

# Literature Review on Fingerprint based Electronic Voting System

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**Abstract:** A key component of democratic systems is voting, which enables people to voice their opinions and take part in decision-making. However, voter impersonation, repeated voting, ballot tampering, and human mistake while counting are some of the major issues that traditional paper-based voting techniques confront and can jeopardize the integrity of elections. Electronic voting machines, or EVMs, have been introduced to mitigate some of these problems, but they are still susceptible if robust voter verification procedures are not put in place. This project suggests a fingerprint-based biometric smart voting system that uses Arduino to overcome these issues. The method makes sure that every voter is individually identifiable by including fingerprint authentication, which lowers the possibility of fraud and avoids repeated votes.

Upon successful verification, voters are able to choose their preferred candidate by utilizing push buttons, with the vote being securely recorded in the Arduino's memory or on an SD card. Immediate feedback is delivered through an LCD display, LEDs, and a buzzer, which enhances transparency and in user confidence. The system is crafted to be cost-effective, scalable, and appropriate for small-scale elections within institutions such as schools, colleges, and local organizations. Furthermore, it can be expanded for larger applications, incorporating features such as Wi-Fi connectivity, online result transmission, and integration with physical ballot boxes.

In summary, the project illustrates a practical, user-friendly, and dependable method for modernizing the voting process, ensuring secure and accurate elections, reducing errors, and fostering voter trust in the electoral system.

**Keywords:** Biometric Voting, Fingerprint Sensor, Arduino, Electronic Voting, Election Security, Vote Authentication, LCD Display

## I. INTRODUCTION

Voting serves as a fundamental element of democracy, enabling citizens to articulate their preferences and engage in decision-making processes. Nevertheless, traditional paper-based voting systems encounter numerous challenges, including voter impersonation, multiple voting, ballot tampering, and counting errors. These problems can undermine the fairness and transparency of elections.

To address some of these issues, many countries have introduced Electronic Voting Machines (EVMs), although even EVMs may have limitations if adequate voter verification is not established. To further bolster election security and streamline the voting process, biometric authentication can be incorporated into voting systems. Fingerprint recognition stands out as one of the most dependable biometric techniques, as each person possesses a unique fingerprint pattern that is challenging to replicate or forge.

This project proposes the development of a Fingerprint-Based Biometric Smart Electronic Voting Machine utilizing Arduino technology, which merges the benefits of biometric verification with the ease and adaptability of Arduino-based electronics. The system operates by first authenticating voters through a fingerprint sensor. Once verified, the voter is able to select a candidate using push buttons, and the vote is securely recorded in the system's memory or on an SD card. The process offers immediate visual and auditory feedback through an LCD display, LEDs, and a buzzer, thereby ensuring



transparency and instilling user confidence. The system is designed to be scalable, cost-effective, and appropriate for small-scale elections in settings such as schools, colleges, or local organizations. With further enhancements like Wi-Fi connectivity, online result transmission, or integration with physical ballot boxes, it can be adapted for larger applications.

## II. LITERATURE SURVEY

Mishra et al. [1] proposed a Secure and Reliable Biometric Voting System using FPGA, which utilizes hardware-level implementation to achieve high processing speed and tamper resistance. Their approach enhances security by directly embedding voter authentication into FPGA circuits, making the system resistant to software manipulation and external attacks.

Sharma et al. [2] developed a Fingerprint-Based Biometric Voting Machine using Arduino, where the system authenticates voters using stored fingerprints and records votes electronically. The design emphasizes low cost and simplicity, making it suitable for small-scale elections and educational purposes while still ensuring voter identity verification.

Patil et al. [3] presented an Electronic Voting Machine using Fingerprint, where voter identity is verified through fingerprint scanning to ensure fair voting. This system reduces the possibility of duplicate voting and increases trust by maintaining secure and accurate vote counts through microcontroller-based processing.

Khan et al. [4] designed a Fingerprint-based Smart Electronic Voting Machine using IoT, integrating Arduino with the R307 fingerprint sensor and IoT connectivity to store and monitor voting data online. This architecture not only authenticates voters but also provides remote monitoring of election results, making it useful for large-scale and transparent voting systems.

Rao et al. [5] implemented a Real-Time Biometrics-Based Smart EVM with FPGA, providing fast fingerprint authentication through Verilog-based FPGA design. Their system highlights the advantage of FPGA in parallel processing, offering high efficiency, reliability, and reduced latency in real-time voter verification.

Verma et al. [6] proposed a Biometric-Enhanced Voting Machine that combines fingerprint and face recognition for voter authentication. Their system integrates dual biometric modalities to ensure higher accuracy and minimize impersonation risks compared to single-biometric approaches. The fingerprint module provides quick verification, while face recognition serves as an additional security layer, making the voting process more robust and reliable.

| Sr. No. | Author(s)     | Year | Research Paper Name                                                          | Research Method                          | Research Gap                                                    |
|---------|---------------|------|------------------------------------------------------------------------------|------------------------------------------|-----------------------------------------------------------------|
| 1       | Mishra et al. | 2023 | Secure and Reliable Biometric Voting System using FPGA                       | Hardware-level FPGA implementation       | High cost and complex design, less suitable for small elections |
| 2       | Sharma et al. | 2023 | Fingerprint-Based Biometric Voting Machine using Arduino                     | Fingerprint authentication with Arduino  | Limited feedback to voters, not scalable                        |
| 3       | Patil et al.  | 2023 | Electronic Voting Machine using Fingerprint                                  | Microcontroller-based fingerprint voting | Lacks external storage and result security                      |
| 4       | Khan et al.   | 2024 | Fingerprint-based Smart Electronic Voting Machine using IoT                  | Arduino + IoT + R307 sensor              | Internet dependency, higher cost, complex setup                 |
| 5       | Rao et al.    | 2023 | Real-Time Biometrics-Based Smart EVM with FPGA                               | Verilog-based FPGA fingerprint system    | Requires expertise, not user-friendly for small institutions    |
| 6       | Verma et al.  | 2024 | Biometric-Enhanced Voting Machine combining Fingerprint and Face Recognition | Dual biometric modalities                | Costly hardware, complex integration                            |



### III. PROPOSED METHODOLOGY

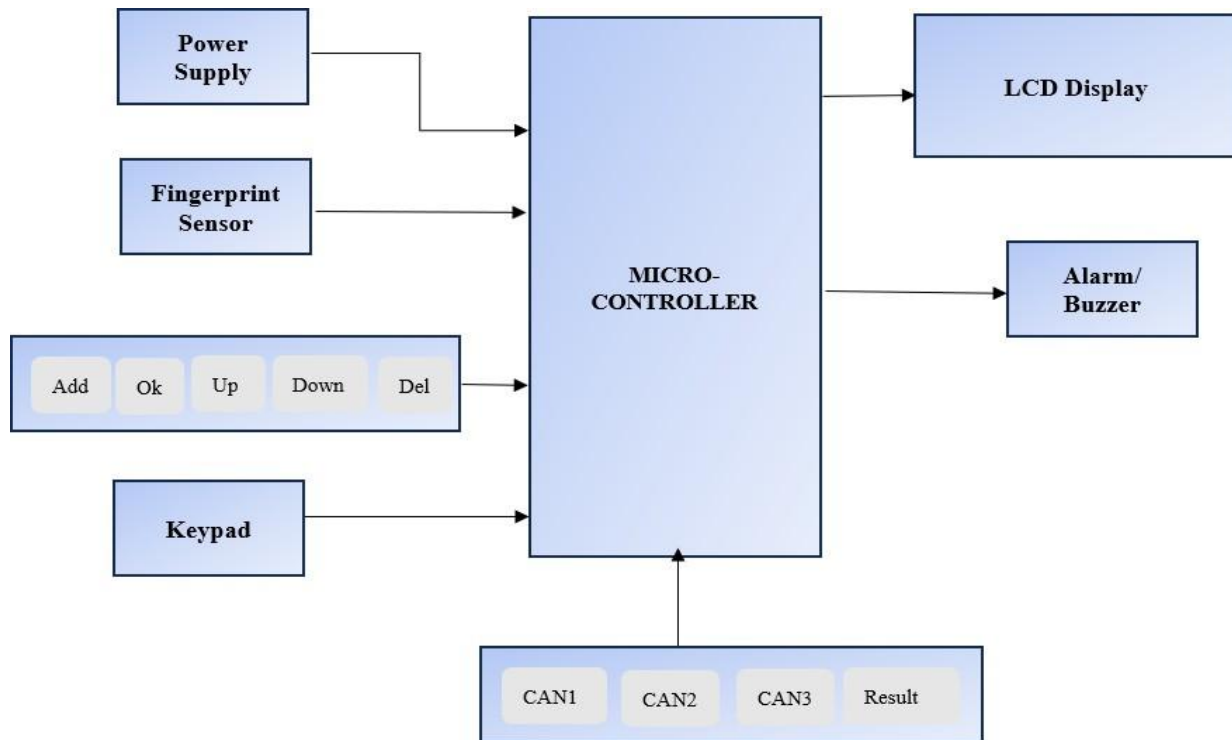


Fig . Block Diagram of Fingerprint Based Electronic Voting System

1. Voter Fingerprint Acquisition: Utilizes a fingerprint sensor to capture the fingerprint of the voter as the main input method.
2. Preprocessing: Transforms the raw fingerprint scan into a digital template, eliminating noise and preparing it for comparison.
3. Fingerprint Matching/Authentication: Evaluates the scanned fingerprint against pre-existing templates in the database to confirm the voter's identity.
4. Voting Interface: After authentication, voters choose their desired candidate through push buttons or a touch interface.
5. Vote Recording Module: Securely logs the chosen vote in the memory of the Arduino or an external database.
6. Feedback and Confirmation: Offers immediate feedback through LEDs, a buzzer, and an LCD screen to verify a successful vote.
7. Security Layer: Guarantees that each voter is allowed to vote only once and blocks unauthorized access.
8. Result Calculation and Display: Tallies the votes and presents the results either on the LCD or through a connected system.

### IV. CONCLUSION

The suggested biometric voting system, which utilizes fingerprint recognition, effectively overcomes the shortcomings associated with both traditional and electronic voting methods by guaranteeing voter authenticity and deterring multiple voting instances. By incorporating Arduino hardware alongside a fingerprint sensor, this system facilitates the secure and instantaneous recording of votes, while also offering immediate feedback through an LCD display, buzzer, and LEDs. Its modular and cost-effective design renders it appropriate for elections of varying scales, from small to large. In summary, this project showcases a practical, user-friendly, and dependable solution that improves electoral transparency, reduces the potential for fraud, and modernizes the voting process.



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