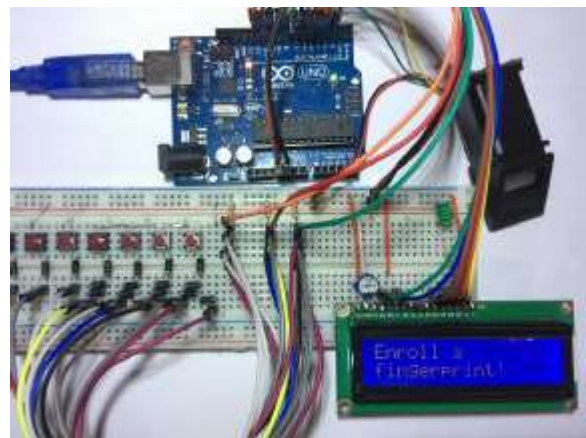


Fig. 11: Fingerprint enrolling



In this time voter ask to user to get an id to save their fingerprint. After given id voter place their finger on fingerprint module to scan, during the enrolling voter place their finger in two times (Figure 11), in first time image take and convert, then second time check the fingerprint with first scan (Figure 12), if fingerprint matched save the fingerprint in given id. Otherwise “Fingerprint did not match” message displayed on LCD.

Then the voter is checked valid or not to vote casting.

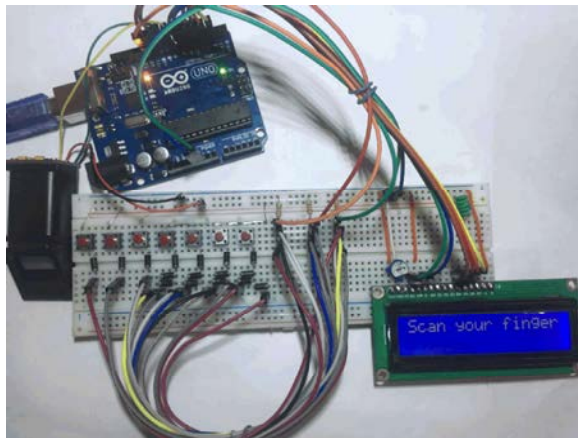


Fig. 12: Fingerprint scan



Fig. 13: Finger not matches

In this step voter scan their finger if fingerprint matched, LCD displayed a message “Did Not Match” (Figure 13), then matched “Found Match”, “Found Id” (Figure 14) messages were displayed on LCD. In this step display the Id of saved fingerprint.



Fig. 14: Result of finger scanning

Then voters cast their votes



Fig. 15: Vote casting ready to select the party

In this step voters select a party to their preference from the party list, (Figure 15, 16) if select a party then cannot change to select another party.



Fig. 16: Vote casting with party selection



Fig. 17: Select three candidates

After select party, voters cast their three preferential votes to the candidates from the selected party (Figure 17).

If press party list button more the one time, it's not allowed to poll vote and cannot select more than 3 candidates from the candidate list.

## CONCLUSIONS

In total, this system overcomes most of the problems faced during the voting period by the paper ballot system. The efficiency of this system depends upon the web interface, its usability. This will surely ensure a safer voting method which is very much what is required for a healthy growth of a developing nation.

In this paper, the proposed Fingerprint based voting system which is better and faster than previous systems. The new system prevents access to illegal voters, provides ease of use, transparency and maintains integrity of the voting process. The system also prevents multiple votes by the same person and checks eligibility of the voter. It also allows a person to vote from anywhere provided that the voter is within electoral limits.

Fingerprint based voting system has provided chance to avoid invalid votes, It reduce the polling time, Easy to carrying to polling center from the polling box, Reduce the staff of voting center, It provide easy and accurate counting without any troubles, Provisioning of voting preventive measures.

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