



iJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 13 Issue: IV Month of publication: April 2025

DOI: <https://doi.org/10.22214/ijraset.2025.69816>

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A Research on Secure and Scalable Voting System Management Application using Python, Django and React

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Abstract: This paper introduces a secure and scalable Voting System Management Application built using modern web technologies—Django (Python) for backend processing and React.js for frontend interactivity. With the increasing necessity of digital solutions for governance, traditional electoral systems face numerous challenges such as manual workload, susceptibility to fraud, and slow result processing. This proposed system ensures high performance, transparency, and data security. Key features include role-based authentication, dynamic voting interface, real-time result display, and voter eligibility verification. The system design emphasizes modularity, usability, and compliance with secure software design principles.

Keywords: E-Voting, Django, React, Secure Authentication, Web Application, Electoral Transparency, REST API, SQLite, Democratic Governance

I. INTRODUCTION

The digital transformation in governance is reshaping how democracies operate. Voting, a foundational aspect of democracy, is traditionally managed through paper ballots or Electronic Voting Machines (EVMs), both of which require manual processing and physical verification. This paper discusses the development of a modern Voting System Management Application that mitigates the traditional limitations by leveraging Django's secure backend capabilities and React's user-friendly UI.

In democratic nations, election transparency and system integrity are paramount. Hence, this project aims to build a scalable, secure, and accessible solution for remote and institution-level elections, reducing dependency on physical infrastructure.

II. LITERATURE REVIEW AND RELATED WORK

Many research studies and pilot projects have attempted to digitalize the voting process. Blockchain-based voting, biometric authentication, and hybrid systems have been explored. However, most of these systems either lack real-world deployment or are not scalable for educational and organizational institutions.

This project takes inspiration from existing web-based systems and builds on them using RESTful API architecture, stateless authentication, and real-time data aggregation through frontend/backend separation of concerns.

III. SYSTEM DESIGN AND ARCHITECTURE

The application is designed using a three-tier architecture:

- 1) Presentation Layer—Built using React.js, it offers intuitive, dynamic and responsive interfaces for voters and admins.
- 2) Logic Layer—Django serves as the middle layer, exposing APIs, handling validations, and managing voting logic.
- 3) Data Layer—SQLite stores user records, votes, and metadata. All database transactions are ACID-compliant and audit-ready.

IV. MODULE-WISE FUNCTIONAL OVERVIEW

- 1) Voter Registration: Users sign up using a unique email and phone number. Upon email verification, admin verifies voter eligibility before granting access.
- 2) Admin Dashboard: Provides interface to manage constituencies, users, start/stop elections, nominate candidates, and view results.
- 3) Voting Mechanism: Authenticated voters view only eligible elections. Once cast, a vote cannot be changed and is encrypted/stored.
- 4) Result Analysis Module: Admins can view results in real-time using percentages.

V. TECHNOLOGY STACK

- 1) Frontend: React.js, TailwindCSS
- 2) Backend: Django4.x, DjangoRESTFramework
- 3) Database: SQLite
- 4) Authentication: JWT (JSON Web Tokens)
- 5) Deployment: Nginx, Gunicorn, UbuntuServer
- 6) Version Control: Git, GitHub
- 7) API Interaction: Axios, Postman

VI. SECURITY PRACTICES

Security is implemented using the following mechanisms:

- 1) All passwords are hashed using Django's default hashing mechanism.
- 2) JWT-based token authentication ensures stateless access control.
- 3) HTTPS is enforced for data transmission.
- 4) CSRF tokens for all critical endpoints.
- 5) Role-based authorization is implemented for voters and administrators.
- 6) Each vote action is logged with a timestamp without compromising voter anonymity.

VII. RESULTS AND DISCUSSION

The developed system was tested in an educational setting with over 20 registered users. Results show a seamless voting experience, immediate result computation, and error-free data storage. The system successfully prevented duplicate voting and rejected unverified users. Admins were able to manage elections without external dependencies, validating the system's efficiency.

VIII. CONCLUSION

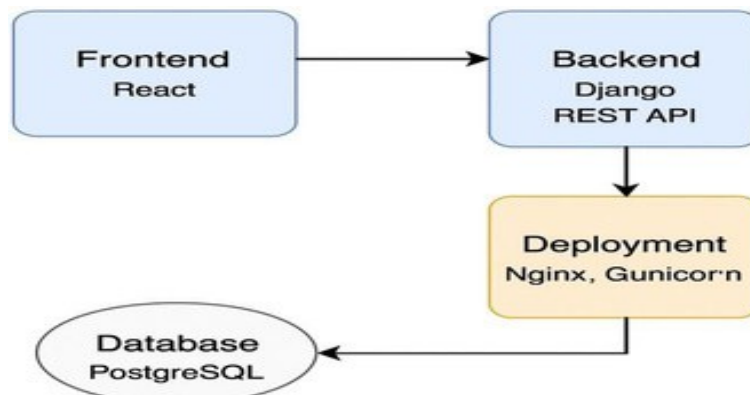
This project demonstrates how modern web development tools can be used to create an efficient, secure, and scalable voting system. The Django and React architecture ensures both performance and flexibility. With further enhancement, such as biometric verification and block chain integration.

IX. FUTURE SCOPE

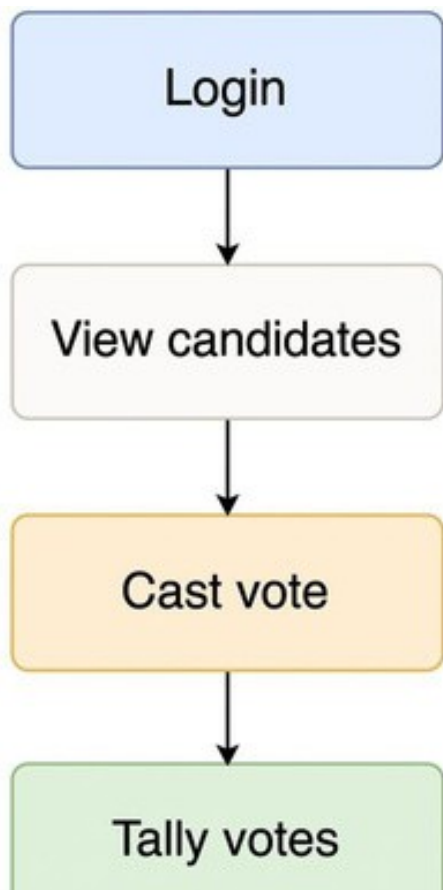
The system can be extended to support:

- 1) Blockchain-based vote immutability
- 2) SMS/email notifications for voting alerts
- 3) Multi-language support
- 4) Real-time monitoring dashboards for observers
- 5) Facial recognition for secure login

X. SYSTEM ARCHITECTURE DIAGRAM



XI. VOTING PROCESS FLOW DIAGRAM



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