IMPLEMENTETION OF FINGERPRINT VOTING MACHINE USING ARDUINO

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ABSTRACT

The Fingerprint Voting System, implemented using Arduino technology, facilitates easy voting for voters. To register, Voters fill out a form containing User identification and password, which the cloud server cross-references with stored voter data for verification. If discrepancies arise, the system denies voting privileges. This approach streamlines the voting process, enhances security, and ensures efficiency. Fingerprint identification provides an additional level of authentication, making the system user-friendly and robust. Its simple architecture enables rapid responses and minimizes polling time. The system also reduces polling center staffing requirements and provides accurate and hasslefree counting, ultimately displaying the results seamlessly.

Keyword : Fingerprint Voting, Arduino Technology, Biometric Authentication, Error handling, Real-time processing, User Interface design, Security measures, Arduino IDE.

¹.1 INTRODUCTION

Voting is an essential right bestowed upon every citizen to choose their leaders. India, being a democratic nation, guarantees this fundamental right to its citizens, allowing them to express their preferences through voting. Elections not only determine government leaders but also leaders in Multiple entities such as schools, colleges, banks, and organizations utilize biometrics as a means of identifying individuals based on physical traits like fingerprints, iris patterns, facial features, and voice. Biometrics primarily functions through two main processes: one-to-one matching, where a biometric sample Evaluated against a single stored sample, and one-to-many matching, where the sample Examined alongside with multiple stored samples.

In one-to-one matching, the biometric sample is compared with a pre-stored sample for verification. Biometric methods offer quicker security checks and more convenient user verification compared to traditional password-based security. Fingerprint recognition, A distinct identifier assigned to each person acts as a dependable method for authentication, verification, and authentication. In this project, fingerprint biometrics are utilized, with each individual possessing a distinct fingerprintpattern.

In this project, fingerprint authentication is employed to enable users to place their votes using theirfingerprint images. Fingerprint matching can be Divided into categories into three types: correlation- based matching, minutiaebased matching, and pattern- based (or image-based) matching. In correlation-based matching, Superimposing two fingerprint images allows for the assessment of the correlation among their respective pixels. across various alignments. In minutiae-based matching, the minutiae The information from the two fingerprints is extracted and then saved as data. a set in a two-dimensional plane.

In this matching method, the goal is to identify The positioning of the template in relation to the input minutiae sets is adjusted to achieve the highest number of pairings between minutiae. IN pattern- based (or image-based) matching, the comparison occurs between the stored Template and its respective candidate's fingerprint, requiring both images to be aligned in that exact orientation. This alignment is achieved by the algorithm identifying a central point within the image depicting the fingerprint and centering it accordingly. In a pattern-based algorithm, the Information pertaining to the is embedded within the template type, size, and orientation of patterns within the aligned fingerprint image. With the digitalization of data in almost all sectors, efforts towards creating a digital India have Contributed to the majority of tasks being conducted online.Online Voting permits voters to cast their votes from any location within the world

Thing Speak is a platform that facilitates online voting, enhancing the speed of the voting process. In traditional voting methods, individuals marked their choice with a stamp on a paper ballot, which was then deposited into a ballot box. To determine the outcome, the number of votes for each candidate in every ballot box must be tallied, and then the totalsfor each candidate are summed. The candidate with the highest number of votes is selected as the winner.

1.2 LITERATURE SURVEY

Vishal Vilas Natu et. al explains that [1] The voting system relies heavily on both paper-based documentation and electronic machines. Significant paperwork is required to store voter information, and voters are typically required to interact with both paper-based and electronic systems during the voting process. go to ballot box by carrying voter id for authentication. Once authentication is done by election executive then voter donate their vote by using An electronic voting machine is utilized, featuring a list of candidates with corresponding buttons in front of their names. Voters can cast their votes by pressing the button next to their chosen candidate's name. This electronic system aims to modernize and streamline the traditional election process. system there has to study of digital technology and their security.

Khasawneh, M. et. al explains that **[2]** paper-based elections Voters cast their votes by simply placingtheir ballots into sealed boxes positioned across the electoral circuits within a designated area and country. When the election period ends, all theseboxes are opened and votes are counted manually in presence of Certified officials oversee the process,but errors can occur. 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. Viredra Kumar, et. al explains that **[3]** An An Electronic Voting System is designed to automate The authentication, validation, and vote counting processes will rely on UIDAI (Unique Identification Authority of India) for assistance and verification. of India) for assistance. The proposed electronic voting system can be implemented along with the traditional election system. The proposed an approach that The system will utilize the information provided by UIDAI for authentication, validation, and othernecessary processes within the Electronic Voting System provided by UIDAI in electronic voting system

R. Moheb, et. al explains that [4] The process entails extracting images from web pages and then accurately identifying skin color regions within these images.

Manvjeet Kaur et. al explains that [5] A fingerprint verification system is developed using the minutiae extraction technique, which is widely employed in fingerprint recognition. This approach relies on minutiae matching, a extensively researched method in the field.

Hoi Le and The Duy Bui, et. al [6] Online fingerprint identification is achieved with a fast and distortion- tolerant method. This approach introduces a tolerant hashing method and presents a specific contribution by introducing a new robust indexing scheme. This scheme not only accelerates fingerprint recognition but also enhances its robustness and improves theaccuracy of the system.

1.3 METHODOLOGY

In this system, we utilize fingerprints as the biometric method of verification in its offline version. The voter's fingerprint and fingerprint ID are enrolled and stored in an Arduino device. During the voting process, the system prompts the user to input their fingerprint ID. If the provided ID matches the stored fingerprint ID, the system verifies whether the fingerprint matches as well. If the fingerprint matches, the system checks whether the individual has already voted in the same election. If the person has not voted previously, a "Fingerprint and fingerprint ID match" message is displayed, granting access to vote. After voting, the vote register is incremented. However, if the person has already voted, an "already voted" message is displayed along with a buzzer sound.



Fig-1. Block diagram of fingerprint based votingmachine using Arduino

In this block diagram voting keys, controlling keysand fingerprint module are input devices and 16×2 LCD, buzzer and LED are output devices for Arduino. In this system Arduino plays a main role by controlling all functions. The Fingerprint Sensor Module is a device designed to capture fingerprintimages and convert them into digital equivalents. It then creates a template from these images and saves them into its memory, associating them with selected IDs managed by the Arduino.

A program for Arduino can indeed be written in any programming language that is compatible with a compiler capable of generating executable code for the Arduino platform. binary machine code for the target processor. Atmel provides a new development environment to their microcontrollers, which includes AVR Studio and the newer Atmel Studio. The The Arduino project furnishes the Arduino integrated development environment (IDE), which is a cross-platform application built using Java. It originated from the IDE initially designed for the Processing and Wiring

1.3.1 BLOCK DIAGRAM

languages.

The IDE encompasses a code editor with functionalities such as text manipulation (cutting, pasting), Text searching and replacing, automatic indentation, matching braces, and highlighting syntax are fundamental features offered by numerous text editors and integrated development environments (IDEs). environments (IDEs) to enhance code readability and assist in programming tasks. Moreover, it offers straightforward, one-click procedures to compile and upload programs to anArduino board.

The Arduino IDE simplifies the use of C and C++ languages by employing specific rules for organizing code. Typically, user-authored code requires only two main functions: one for initializing the sketch and another for the main program loop. These functions are then compiled and linked with a program stub main() togenerate an executable cyclic executive program. This process utilizes the GNU toolchain, which comes bundled with the IDE distribution. In this system, there are two distinct processes: the nollment process and the voting process



Fig-2. Flow chart for Enrolling Process

To begin the enrollment process, the user must press the ENROLL button using push buttons/keys. Following this, the LCD prompts the user to input a location/ID where the finger will be stored. The user navigates through the available locations/IDs using the UP/DOWN keys and confirms their selection by pressing the OK (DEL) key.

Subsequently, the LCD instructs the user to placetheir finger over the fingerprint module. The usercomplies, and the system prompts them to remove their finger before requesting them to place it overthe module again. This sequence allows the fingerprint module to capture an image and generate templates, which are then stored in the module's memory under the selected ID.

Once this process is completed, the voter becomes successfully registered and eligible to vote. This procedure is repeated for each voter to be registered within the system.

1:3:2 BLOCK DIAGRAM

- The circuit for the Fingerprint Based The Voting Machine Project is simple and consists of the following components:
 - 1 Arduino: Controls the entire project process.
 - 2 Push buttons: Used for enrolling, deleting, selecting IDs, and voting.
 - 3 Buzzer: Provides alerts to users.
 - 4 LEDs: Provide visual indications.
 - 5 16x2 LCD: Instructs voters and displaysresults.

The circuit connections are as follows:

- 6 Push buttons: Connection to Arduino pins A0 (ENROL),A1(DEL),A2(UP),A3 (DOWN), A4 (Match), D5 (Can1), D4(Can2), D3 (Can3), D2 (Result), and ground.
- 7 Yellow LED: Connected to Arduino digital pin D7 via a 1k resistor and ground, indicating readiness for fingerprint image capture.
- 8 Green LED: Connection to Arduino digital pin D6 via the same method, indicating system readiness for voting or result viewing.
- 9 Fingerprint module: RX and TX directly connected to Arduino's TX and RX pins.
- 10 Power supply: Fingerprint module is powered by 5V from the Arduino board.
- 11 Buzzer: Connection to Arduino pins A5.16x2 LCD: Configured in 4-bit mode, with RS, EN, D4, pins connected to the respective Arduino connection pointsD13, D12, D11, D10, D9, and D8, Respectively.





Fig-3. CIRCUITCONNECTION

1 FINGERPRINT SENSOR:



Fig-5. FINGER PRINT SENSING

In the Fingerprint Voting Machine Circuit, the FingerPrint Sensor Module is utilized to authenticategenuine voters by capturing their fingerprint input. The system employs 5 push buttons with specificfunctionalities:

 \square \square \square Match: Used for voter authentication before casting a vote.

□□□ Enroll/back: Functions as both an enrollment trigger for new fingerprints and aback function to return to the previous stepif needed.

Delete/OK: Also serves a dual purpose, acting as a deletion command and an OK function to confirm selections.

 \square \square \square UP and Down: Used for navigating through options, such as selecting the ID or location for storing fingerprint data.

When enrolling a new fingerprint, the user initiates the process by pressing the Enroll key. The LCDprompts the user to input an ID or location for storingthe fingerprint output. If the user decides not to proceed, pressing the Enroll key again acts as a back function, allowing them to return to the previous step.

Similarly, the DEL/OK key offers two functionalities. After selecting the ID or location using the UP and Down keys, pressing DEL/OK confirms the choice (OK function) to proceed with the enrollment process.

The Match key is utilized when a voter intends to cast their vote. Before voting, the voter must authenticate themselves by placing their finger on the Finger Print Sensor. If the authentication is successful, the voter is permitted to proceed with voting

1.3.2 VOTING PROCESS

The Fingerprint Based Voting Machine Project circuit is uncomplicated, comprising the following components: The circuit connections are as follows:

- [1] Push buttons: Directly linked toArduino pins A0 (ENROL), A1(DEL), A2 (UP), A3 (DOWN), and A4 (Match), as well as D5 (Can1),D4 (Can2), D3 (Can3), D2 (Result),connected to ground.
- [2] Yellow LED: Connected to Arduino digital pin D7, grounded via a 1k resistor, indicates readiness for fingerprint image capture.
- [3] Green LED: Connected similarly toD6 of Arduino, signifies system readiness for voting or result viewing.
- [4] Fingerprint module: RX and TX directly interfaced with Arduino'sTX and RX pins.
- [5] Power supply: Fingerprint module powered by 5V from the Arduino board. [6] Buzzer: Connected to Arduino pin A5.

16x2 LCD: Configured in 4-bitmode, RS, EN, D4, D5, D6, andD7 pins linked to Arduino pointsd13, d12, d11, d10, d9, and d8, respectively.



Fig-6 FINGER PRINT SENSOR

Project outcome and equipment used the Arduino Uno is an 8-bit microcontroller equipped with a USB programming interface and various input-output pins. It operates using the Integrated Development Environment (IDE) of the Arduino UNO. The Uno board integrates two microprocessors: the Atmega328 and the Atmega16U2. While Arduino Uno does not support driving analog outputs, it accepts analog inputs. Key features of the Arduino interface include:

- 14 digital input/output pins, with 6 capable of PWM output 6 analog inputs.
- A 16 MHz quartz crystal for clocking.
- A USB connection for programming and communication.
- A power jack for power supply
- An ICSP header for in-circuit serialprogramming.
- A reset button for reinitializing themicrocontroller.

Arduino Uno simplifies microcontroller programming and experimentation. It provides a user-friendly environment for hardware tinkering, with the ability to connect to a computer via USB or operate using external power sources. The Uno's versatility allows users to explore various projects with ease. The Arduino platform originated from the Wiring platform, featuring a hardware PCB with an Atmega128 microcontroller, an IDE based on Processing, and library functions for simplified microcontroller programming

1:3:3 RESULT AND DISCUSSION:

The proposed system is implemented. This system primarily consists of two units: one for verification and the other for voting and stored in an Arduino.



Fig-8.ENTER FINGER ID



Fig-9. PLACE FINGER

During the voting process, the first system requests the fingerprint ID. If the provided ID matches the stored fingerprint ID, the system verifies whether the fingerprint matches. If the fingerprint matches, the system then checks whether the person has voted before in the same election.



Fig-9. REMOVE FINGER

If he has not voted then "Fingerprint and fingerprint ID matches, Cast vote" message be displayed. After voting, the register will be incremented. If that person has voted before, then "already voted" message is displayed along with a buzzer sound. Fingerprint based voting machine project is completed successfully.



Fig-10. PLACE FINGER AGAIN



Fig-11. STORED.

The below figures are real time LCD outputsin enrolling process



1.4 Press match key to start system.



1.6 Authorisedvoter please wait



1.7 Please place your vote



1.8 Vote submitted

The below figures are real time LCDoutputs in voting process



a) Enter Fingerprint ID



b) Please wait



c) Finger deleted successfully

If we want to delete fingerprint ID. Afterpress the delete key and select fingerprint ID. And press delete key then fingerprint ID is deleted. And "finger deleted successfully" displayed in LCD.

1.9 CONCLUSION

The primary objective of the "Fingerprint Based Voting Machine" project was to develop an advancedballot paper and Voting Machine (EVM) based on fingerprint technology, facilitating free and fair elections, a cornerstone of democracy in countries like India.

The proposed fingerprint-based voting system represents a notable advancement over previous methods, offering enhanced speed and reliability. It prevents unauthorized access, ensures ease of use, transparency, and upholds

Ensuring the integrity of the voting process is paramount. Additionally, thesystem prevents duplicate voting, verifies votereligibility, and allows the user voting from any location within electoral boundaries.

Key beneficial to the Fingerprint-based voting systeminclude the elimination of invalid votes, reduced polling duration, portability to polling centers, decreased staffing requirements, streamlined and accurate vote counting, and allows the preventive voting measures.

FEATURE SCOPE:

- In this project we can implement eyriesfuture.
- In this project we can set a time and date of every vote.
- This can be modified by interfacing Aadhar server into this prototype to provide additional security.

1.10 **REFERENCES**

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