

Biometric Voting Machine Based on Fingerprint Scanner and Arduino

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Abstract — This paper describes design of Biometric Voting Machine Using Fingerprint Scanner and Arduino for voting in institutes and organizations. Indian constitution empowers its citizen to exercise right to vote. Election decides the future of country, so that the system used for voting should be trustworthy. The conventional system for voting is ballot paper and Electronic voting machine too, has many flaws and trust issues. To eradicate malpractice and defrauding of the above methods of voting, we have designed an advanced system by using arduino and Fingerprint module. In this system, a person has to register a fingerprint ID with the system which will be centrally stored in arduino. In organizations, educational institutes, a co-operative bank, maximum number of votes elect head of organization that holds the office of public interest. For confirmation of voter, the name of the candidate will be displayed on LCD for whom the voter has cast a vote. It has simple hardware design and it is easily accessible. In case user wants to remove any of stored ID then the user need to press DEL key, after pressing DEL key, LED will ask to select ID that is to be deleted. After pressing OK key, the selected ID will be deleted and LCD will display that which ID has been deleted successfully. This system is flexible to use.

Keywords—Arduino, Fingerprint module, ID, Keys, System.

I. INTRODUCTION

This system is divided between the following terms: Electronic voting: Electronic machines are used to facilitate vote without using paper ballots. We used biometric system for voting. Biometric is form of print made by an impression of the ridges of the skin of a finger. The module is a biometric finger print reader module (R305) that interface with arduino directly.

Electronic vote counting: Electronic vote counting is displayed on LCD.

We have implemented a system which is based on fingerprint scanning which would replace a traditional voting system i.e. ballot paper system. Fingerprint sensor is a module which captures fingers print image and then convert it into equivalent format and stores them into its memory on selected location in Arduino. Here all the

processes are controlled by Arduino. Another name for fingerprint scanning is biometric. Biometric points towards the technologies that analyze human body characteristics such as finger print and many more for authentication purpose. Every single person has unique biometric impression.

In organizations, educational institutes, co-operative banks, votes decided the committee and head of organization that is responsible for bright future. So we have implemented a new method of voting system to increase standard of living. Votes could be counted manually in current system so that there is more opportunity of manipulation and fraud such as duplicate counting and completely missed counting. False counting of votes could lead to impact on people mind-set towards the system.

A. Objective of Research

The biometric voting system demands the user to enroll fingerprint while voting [10]. The project uses arduino system and fingerprint technology to design this application the main objective of this project is to design a system that ask to user to show fingerprint as an identity proof the system reads the data from fingerprint and verify the data stored in database [6]. If the given details are match with database stored in arduino the system allows the user to cast vote if the given fingerprint does not stored in database the system will not allow to cast a vote and display security message.

B. Literature survey

To replace traditional system for voting like ballot paper voting system, Electronic Voting Machine was introduced in 1998 in India [4]. Balloting unit and control unit are the two units consist in voting machine used in India. This makes this voting system difficult to transport. This system is introduced by Bharat Electronic Limited (BEL). From 1998 till now many invention has been made in Electronic Voting machine. This system has 15 years life [9]. As per the suggestion of Election Commission manufacturer adopted third-generation design having addition changes. Now a days voting machine are electronics which stores

votes electronically instead of ballot paper [2]. “Table I” shows different voting processes used in India.

TABLE I. DIFFERENT TYPES OF VOTING SYSTEM

Sr.no.	Type of voting	Hardware	Limitations
1	Ballot paper voting	Paper and ballot box is used for this type of voting.	Collection of all paper and declaration of result is delayed
2	VVPAT	Ballot unit.	Complex circuitry
3.	Electronic Voting Machine	Control unit and ballot unit.	Assembly of all system is complex
4	Remote Internet Voting	Internet connection, Website, Software.	Without internet connection system will not work
5	Biometric Voting Machine By using Fingerprint Module	Arduino and Fingerprint Module	Suitable only for small scale purpose.

- **Ballot paper voting:** In this type of voting system piece of paper is used to cast vote. A ballot is simple paper on which each voter writes the name of a candidate to cast a vote. For this type of voting the ballot paper and ballot box is used.
- **VVPAT:** The full form of VVPAT is ‘Voter Verifiable Paper Audit Trail’. VVPAT is intended as an independent verification system for voting machines designed to allow voters to verify that their vote is cast correctly or not. This system is also used in collaboration with electronic voting machine in 2019 elections in India.
- **Electronic voting machine:** Electronic Voting is the standard means of conducting elections using Electronic Voting Machines. The Electronic Voting Machines is introduced in Indian elections between 1998 and 2001. Before introducing Electronic voting machine, the ballot paper system was use for elections in India. The paper ballots method was widely criticized because of fraudulent voting so the Electronic voting machine is introduced.
- **Remote Internet voting:** In this system using internet user can vote from anywhere were he can by accessing the internet. It helps to increases percentage of voting by maximizing access and convenience of voter by using internet facility. [5]

II. WORKING PRINCIPLE

Fingerprint based biometric voting machine is divided in to two parts, in first part user needs to register and in second part user will vote for desired candidate [1]. Block diagram is shown in “Fig.1”. Enrollment in system is needed for every voter or user with the help of push button or key. For this process user needs to press ENROLL key and then LCD will ask for entering location id where finger will be store in arduino on specific memory location. UP/DOWN keys are needed to enter ID. For selection of ID OK key is provided. Fingerprint module will ask for the finger to be place over module. For proper identification LCD will ask to remove fingerprint from fingerprint module and again ask for placing the finger. Simultaneously with this process fingerprint module takes an image and convert it into proper

format and store it by selected ID into the fingerprint module’s memory. Now voter is register with the system and he/she can cast the vote to his candidate. Similarly all users will have to register.

We can remove any of stored ID by pressing DEL key to the selected ID. The selected ID will be deleted and LCD will display ID number which has been deleted successfully [2]. All this details are for single system, data of one system will be stored in that system itself there is not any mutual connection between two systems. All the systems are isolated from each other to avoid being hacked.

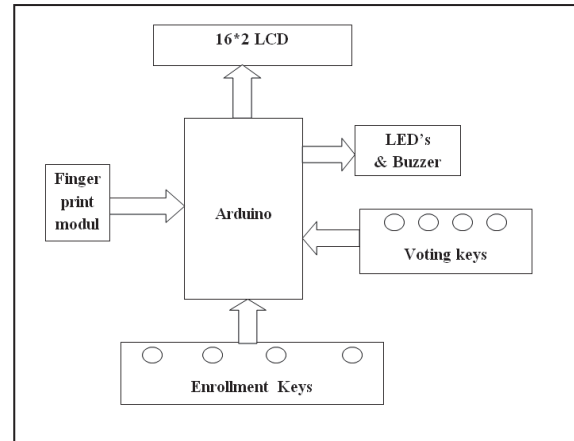


Fig.1.Block Diagram

A. Voting Process

Voting process is divided into some simple steps. When user wants to vote then he or she needs to press match key and then buzzer will beep and at the same time LED will glow and LCD will ask for place finger over fingerprint module. That time user id will be store in Arduino. Now user can cast the vote, for that user again have to place finger over fingerprint module meanwhile module capture finger image find its id which is present in the system. If finger id detected then LCD will display authorized voter. It means the user is authorized voter and process will move to next step for voting. Now voter can vote their candidate by pressing selected key. If same voter try to vote again system will display ‘Already Voted’ on LED, simultaneously buzzer will beep for a 5 seconds, means same voter can’t vote again. If any non-registered users try to attempt voting then ‘No Fingerprint Found’ message will be displayed on LCD. For the results a separate push button is given [4].

III. HARDWARE DISCRIPTION

A. Requirement:

This system is based on concept of biometric identification of users which required following components which are shown in”Fig.2.”.

1. Fingerprint sensor R305 - For biometric identification
2. Arduino Uno - To store data
3. 16*2 LCD - For displaying results
4. Buzzer - For vote conformation
5. LED - For voter conformation
6. Connecting wires - For connections
7. Resistors - For controlling amount of current

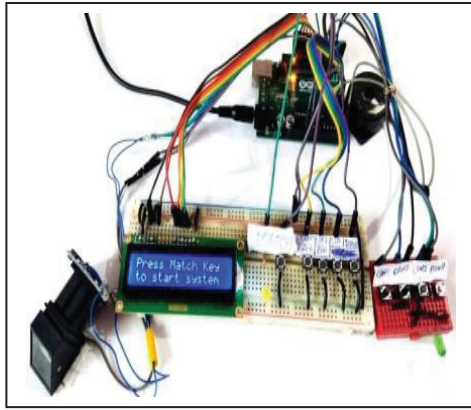


Fig.2. Circuit connections

B. Arduino

Arduino is microcontroller board build on ATMEGA328. There are combination of 14 digital i/o pins, and 6 analog inputs. Arduino has 16 MHZ crystal oscillator, USB port, power slot and reset button. To interface fingerprint module with Arduino we have used Adafruit Fingerprint Sensor Library in Arduino IDE which is platform to code Arduino. Analog pins of Arduino are connected to push buttons. Pin A0, A1, A2, A3 and A4 are connected to ENROLL, DEL, UP, DOWN, MATCH respectively. While digital pins D5, D4, D3 and D2 are interfaced with candidate 1 as CAN1, candidate 2 as CAN2, candidate 3 as CAN3 and RESULT respectively [11]. Voting keys are shown in “Fig.3”.

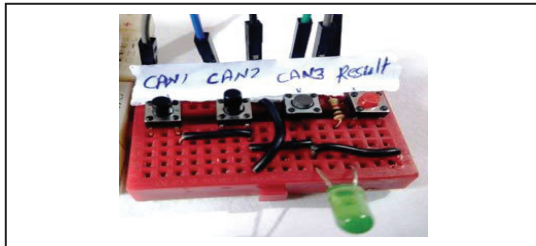


Fig.3. Voting Keys

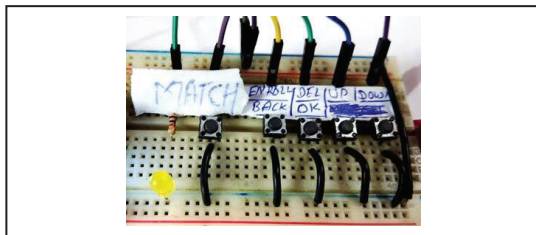


Fig.4. Enrollment keys

C. Fingerprint Module

Security with biometric can be done with the help of Fingerprint module. “Fig.5.” shows Fingerprint module R305. The fingerprint sensor module will make adding fingerprint detection and verification very simple [7]. There’s a high powered DSP chip that does the feature-finding and searching. Connect to any microcontroller or system with TTL serial, and send packets of data to detect fingerprint. We can enroll new fingerprints with the help of

enrollment keys as shown in “Fig.4”. This system has limit up to 99 fingerprints [8].



Fig.5. Fingerprint scanner

TABLE II. LCD DISPLAY TO ARDUINO CONNECTIONS

LCD DISPLAY	ARDUINO BOARD
VSS	GND
VDD	5V PIN
RS PIN	DIGITAL PIN 13
ENABLE PIN	DIGITAL PIN 12
D4	DIGITAL PIN 11
D5	DIGITAL PIN 10
D6	DIGITAL PIN 09
D7	DIGITAL PIN 08
ANODE PIN	5V PIN
CATHODE PIN	GND

In “Table II”. we have shown connections of LCD display and Arduino board. VSS and Cathode pins of LCD are connected to GND pin of arduino and VDD and Anode pins are connected to 5V pin of arduino to power the LCD to glow. Enable pin of LCD display is given to the Digital pin of arduino.

TABLE III. FINGERPRINT MODULE TO ARDUINO CONNECTIONS

FINGERPRINT MODULE	ARDUINO BOARD
VCC	5V PIN
GND	GND
TX	RXD
RX	TXD

In “Table III”, we have shown connections of Fingerprint module to arduinon board. For transferring data between Fingerprint module and arduino board transmission pin TX of Fingerprint module is connected to Receiver pin RXD of arduino board, and receiver pin RX of Fingerprint module is connected to transmission pin TXD of arduino board. To provide powersupply to Fingerprint module through arduino GND pin of module is connected to GND pin of arduino, and VCC pin of module is connected to 5V pin of arduino.

D. Algorithm:

The voting process is shown in 9 steps. First three steps are for enrollment process. Step 4 to step 6 shows the voting process and step 7, 8, 9 indicates the vote has been casted [5].

- Step 1: Start.
- Step 2: Press match key to enroll your Finger ID.
- Step 3: Place Finger on Fingerprint module.
- Step 4: Finger match, authorized voter.
- Step 5: Cast your vote.
- Step 6: Press key to cast a vote.
- Step 7: Candidate Selected.
- Step 8: Vote success.
- Step 9: Stop.

E. Programming

The given function is used to taking finger print image and converts them into the template and save it by selected ID into the finger print module memory [12].

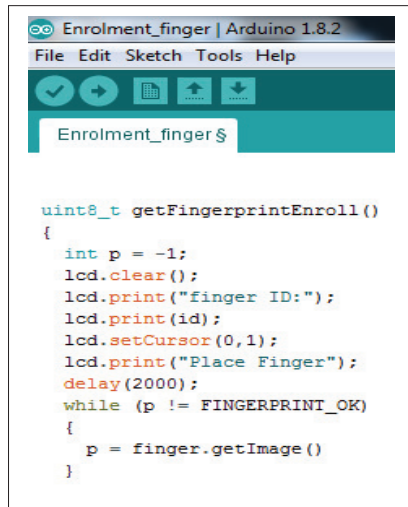


Fig.6. Screenshot of Program for Enrolment of finger

Here the function is used for entering ID to be deleted and calling `uint8_t deleteFingerPrint(uint8_t id)` function that will delete finger from records.

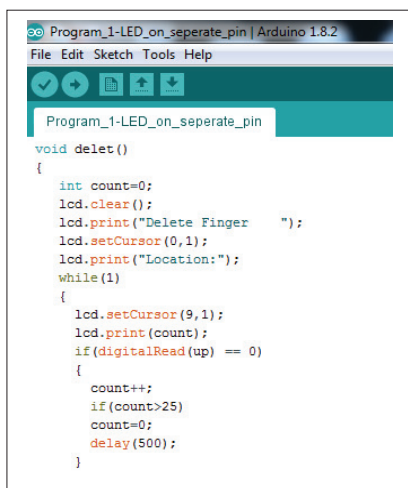


Fig.7. Screenshot of Program for delete entry of finger

IV. ADVANTAGES AND DISADVANTAGES

A. Advantages:

1. System is easy to operate.
2. Arduino is the main controlling system, which operates on +5V DC supply, so less amount of power is required.
3. Economical feasible.
4. Requirement of man power is less
5. Ease of transportation due to its size.
6. Only authenticated user can vote.

B. Disadvantages:

1. Fingerprint module's sensitivity may cause error.
2. User has to enroll before voting.
3. Only 99 candidate can enroll and vote because limitations of arduino.

4. Suitable only for small scale purpose.

V. RESULT AND CONCLUSION

The hardware setup successfully implements the EVM with the help of Fingerprint sensor and Arduino. Result of voting count will be displayed on LCD. Operation shows innovative and secure process of voting. We have designed Biometric voting machine for small scale purpose like institutes and organization. This concludes that fingerprint is useful for voting.

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