# WEB ENABLED FINGERPRINT BASED ELECTRONIC VOTING MACHINE FOR PRIVATE COMMUNITIES

A Secure and Biometric-Authenticated Voting System

Group Number:15


Presented by

Brijesh Nishad : 2101321550026

Ashutosh : 2101321550021

Aayush Pandey : 2101321550001

Under the Supervison of

Mr. Rajat Kishor Varshney




(Department of CSE-IoT , GNIOT Greater Noida,India)

# Introduction

## Problem Statement

Traditional voting systems are vulnerable to fraud and impersonation, undermining democratic processes. These issues necessitate a more secure, tamper-proof alternative for voting in private communities.

## Need for Secure Voting

There is an urgent requirement for a voting system that guarantees voter identity and prevents unauthorized access or tampering. The increasing reliance on technology in voting amplifies the need for foolproof systems.

WEF-EVM

Web Enabled Fingerprint EVM Private Community

## Solution Overview

The proposed solution combines biometric fingerprint authentication with a web-based electronic voting machine (EVM) to create a secure and efficient voting process for private communities.

## Key Features

Key features include fingerprint verification for user authentication, a real-time results web dashboard, and the specialized ESP32 hardware for efficient offline fingerprint processing.

# Problem Statement

Traditional voting systems are vulnerable to fraud and impersonation, undermining democratic processes. These issues necessitate a more secure, tamper-proof alternative for voting in private communities.

# Need for Secure Voting

There is an urgent requirement for a voting system that guarantees voter identity and prevents unauthorized access or tampering. The increasing reliance on technology in voting amplifies the need for foolproof systems.

WEF-EVM

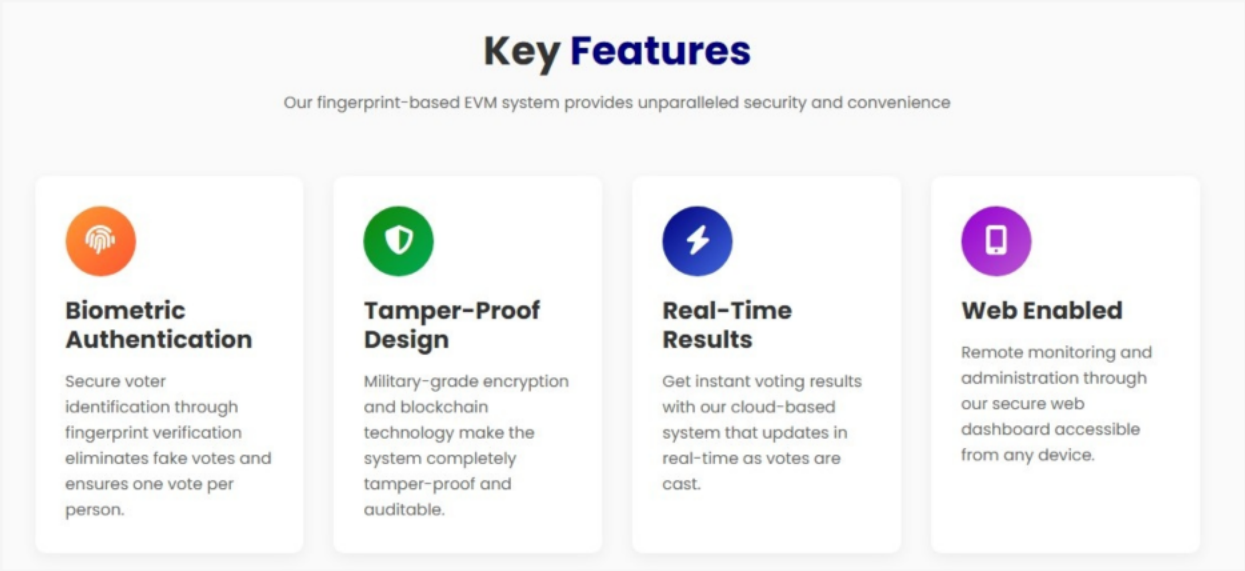
Web Enabled Fingerprint EVM
Private Community

# Solution Overview

The proposed solution combines biometric fingerprint authentication with a web-based electronic voting machine (EVM) to create a secure and efficient voting process for private communities.

# Key Features

Key features include fingerprint verification for user authentication, a real-time results web dashboard, and the specialized ESP32 hardware for efficient offline fingerprint processing.



# WEB ENABLED FINGERPRINT BASED ELECTRONIC VOTING MACHINE FOR PRIVATE COMMUNITIES

A Secure and Biometric-Authenticated Voting System

Group Number:15


Presented by

Brijesh Nishad : 2101321550026

Ashutosh : 2101321550021

Aayush Pandey : 2101321550001

Under the Supervison of

Mr. Rajat Kishor Varshney




(Department of CSE-IoT , GNIOT Greater Noida,India)

# Exploring Existing Voting Systems

## Existing Systems Overview

Traditional EVMs in countries like India utilize hardware solutions without biometric checks, exposing vulnerabilities. Additionally, online voting platforms rely on password systems that are increasingly susceptible to phishing attacks.

## Gaps in Current Solutions

Most existing voting systems fail to provide unique voter verification, leading to potential duplicate votes. Hybrid systems combining web technology with hardware are scarce, resulting in limited accessibility and security.


## Addressed Challenges

Implementing biometric authentication, such as fingerprint verification, helps to significantly reduce impersonation risks. A hybrid architecture optimizes both security and user accessibility, addressing crucial gaps in the current voting landscape.

# Existing Systems Overview

Traditional EVMs in countries like India utilize hardware solutions without biometric checks, exposing vulnerabilities. Additionally, online voting platforms rely on password systems that are increasingly susceptible to phishing attacks.

# Gaps in Current Solutions

Most existing voting systems fail to provide unique voter verification, leading to potential duplicate votes. Hybrid systems combining web technology with hardware are scarce, resulting in limited accessibility and security.


# Addressed Challenges

Implementing biometric authentication, such as fingerprint verification, helps to significantly reduce impersonation risks. A hybrid architecture optimizes both security and user accessibility, addressing crucial gaps in the current voting landscape.

# WEB ENABLED FINGERPRINT BASED ELECTRONIC VOTING MACHINE FOR PRIVATE COMMUNITIES

A Secure and Biometric-Authenticated Voting System

Group Number:15


Presented by

Brijesh Nishad : 2101321550026

Ashutosh : 2101321550021

Aayush Pandey : 2101321550001

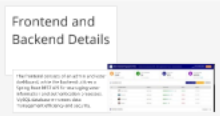
Under the Supervison of

Mr. Rajat Kishor Varshney

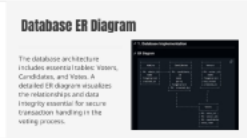



(Department of CSE-IoT , GNIOT Greater Noida,India)

## Proposed Methodology

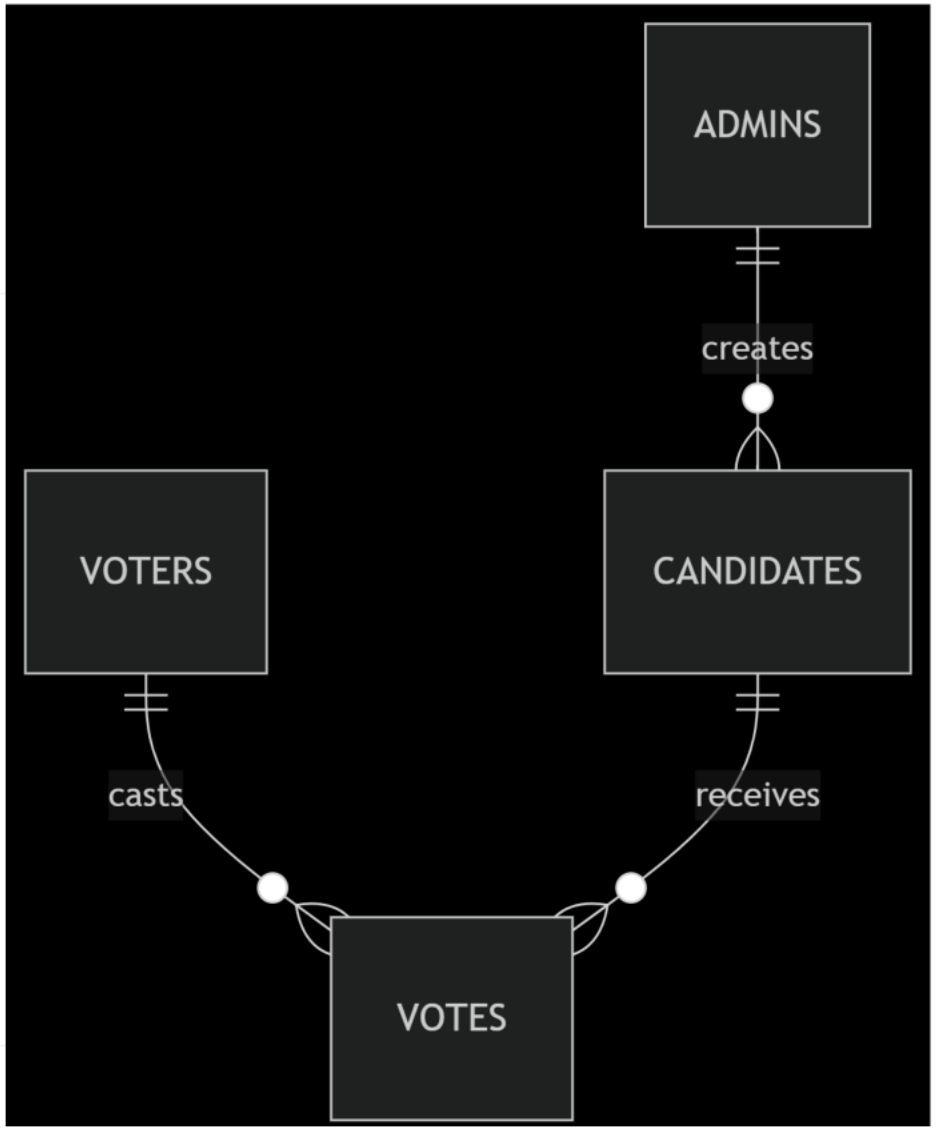





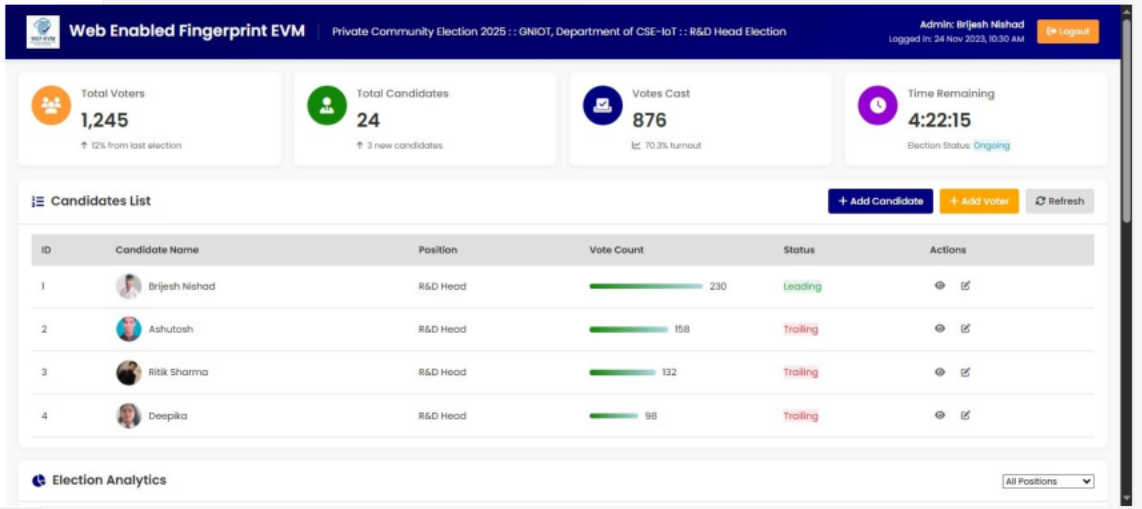
# System Architecture

The proposed architecture integrates a web portal for user interaction with an ESP32 backend, processing fingerprint data and managing database connections. This hybrid setup ensures both security and accessibility for voting in private communities.



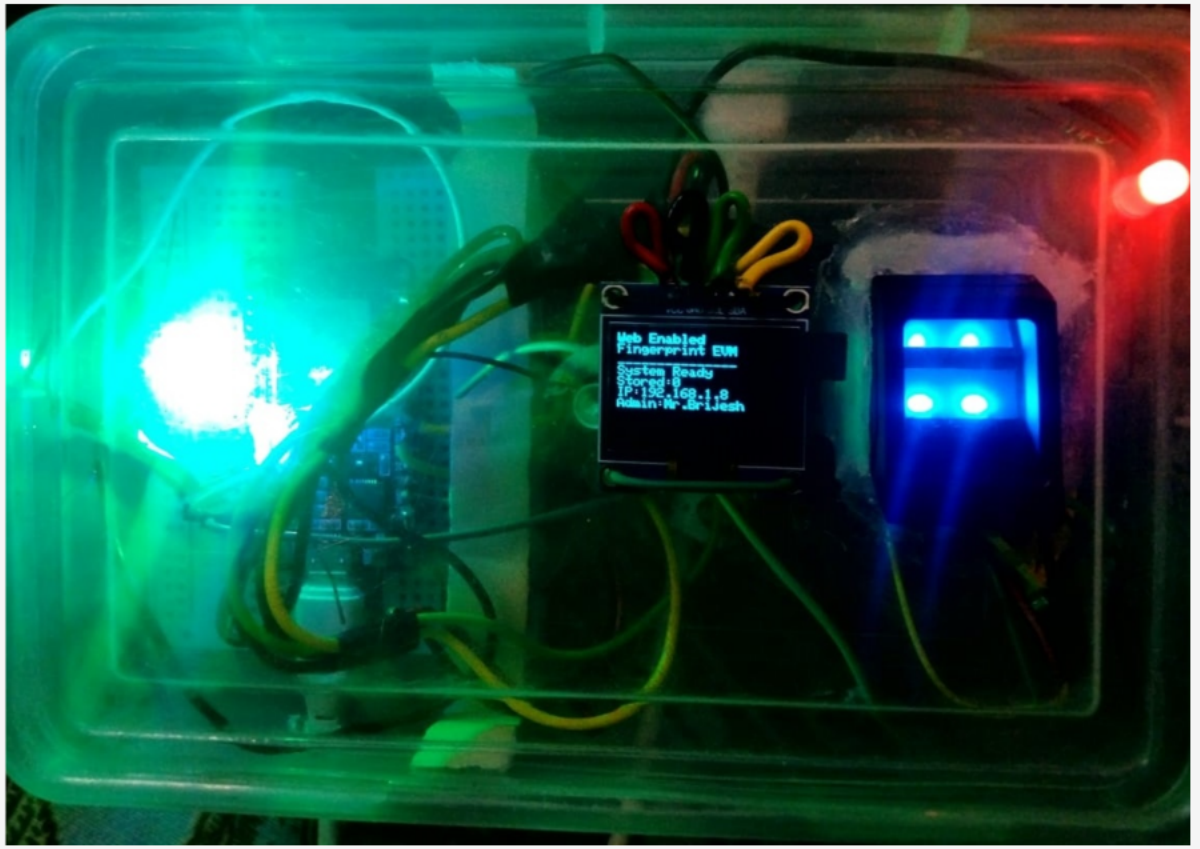
# Frontend and Backend Details

The frontend consists of an admin and voter dashboard, while the backend utilizes a Spring Boot REST API for managing voter information and authentication processes. MySQL database enhances data management efficiency and security.



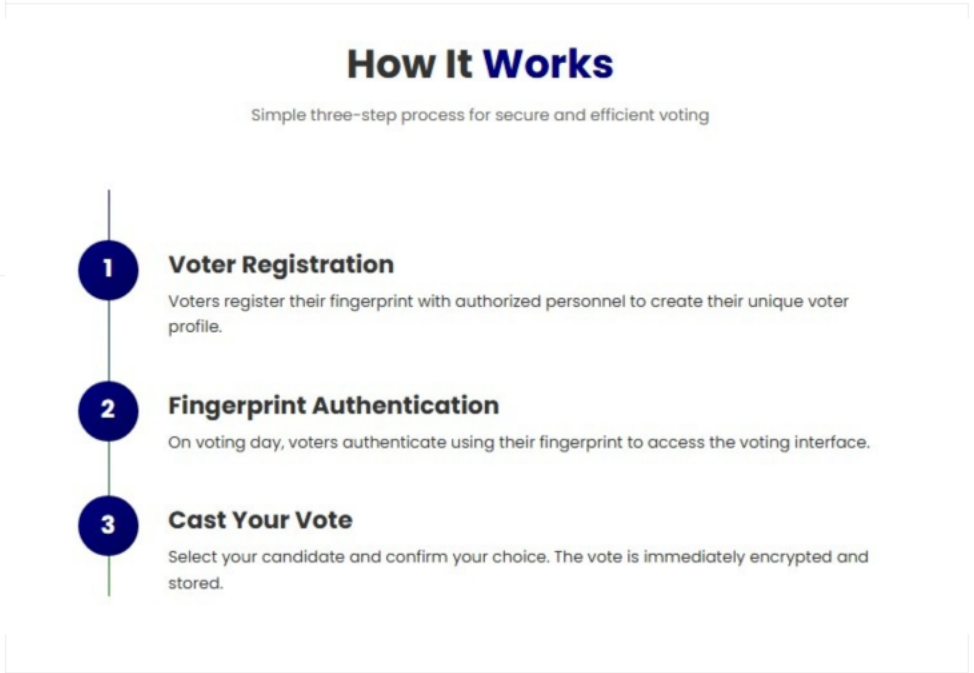
# Hardware Components

Key hardware components include the ESP32 microcontroller for data processing and the R307 fingerprint sensor for capturing and verifying fingerprints. Together, they form the backbone of biometric authentication in voting.



# Workflow Diagram

The voting process workflow involves admin registration of voters via fingerprint, followed by voter authentication and vote casting. This flow ensures a systematic approach to secure and reliable voting.

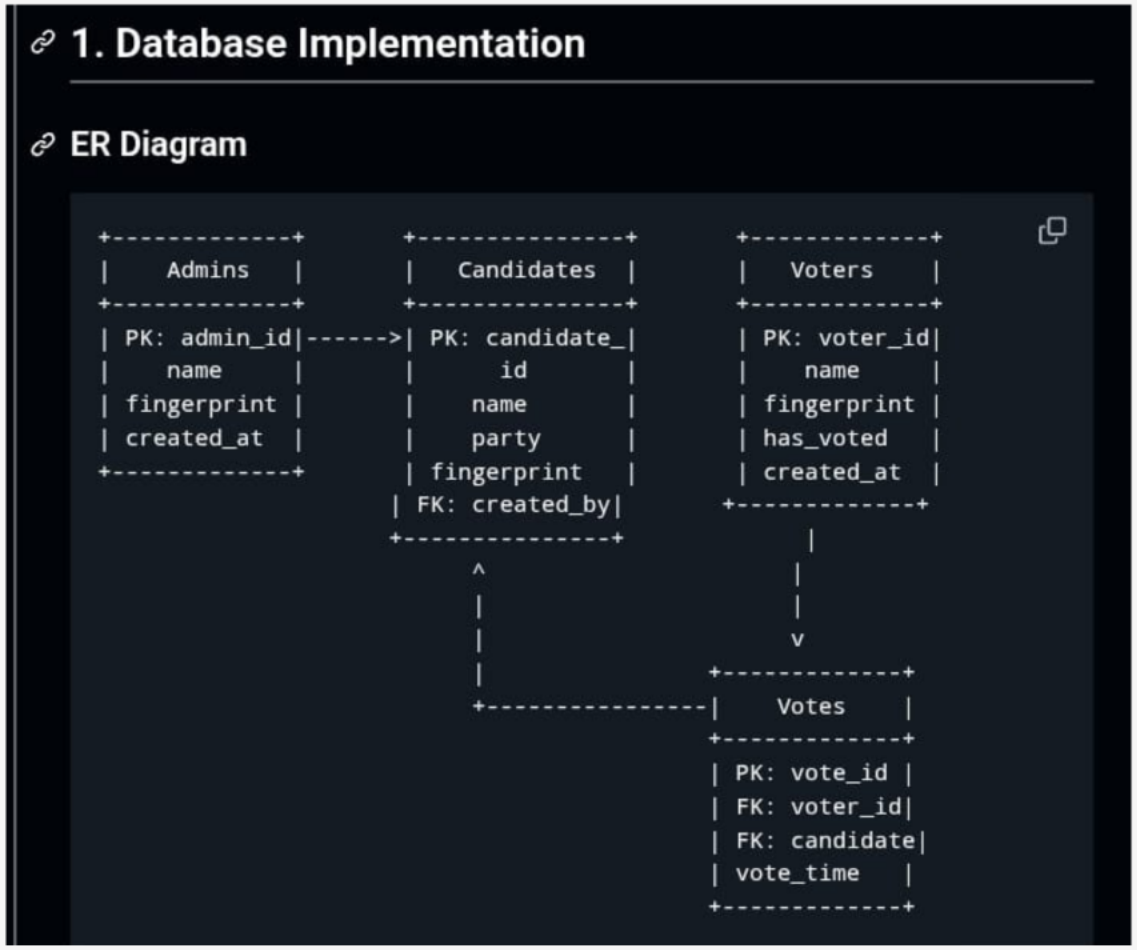


# Database ER Diagram

The database architecture includes essential tables: Voters, Candidates, and Votes. A detailed ER diagram visualizes the relationships and data integrity essential for secure transaction handling in the voting process.

## 1. Database Implementation

### ER Diagram



# WEB ENABLED FINGERPRINT BASED ELECTRONIC VOTING MACHINE FOR PRIVATE COMMUNITIES

A Secure and Biometric-Authenticated Voting System

Group Number:15


Presented by

Brijesh Nishad : 2101321550026

Ashutosh : 2101321550021

Aayush Pandey : 2101321550001

Under the Supervison of

Mr. Rajat Kishor Varshney

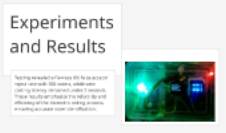



(Department of CSE-IoT , GNIOT Greater Noida,India)

# Implementation and Results

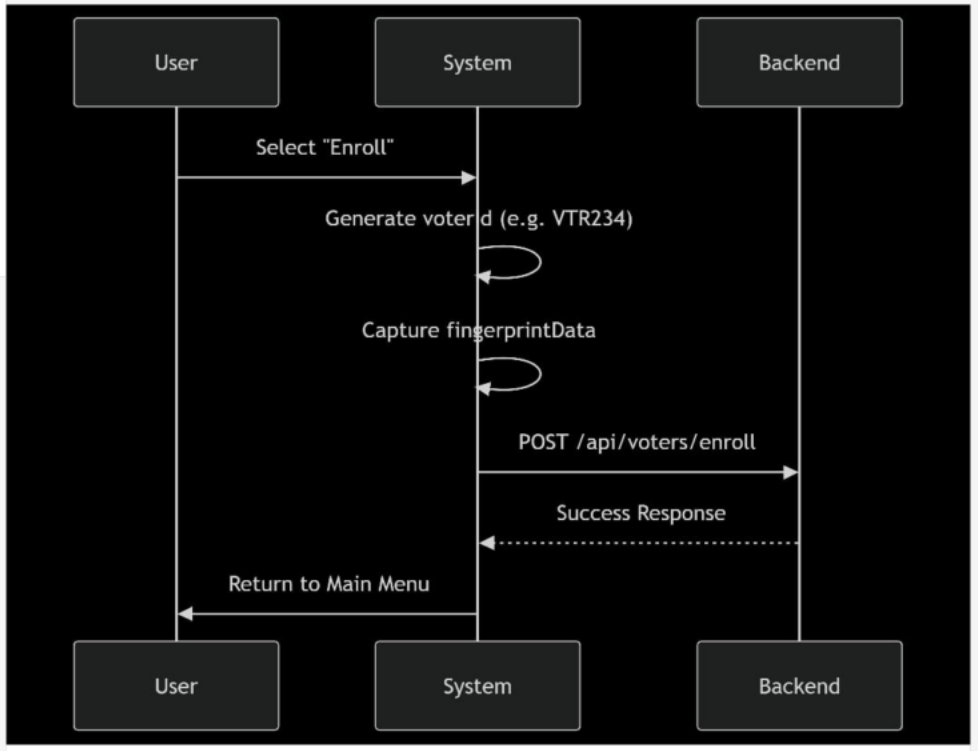







# Database Implementation

The voting system includes critical tables: Voters, which contains IDs and fingerprint templates; Candidates with IDs and party affiliations; and Votes mapping voters to candidates. An example SQL statement creates the Voters table with fingerprint templates stored as LONGBLOB for privacy and security.



```
REST API Documentation
Base URL
https://portal.wef-evm.com/api

Authentication
Endpoint        Method  Description
/admin/admin-login      POST    Password-based admin login
/admin/admin-login-biometric    POST    Fingerprint-based admin login
Admin Endpoints
Endpoint        Method  Description
/admin/login-success-get-center-info    GET     Get voting center info
/admin/total-voters     GET     Get total registered voters
/admin/total-candidates GET     Get total candidates
/admin/votes-cast       GET     Get total votes cast
/admin/add-candidate    POST    Add new candidate
/admin/add-voter        POST    Register new voter
/admin/candidate-lists  GET     List all candidates
/admin/analysis GET     Get voting analytics
/admin/recent-activity  GET     Get recent system activity
/admin/evm-health       GET     Check system health status
Voter Endpoints
Endpoint        Method  Description
/voter/verify-fingerprint       POST    Verify voter fingerprint
/voter/cast-vote        POST    Submit vote
Candidate Endpoints
Endpoint        Method  Description
/candidate/list GET     List all candidates
```

# REST API Endpoints

The system utilizes three essential API endpoints: /api/admins/add-voter for registering voters, /api/votes/cast for submitting votes, and /api/votes/results for fetching real-time voting results. These endpoints facilitate streamlined interactions between the frontend and the backend.

# Hardware Wiring and Functionality

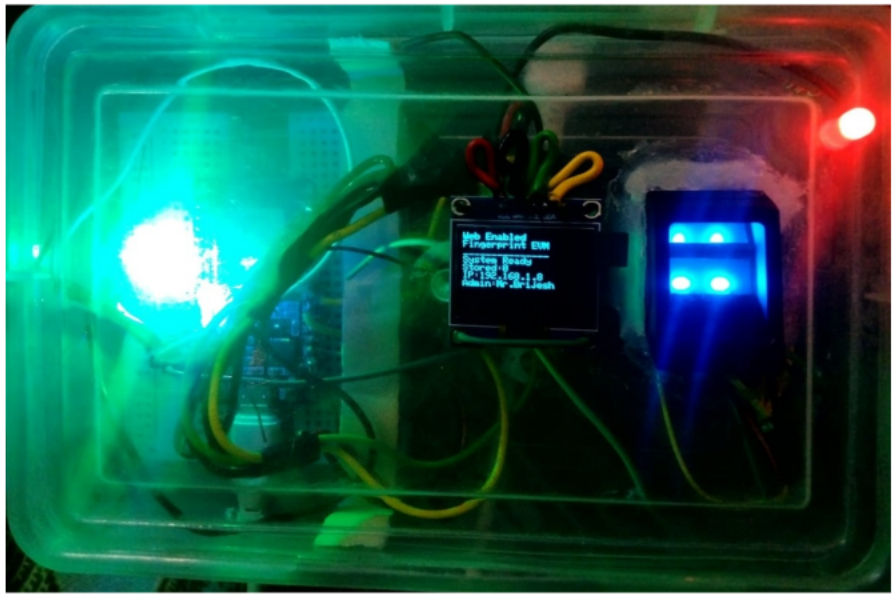
The hardware comprises an ESP32 microcontroller and an R307 fingerprint sensor. Wiring connects the VCC to 3.3V, with TX and RX routed through GPIO16 and GPIO17, respectively, enabling robust fingerprint processing and server communication.

# Security Considerations

An HTTPS protocol secures communication between the ESP32 and server, while JWT tokens are used for session management. Fingerprint templates are securely stored as LONGBLOB, ensuring they remain irretrievable, coupled with fast indexing for efficient lookup.

# Experiments and Results

Testing revealed a flawless 0% false accept/reject rate with 100 voters, while vote casting latency remained under 2 seconds. These results emphasize the reliability and efficiency of the biometric voting process, ensuring accurate voter identification.



# Conclusion and Future Scope

The web-enabled voting system presents a secure, scalable, and fraud-resistant solution for private communities. Future enhancements may include integrating facial recognition and implementing blockchain technologies to ensure even greater transparency and tamper-resistance.

# WEB ENABLED FINGERPRINT BASED ELECTRONIC VOTING MACHINE FOR PRIVATE COMMUNITIES

A Secure and Biometric-Authenticated Voting System

Group Number:15


Presented by

Brijesh Nishad : 2101321550026

Ashutosh : 2101321550021

Aayush Pandey : 2101321550001

Under the Supervison of

Mr. Rajat Kishor Varshney




(Department of CSE-IoT , GNIOT Greater Noida,India)