Nationwide Unified Voting System Using Blockchain and AI-Driven Face Recognition

Abstract

Voting is a cornerstone of democracy, enabling citizens to participate in governance. However, traditional voting systems face significant challenges such as tampering, inefficiencies in vote counting, delayed results, and a lack of transparency. Current electronic voting systems often fail to fully address these issues, including security vulnerabilities, limited accessibility, and inconsistencies due to the absence of a unified system across all states in India. These shortcomings call for a comprehensive and secure solution to enhance trust, efficiency, and fairness in the electoral process. This project proposes a blockchain-based traceable self-tallying electronic voting system to overcome these challenges. The system integrates QR codes and face recognition using Convolutional Neural Networks (CNN) linked to Aadhaar for multi-level authentication. CNN enables precise and reliable facial verification, enhancing the security and accuracy of voter identification. Voters can cast their votes at any authorized booth, and each vote is encrypted using 256-bit SHA hash codes and securely stored on a blockchain. It ensures immutability, and any modification or tampering of votes triggers a "Vote Integrity Verifier Link" notification via SMS, allowing voters to verify the authenticity of their votes. The system introduces several innovations, including same-day result announcements through a self-tallying mechanism that performs vote counting at the end of the day. Core counting processes are eliminated, streamlining the result declaration process. Additionally, the adoption of a unified voting platform for all states in India ensures consistency and efficient election management across the nation. This project offers a secure, transparent, and scalable solution to address the limitations of existing voting systems, reinforcing trust in the democratic process while providing timely and accurate results.

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CHAPTER 1
INTRODUCTION

1.1. OVERVIEW

India is the largest democratic and Republic country in the world. In any democratic and republican country elections are necessary and also a heart to the democracy. In a democracy people have the privilege of being ruled by a government of their own choice. People choose their representatives through elections which are the normal features of democracies all over the world. But these elections should be held freely, fairly, transparently and impartially. For this purpose, the constitution of India provides an Election Commission with autonomous, consisting a Chief Election Commissioner and other Election Commissioners (at present two other election commissioners).

1.1.1. Indian Electoral System

The Constitution of India has vested in the Election Commission of India the Superintendence, direction and control of the entire process for conduct of elections to Parliament and Legislature of every State and to the offices of President and Vice-President of India. The Indian Electoral system has been broadly divided into two, they are Direct election based on territorial constituencies and proportional representation by means of a single transferable vote. The first system is followed for the election of the members of Lok Sabha, State Assemblies and Union Territories 'assemblies. The second, election held on the basis of proportional representation by means of a single transferable vote for the President and the Vice-President of India, members of Rajya Sabha and members of Legislative councils.

The main features of Indian electoral system:

- Elections are held on the basis of Universal adult franchise. Who is a citizen of India and not less than 18 years of age can register as a voter in electoral roll of India. There is no discrimination on the ground of religion, race, caste, sex or any of them.
- There is a provision for reservation of seats for Scheduled Castes (84 Seats) and Scheduled Tribes (47 Seats) in Lok Sabha and Assemblies of State and Union Territories, but there is no such provision of reservations in Rajya Sabha at the Union level and Legislative councils at the State level.

- For the general seats representation is accorded on territorial basis through common electoral roll. Constituencies are delimited with the help of a delimitation commissions (1952, 1963, 1973 and 2002) which is appointed after the census that takes place after every ten years. The result of the revision of constituencies is that that the areas/boundaries change from election to election, but the number of constituencies will not be changed up to the year 2026.
- Voting takes place through secret ballot for the Lok Sabha and State assemblies. It is most important and prerequisite to the public to express their will freely and fairly. For the Rajya Sabha and Council of States through the open ballot system is introduced to stop the corruption in those elections.
- Political parties are an indispensable part of the electoral process. In India multi-party system is functioning.

1.1.2. Evolution of electoral system in India

After India attained Independence in August 1947, there was a need to hold General Elections to elect a truly representative Government on the basis of universal adult suffrage. Article 324, which provides for the setting up of Election Commission as an independent constitutional authority, was therefore brought into force from November 26th, 1949. To provide a legal framework for the conduct of elections, Parliament passed the first Acton May 12th, 1950 (Representation of the People Act, 1950) providing mainly for the preparation of electoral rolls and second Act on July 17th, 1951 (Representation of the People Act, 1951) laying down the procedure for the conduct of elections to both Houses of Parliament and Vidhana Sabha's for each State. After the constitution of the two Houses of Parliament and the State Legislative Assemblies, the first Presidential election was held in May, 1952 and the first duly elected President assumed the charge of office on May 13th, 1952. For the first and second General Elections in 1951-52, and 1957, the Election Commission adopted the 'Balloting System' of voting. From the 3rd General Elections in 1962 onwards, the Commission switched over to 'marking system' of voting. The Electronic Voting Machines (EVMs) were used for the first time in part of Parur Assembly Constituency in Kerala in 1982, on experimental basis. Later, the extensive use of EVMs started in 1998. The EVMs were used at all polling stations in the country in the14th General Elections to the Lok Sabha in 2004 for the first time. Since then, all elections to Lok Sabha and Legislative Assemblies have been held using EVMs.

1.2. PROBLEMS DEFINITION

A significant problem with the traditional voting systems is the vulnerability to manipulation, security breaches, and inefficiencies that undermine the fairness, transparency, and integrity of the electoral process. One major issue is voter impersonation and fraud, where unauthorized individuals may cast votes under false identities. This is a common challenge in regions with weak authentication mechanisms or poorly managed voter registration processes. Even in electronic voting systems, the lack of robust verification techniques often exposes the process to fraud and manipulation, which compromises the credibility of election results. Another concern is the lack of transparency in vote counting, where manual or semi-automated systems introduce the possibility of human error or deliberate tampering. This raises doubts among voters about whether their votes are accurately counted, especially in close elections where every vote matters. The reliance on centralized databases for vote storage and processing further increases the risk of unauthorized access, hacking, and data breaches that can alter or even erase votes. Moreover, the delay in announcing election results is another problem, mainly due to the slow process of vote tallying. In most systems, votes are manually counted, or in some cases, electronic systems fail to provide timely results, causing uncertainty and eroding public trust. Additionally, the lack of standardization across different regions and states introduces complexities and inefficiencies in managing elections, leading to inconsistencies in election procedures and results. Finally, voters often have no way of verifying whether their vote has been correctly cast and recorded. Without mechanisms to allow individuals to check the status or integrity of their vote, concerns about vote tampering or errors persist. This problem is further compounded by the growing threat of cyber-attacks and unauthorized access to voting systems, which can manipulate or steal voter data, ultimately affecting the election outcome. This project aims to tackle these issues by leveraging blockchain technology for secure, transparent, and immutable vote storage, along with AI-driven facial recognition for robust voter authentication. The use of blockchain ensures that once a vote is cast, it cannot be tampered with, providing an unprecedented level of trust and security. The integration of AI for face recognition adds an extra layer of protection against fraud and identity theft, while ensuring that voters can be easily and accurately verified. Through these innovations, the project seeks to provide a secure, transparent, and efficient voting system that restores public confidence in the electoral process.

1.3. ARTIFICIAL INTELLIGENCE

Artificial Intelligence (AI) is increasingly changing the way we live. AI systems are also being used in democratic elections. The emergence of artificial intelligence (AI), machine learning (ML), and big data have fundamentally changed how politicians engage the Indian electorate and will continue to challenge centuries of political and intrapersonal norms surrounding voter enfranchisement.

Electoral Biometrics

In electoral law, the ballot is considered fair if it meets the requirements of equality and liberty, and the secrecy of voting is respected. The usage of biometric systems in electoral processes makes it possible to meet challenges involved in implementing the principle of "one voter, one vote," which is necessary for the holding of democratic, free and transparent elections.

Blockchain and IoT

The Internet of things (IoT) is transforming the way enterprises operate through the use of sensors and other edge devices and infrastructure. This presents a major challenge for enterprises, which must protect information at all levels of the IoT ecosystem. With the number of connected devices growing multi fold every year, data security has become increasingly complex. Blockchain is helping combat security breaches in an IoT system. Blockchain is a distributed ledger technology that combines with IoT to make machine-to-machine transactions possible. It uses a set of transactions that are recorded in a database, verified by multiple sources and entered in a common ledger distributed across every node. The combination of IoT and blockchain offers various potential benefits and allows a smart device to function autonomously without the need for a centralized authority. It can also track how devices communicate with each other. While the decentralized nature of blockchain is an architectural benefit, it can be a potential problem for IoT. IoT platforms rely on client-server or hub-and-spoke architecture, which is a centralized authority.

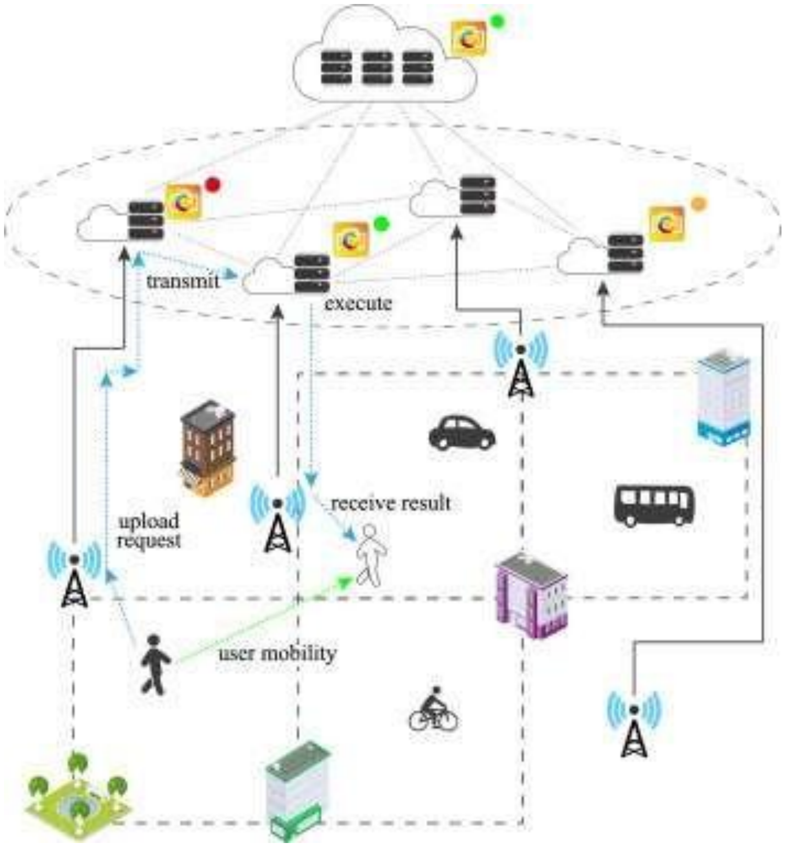


Figure 1.2. Blockchain and IoT

Building an IoT platform that is decentralized in nature will help ensure compatibility with a blockchain network, but it can be a challenge to configure IoT sensors to handle their own computer and data storage, since they rely on central compute and storage resources. This application of blockchain technology allows enterprises to manage data on edge devices in an IoT system, reducing costs associated with IoT device maintenance and data transfer. It reduces the risks of managing data, because there is no centralized data repository and the ledger is not vulnerable to cyberattacks. It eliminates the IoT gateway or any other intermediate device for data exchange and reduces the time required to process the data. Blockchain imposes high-level security by authenticating and authorizing encrypted device-generated data with the help of decentralized, distributed ledgers. In a distributed ledger, data computation and storage are spread across millions of devices. As a result, the failure of a device, a server or the network will not affect the entire IoT ecosystem, as it might in the traditional model. In many cases, the resiliency of a blockchain network will approach fault-tolerance, where the network can continue operating if nodes are taken offline. Due to weak access control and client/server architectures, many IoT ecosystems present soft targets for hijackers.

Distributed denial of service (DDoS) attacks, which disrupt normal traffic to connected devices by overwhelming the target or surrounding infrastructure with a flood of internet traffic, have become more frequent. The Mirai and Hajime IoT botnets exposed the vulnerability of connected devices to DDoS attacks. IoT devices and networks can be protected from botnet-driven DDoS attacks with the distributed security architecture of a blockchain. In this architecture, every device in a network is independently secured with a blockchain peer-to-peer network.

1.3.1. Applications of IoT and blockchain

- **Log operational maintenance data**

IoT devices track the state of safety for critical machines and their maintenance. From engines to elevators, blockchain provides for a tamper-free ledger of operational data and the resulting maintenance. Third-party repair partners can monitor the blockchain for preventive maintenance and record their work back on the blockchain. Operational records can also be shared with government entities to verify compliance.

- **Automotive Sector**

The impact of digitalization has resulted in the prolific growth of its competitive demand. Automotive industries have been successfully utilizing IoT-enabled sensors for the development of completely automated vehicles. One of the most prolific uses of blockchain IoT can be identified in the automotive sector for connecting blockchain with industrial IoT solutions. As a result, it can empower multiple users for easier and faster exchange of crucial information.

- **Smart homes/biometrics**

Following on from smart cities, smart homes are gaining protagonist as well, as IoT devices are increasingly used in our everyday lives. Yet, biometrics alone cannot remove the issue of centralized infrastructure or the possibility of hackers tampering with the data captured by smart devices. Blockchain provides a much safer way of securing the multitude of biometric data, ensuring that it is only accessible to the right parties. This not only keeps consumers safe but saves businesses from the threat of costly cyberattacks, data breaches, and even litigation.

- **Machine-led maintenance**

IoT devices are already helping manufacturers around the world to eliminate inefficiencies and boost their bottom lines. By using smart sensors on their equipment, businesses can reduce expensive downtime through machine-led maintenance.

The sensors transmit real-time data on machinery and send reports or error messages allowing business owners to schedule preventive maintenance, essentially fixing a problem before it arises. However, with the attack vector of IoT devices still an easy target for hackers, human intervention and checks are still widely used to ensure that error reports are not altered, tampered with, or overwritten, blockchain can help eliminate this. Plus, with the data distributed across multiple servers, blockchain eliminates the threat of attack and single point of failure of centralized systems, greatly increasing IoT's reliability while removing the need for manual processes and eliminating human error. This risk mitigation translates into significant cost savings for businesses that they can pass on to consumers. E-voting (Electronic Voting) approach that ensures security, privacy, and transparency. have decided to use the blockchain system. Blockchain technology lowers the cost of centralized Clouds, Datacentres, and Networking Equipment, decreases the need for middlemen, and provides data privacy and transparency; all of which are critical for a fair election. An Architecture and Algorithm are suggested for the blockchain-based voting system. An internet of things (IoT) based system is designed to exchange data from the electronic voting machine and the nodes. Furthermore, it introduced its features, and concluded with some future investigations.

1.4. AIM AND OBJECTIVE

Aim

The aim of the project is to design and implement a secure, transparent, and efficient blockchain- based electronic voting system that integrates multi-level authentication mechanisms, including QR codes and CNN-based face recognition linked to Aadhar, to ensure accurate voter identification, tamper-proof vote storage, and real-time result verification, thereby addressing the limitations of existing voting systems.

Objectives

- To ensure secure voter authentication using QR codes and CNN-based face recognition linked to Aadhar.
- To store votes immutably on a blockchain with 256-bit encryption.
- To notify voters of tampering attempts via a "Vote Integrity Verifier Link."
- To automate vote counting and enable same-day result announcements.
- To provide a unified and consistent voting platform across all Indian states.
- To allow voting from any authorized booth nationwide for enhanced accessibility.
- To protect voter privacy and comply with data security laws.
- To design a scalable system suitable for large-scale elections.

1.5. SCOPE OF THE PROJECT

- **Security and Authentication:** The project leverages advanced technologies such as QR codes and CNN-based face recognition linked to Aadhar for multi-level voter authentication. This ensures accurate voter identification and prevents unauthorized access. Blockchain technology further enhances security by encrypting and immutably storing votes using 256-bit SHA hash codes, safeguarding the electoral process against tampering.
- **Transparency and Trust:** By integrating blockchain's immutable ledger, the system ensures that votes remain unaltered and traceable. A Vote Integrity Verifier Link notification system alerts voters of any tampering attempts, allowing real-time verification of their vote's authenticity. This transparency builds trust in the democratic process.
- **Efficiency and Automation:** The self-tallying mechanism automates vote counting, enabling same-day result announcements and eliminating manual counting processes. This innovation reduces human error, streamlines result declarations, and enhances overall electoral efficiency.
- **Uniformity Across States:** The project introduces a unified electronic voting platform to standardize elections across all Indian states. This ensures consistency in procedures, technologies, and management, improving the overall efficiency of the electoral process.
- **Accessibility and Convenience:** Voters can cast their votes from any authorized booth nationwide, making the process more accessible and encouraging higher voter participation. The system aims to simplify voting logistics while maintaining robust security measures.
- **Scalability and Adaptability:** Designed for large-scale elections, the system can accommodate varying voter populations at local, state, and national levels. Its flexible architecture allows for seamless integration of future technological advancements and compliance with evolving legal requirements.
- **Impact on Democracy:** By addressing the limitations of traditional and electronic voting systems, the project enhances transparency, security, and efficiency. These improvements strengthen public trust in elections, promote greater participation, and uphold the principles of democracy.

CHAPTER 2
SYSTEM ANALYSIS

2.1. EXISTING SYSTEM

The existing voting systems predominantly rely on traditional methods such as paper ballots and electronic voting machines (EVMs). While these systems have served for decades, they present significant limitations that impact the integrity, efficiency, and inclusivity of the electoral process.

- **Paper-Based Voting**

Paper ballots, one of the oldest voting methods, are still used in certain regions due to their simplicity. However, this system is prone to errors in vote counting and is labor-intensive, resulting in delays in result announcements. Furthermore, paper ballots are vulnerable to tampering, which compromises election fairness.

- **Electronic Voting Machines (EVMs)**

EVMs were introduced to address the inefficiencies of paper-based voting by providing faster and more accurate vote counting. However, these machines face challenges such as limited voter verification mechanisms and centralized vote storage, which can raise concerns about data security and trust.

2.1.1. DISADVANATGES

- Risk of tampering and data breaches in both paper ballots and EVMs.
- Voters cannot verify if their votes are recorded accurately.
- Manual counting and centralized systems delay result announcements.
- Inconvenience for voters in remote areas or with disabilities.
- Variations across states lead to inconsistencies in election management.
- Lack of real-time tracking and verification mechanisms.

2.2. PROPOSED SYSTEM

The proposed system is designed to overcome the limitations of traditional voting methods. By integrating cutting-edge technologies such as blockchain, facial recognition, and multi-level authentication, this system aims to ensure a more secure, efficient, and transparent electoral process.

- **Multi-Level Authentication for Voter Security**

The system incorporates multi-level authentication, using QR codes and facial recognition powered by Convolutional Neural Networks (CNN). This method links voter identity with Aadhaar for precise verification, enhancing security and minimizing the possibility of identity fraud or voter impersonation.

- **Blockchain Technology Integration**

The use of blockchain technology in the proposed system ensures that votes are encrypted and securely stored, guaranteeing immutability and preventing tampering. Each vote is traceable, and any unauthorized changes are immediately detected, triggering an alert system to ensure the integrity of the election process.

- **Self-Tallying Vote Mechanism**

A key feature of the system is its self-tallying mechanism, which automatically counts the votes at the end of the election day. This eliminates the need for manual vote counting, resulting in faster and more accurate results. Additionally, the self-tallying system allows for same-day result announcements, improving the efficiency of the election process.

- **Vote Integrity Verification**

To ensure transparency, the system provides a Vote Integrity Verifier Link, enabling voters to verify the authenticity of their votes. If any tampering or discrepancies occur, the system sends an SMS notification to alert the voter and ensure they can confirm the validity of their vote.

- **Unified National Voting Platform**

The proposed system also creates a unified voting platform for all states in India, ensuring consistency and standardization in the election process across the country. This unified approach simplifies election management and promotes efficiency by eliminating the inconsistencies that arise from fragmented systems across different states.

- **Enhanced Accessibility and Inclusivity**

The system enhances accessibility by allowing voters to cast their votes at any authorized polling booth, offering greater convenience, especially for those in remote areas. Additionally, the system is designed to be inclusive, providing necessary accommodations for voters with disabilities.

This proposed system offers a solution to the shortcomings of existing voting methods, providing a secure, transparent, and efficient approach to modernizing the electoral process.

2.2.1. ADVANATGES

- Blockchain ensures immutability and protects votes from tampering.
- Voters can verify vote authenticity via the Vote Integrity Verifier Link.
- Self-tallying mechanism enables same-day vote counting and results.
- Facial recognition and Aadhar ensure secure voter identification.
- Standardized voting process across all states for consistency.
- Voting can be done at any authorized booth for greater convenience.
- Accessible for voters with disabilities and in remote locations.
- Reduces labor costs by eliminating manual vote counting.
- Suitable for elections of any size, from local to national levels.

CHAPTER 3

SYSTEM REQUIREMENTS

3.1 HARDWARE REQUIREMENTS

- **Processors** : Intel® Core™ i5 processor, 16 GB of DRAM
- **Disk space** : 320 GB
- **Operating systems** : Windows® 10

3.2. SOFTWARE REQUIREMENTS

- **Programming Language** **:** Python 3.8
- **Frameworks** **:** TensorFlow, Keras, Flask
- **Libraries** **:** NumPy, Pandas, Matplotlib, Scikit-learn
- **Database** **:** MySQL
- **APIs** **:** OpenCV (for face recognition)
- **Blockchain** : JSON

CHAPTER 4

SOFTWARE DESCRIPTION

4.1. PYTHON 3.8

Python is a general-purpose interpreted, interactive, object-oriented, and high-level programming language. It was created by Guido van Rossum during 1985- 1990. Like Perl, Python source code is also available under the GNU General Public License (GPL). This tutorial gives enough understanding on Python programming language.

Python is a high-level, interpreted, interactive and object-oriented scripting language. Python is designed to be highly readable. It uses English keywords frequently where as other languages use punctuation, and it has fewer syntactical constructions than other languages. Python is a MUST for students and working professionals to become a great Software Engineer specially when they are working in Web Development Domain. Python is currently the most widely used multi-purpose, high-level programming language. Python allows programming in Object-Oriented and Procedural paradigms. Python programs generally are smaller than other programming languages like Java. Programmers have to type relatively less and indentation requirement of the language, makes them readable all the time. Python language is being used by almost all tech-giant companies like – Google, Amazon, Facebook, Instagram, Dropbox, Uber… etc. The biggest strength of Python is huge collection of standard libraries which can be used for the following:

- Machine Learning
- GUI Applications (like Kivy, Tkinter, PyQt etc.)
- Web frameworks like Django (used by YouTube, Instagram, Dropbox)
- Image processing (like OpenCV, Pillow)
- Web scraping (like Scrapy, BeautifulSoup, Selenium)
- Test frameworks
- Scientific computing

Tensor Flow

TensorFlow is an end-to-end open-source platform for machine learning. It has a comprehensive, flexible ecosystem of tools, libraries, and community resources that lets researchers push the state- of-the-art in ML, and gives developers the ability to easily build and deploy ML-powered applications.

TensorFlow provides a collection of workflows with intuitive, high-level APIs for both beginners and experts to create machine learning models in numerous languages. Developers have the option to deploy models on a number of platforms such as on servers, in the cloud, on mobile and edge devices, in browsers, and on many other JavaScript platforms. This enables developers to go from model building and training to deployment much more easily.

Keras

Keras is a deep learning API written in Python, running on top of the machine learning platform TensorFlow. It was developed with a focus on enabling fast experimentation.

Simple. Flexible. Powerful.

- Allows the same code to run on CPU or on GPU, seamlessly.
- User-friendly API which makes it easy to quickly prototype deep learning models.
- Built-in support for convolutional networks (for computer vision), recurrent networks (for sequence processing), and any combination of both.
- Supports arbitrary network architectures: multi-input or multi-output models, layer sharing, model sharing, etc. This means that Keras is appropriate for building essentially any deep learning model, from a memory network to a neural Turing machine.

Pandas

pandas are a fast, powerful, flexible and easy to use open source data analysis and manipulation tool, built on top of the Python programming language. pandas are a Python package that provides fast, flexible, and expressive data structures designed to make working with "relational" or "labeled" data both easy and intuitive. It aims to be the fundamental high-level building block for doing practical, real world data analysis in Python.

Pandas is mainly used for data analysis and associated manipulation of tabular data in Data frames. Pandas allows importing data from various file formats such as comma-separated values, JSON, Parquet, SQL database tables or queries, and Microsoft Excel. Pandas allows various data manipulation operations such as merging, reshaping, selecting, as well as data cleaning, and data wrangling features. The development of pandas introduced into Python many comparable features of working with Data frames that were established in the R programming language. The panda's library is built upon another library NumPy, which is oriented to efficiently working with arrays instead of the features of working on Data frames.

NumPy

NumPy, which stands for Numerical Python, is a library consisting of multidimensional array objects and a collection of routines for processing those arrays. Using NumPy, mathematical and logical operations on arrays can be performed.

NumPy is a general-purpose array-processing package. It provides a high-performance multidimensional array object, and tools for working with these arrays.

Matplotlib

Matplotlib is a comprehensive library for creating static, animated, and interactive visualizations in Python. Matplotlib makes easy things easy and hard things possible.

Matplotlib is a plotting library for the Python programming language and its numerical mathematics extension NumPy. It provides an object-oriented API for embedding plots into applications using general-purpose GUI toolkits like Tkinter, wxPython, Qt, or GTK.

Scikit Learn

scikit-learn is a Python module for machine learning built on top of SciPy and is distributed under the 3-Clause BSD license.

Scikit-learn (formerly scikits. learn and also known as sklearn) is a free software machine learning library for the Python programming language. It features various classification, regression and clustering algorithms including support-vector machines, random forests, gradient boosting, k- means and DBSCAN, and is designed to interoperate with the Python numerical and scientific libraries NumPy and SciPy.

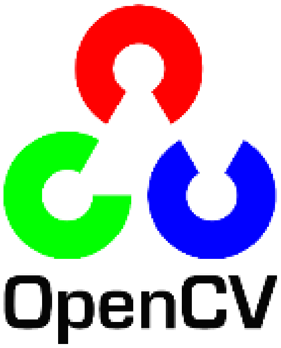
Pillow

Pillow is the friendly PIL fork by Alex Clark and Contributors. PIL is the Python Imaging Library by Fredrik Lundh and Contributors.

Python pillow library is used to image class within it to show the image. The image modules that belong to the pillow package have a few inbuilt functions such as load images or create new images, etc.

OpenCV

OpenCV is an open-source library for the computer vision. It provides the facility to the machine to recognize the faces or objects.



In OpenCV, the CV is an abbreviation form of a computer vision, which is defined as a field of study that helps computers to understand the content of the digital images such as photographs and videos.

4.2. MYSQL 5

MySQL is a relational database management system based on the Structured Query Language, which is the popular language for accessing and managing the records in the database. MySQL is open-source and free software under the GNU license. It is supported by Oracle Company. MySQL database that provides for how to manage database and to manipulate data with the help of various SQL queries. These queries are: insert records, update records, delete records, select records, create tables, drop tables, etc. There are also given MySQL interview questions to help you better understand the MySQL database.

MySQL is currently the most popular database management system software used for managing the relational database. It is open-source database software, which is supported by Oracle Company. It is fast, scalable, and easy to use database management system in comparison with Microsoft SQL Server and Oracle Database. It is commonly used in conjunction with PHP scripts for creating powerful and dynamic server-side or web-based enterprise applications. It is developed, marketed, and supported by MySQL AB, a Swedish company, and written in C programming language and C++ programming language. The official pronunciation of MySQL is not the My Sequel; it is My Ess Que Ell. However, you can pronounce it in your way. Many small and big companies use MySQL. MySQL supports many Operating Systems like Windows, Linux, MacOS, etc. with C, C++, and Java languages.

4.3. WAMPSERVER

WampServer is a Windows web development environment. It allows you to create web applications with Apache2, PHP and a MySQL database. Alongside, PhpMyAdmin allows you to manage easily your database.

WAMPServer is a reliable web development software program that lets you create web apps with MYSQL database and PHP Apache2. With an intuitive interface, the application features numerous functionalities and makes it the preferred choice of developers from around the world. The software is free to use and doesn’t require a payment or subscription.

4.4. BOOTSTRAP 4

Bootstrap is a free and open-source tool collection for creating responsive websites and web applications. It is the most popular HTML, CSS, and JavaScript framework for developing responsive, mobile-first websites.

It solves many problems which we had once, one of which is the cross-browser compatibility issue. Nowadays, the websites are perfect for all the browsers (IE, Firefox, and Chrome) and for all sizes of screens (Desktop, Tablets, Phablets, and Phones). All thanks to Bootstrap developers - Mark Otto and Jacob Thornton of Twitter, though it was later declared to be an open-source project.

Easy to use: Anybody with just basic knowledge of HTML and CSS can start using Bootstrap

Responsive features: Bootstrap's responsive CSS adjusts to phones, tablets, and desktops

Mobile-first approach: In Bootstrap, mobile-first styles are part of the core framework

Browser compatibility: Bootstrap 4 is compatible with all modern browsers (Chrome, Firefox, Internet Explorer 10+, Edge, Safari, and Opera)

4.5. FLASK

Flask is a web framework. This means flask provides you with tools, libraries and technologies that allow you to build a web application. This web application can be some web pages, a blog, a wiki or go as big as a web-based calendar application or a commercial website.

Flask is often referred to as a micro framework. It aims to keep the core of an application simple yet extensible. Flask does not have built-in abstraction layer for database handling, nor does it have formed a validation support. Instead, Flask supports the extensions to add such functionality to the application. Although Flask is rather young compared to most Python frameworks, it holds a great promise and has already gained popularity among Python web developers. Let’s take a closer look into Flask, so-called “micro” framework for Python. Flask is part of the categories of the micro- framework. Micro-framework are normally framework with little to no dependencies to external libraries. This has pros and cons. Pros would be that the framework is light, there are little dependency to update and watch for security bugs, cons is that some time you will have to do more work by yourself or increase yourself the list of dependencies by adding plugins.

4.6. JSON

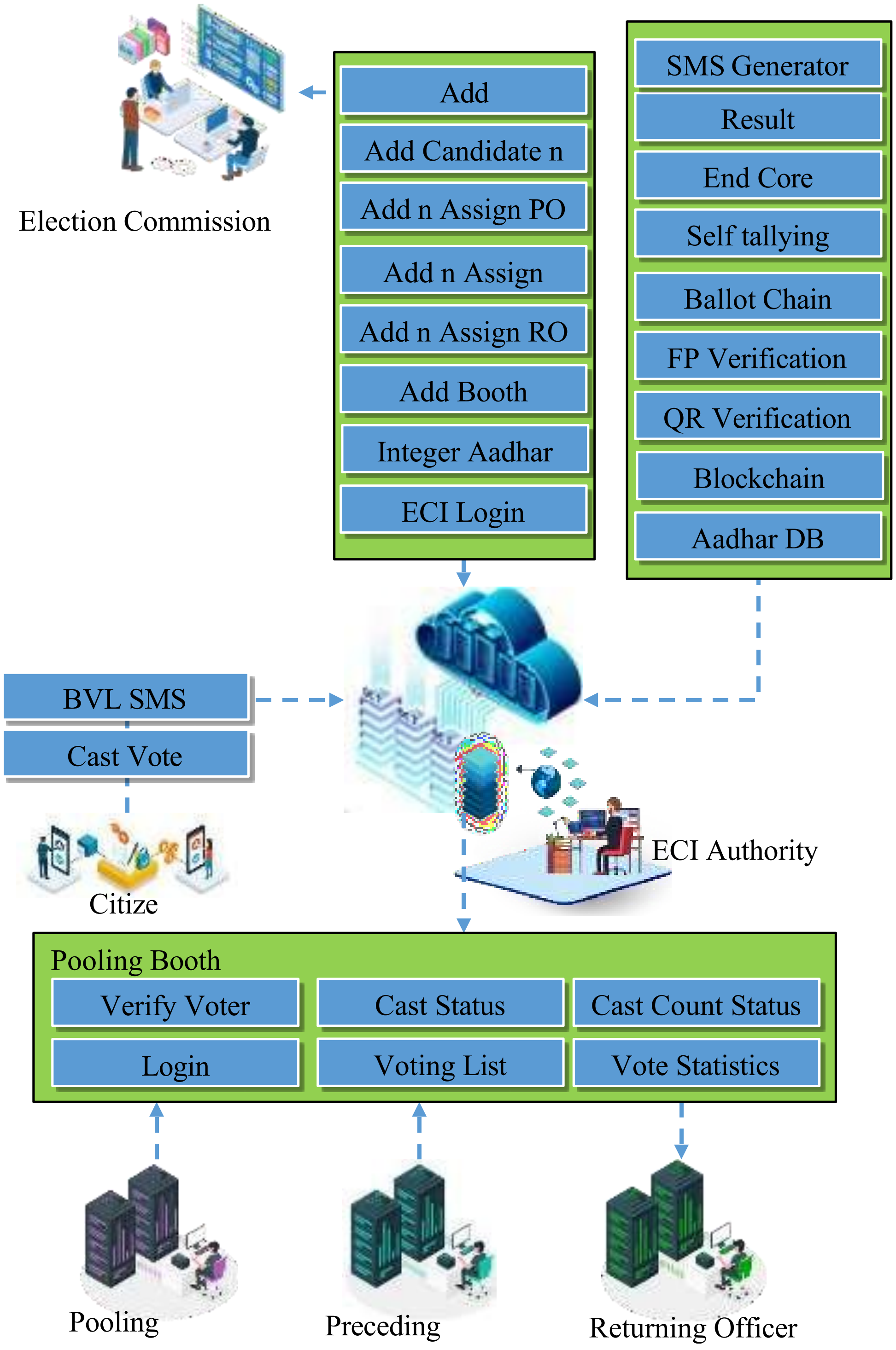
JSON (JavaScript Object Notation) is a lightweight data-interchange format. It is easy for humans to read and write. It is easy for machines to parse and generate. It is based on a subset of the JavaScript Programming Language Standard ECMA-262 3rd Edition - December 1999. JSON is a text format that is completely language independent but uses conventions that are familiar to programmers of the C-family of languages, including C, C++, C#, Java, JavaScript, Perl, Python, and many others. These properties make JSON an ideal data-interchange language.

JSON consists of "name: object" pairs and punctuation in the form of brackets, parentheses, semi- colons and colons. Each object is defined with an operator like "text:" or "image:" and then grouped with a value for that operator. The simple structure and absence of mathematical notation or algorithms, JSON is easy to understand and quickly mastered, even by users with limited formal programming experience, which has spurred adoption of the format as a quick, approachable way to create interactive pages.

CHAPTER 5

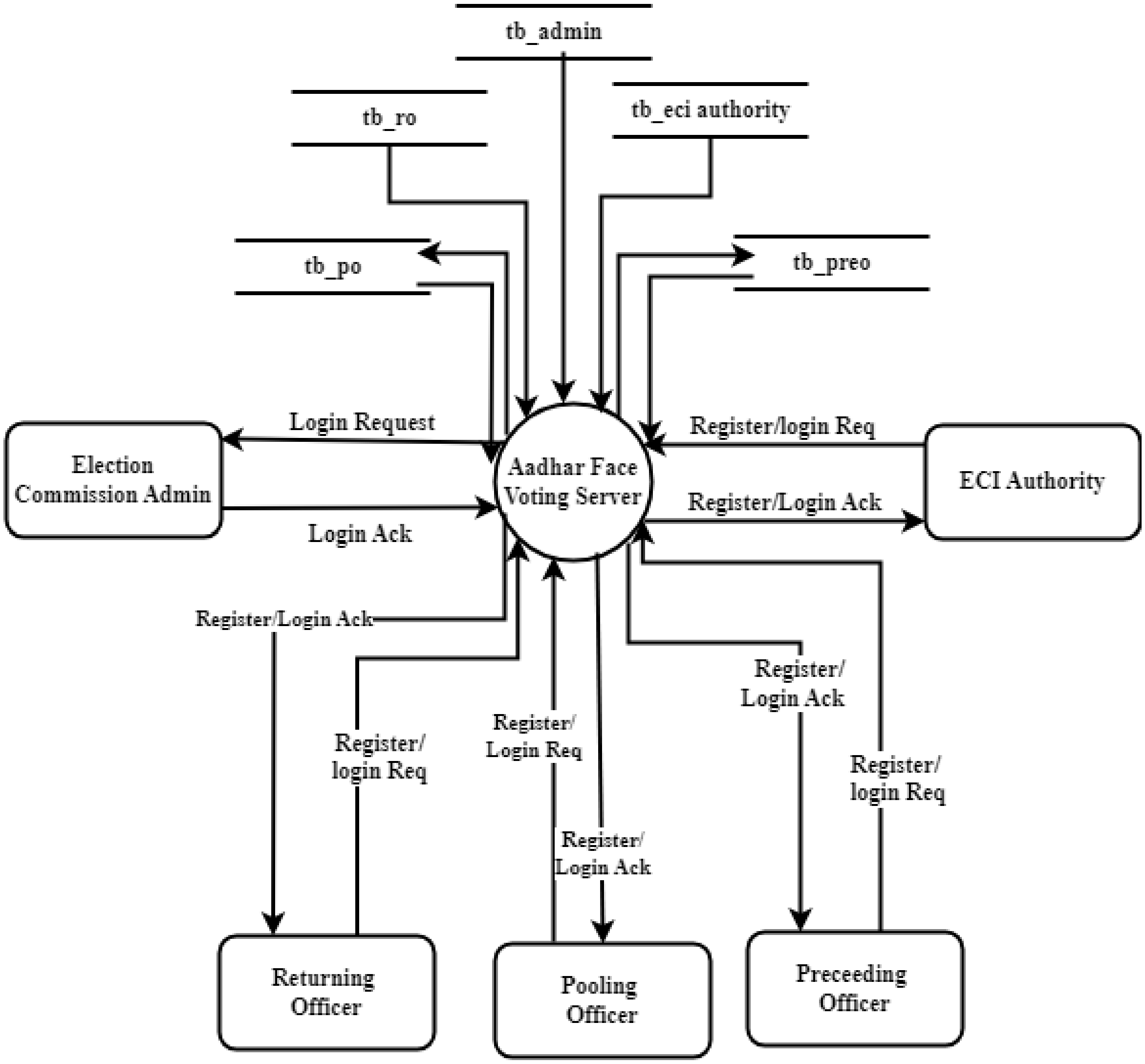
SYSTEM DESIGN

5.1. SYSTEM ARCHITECTURE



5.2. DATA FLOW DIAGRAM

LEVEL 0



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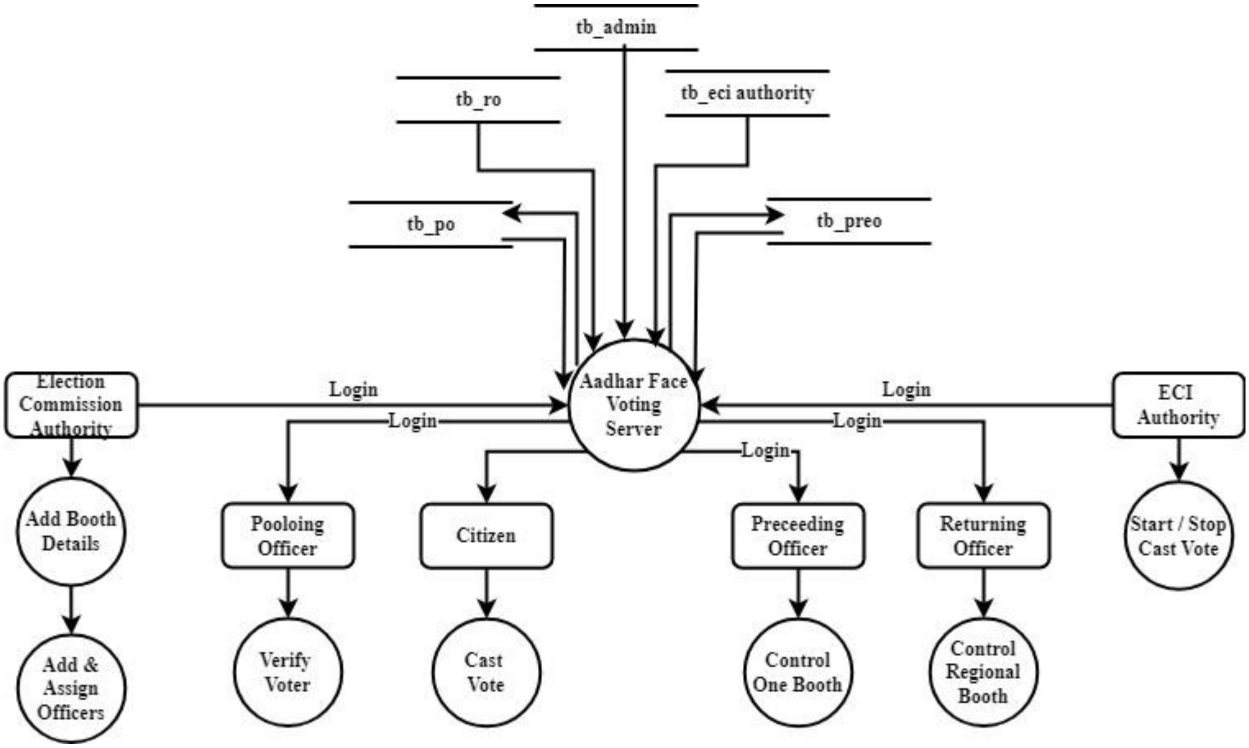
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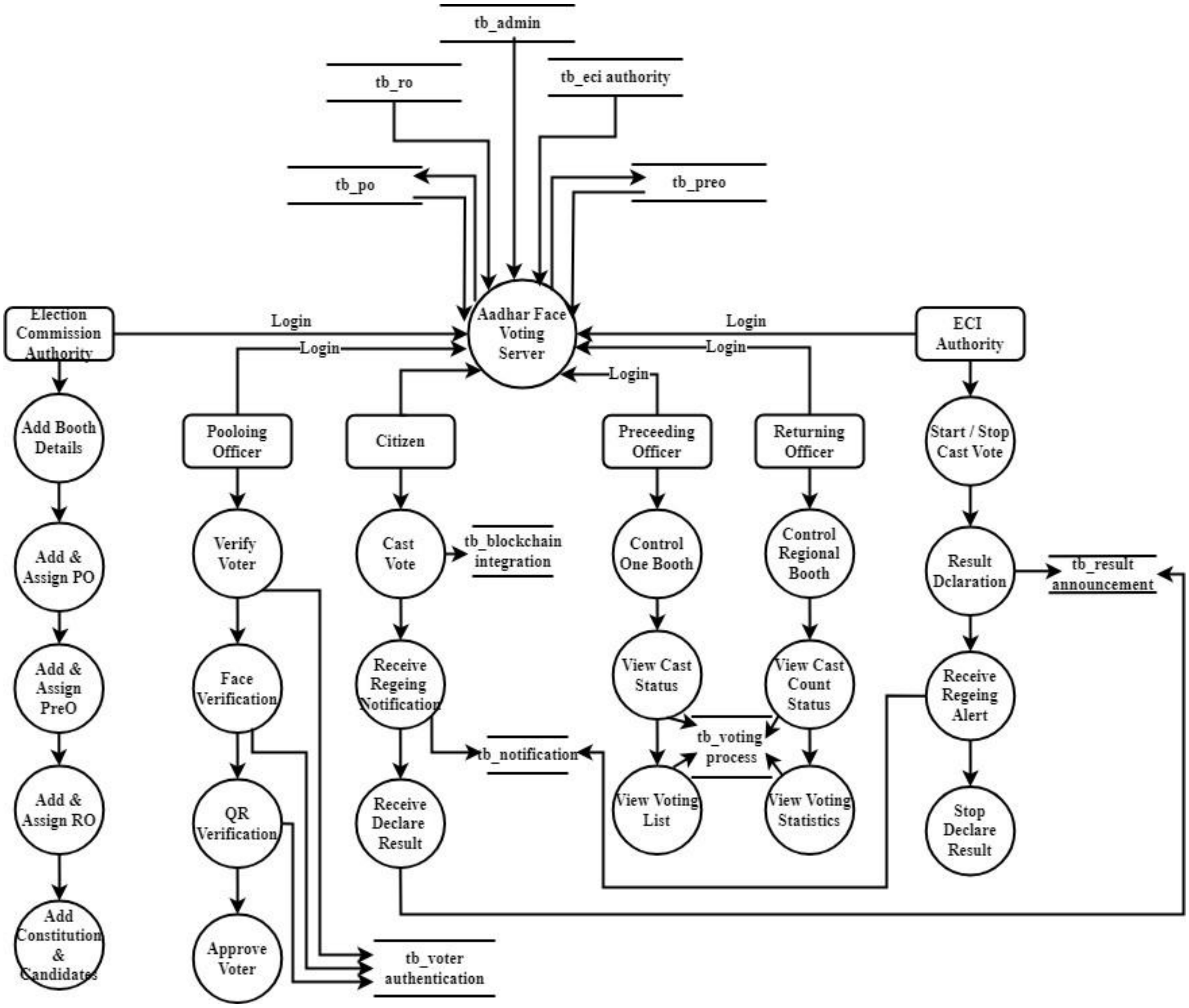
tb_ro
tb_eci authority
tb_po
tb_preo
Election Commission Authority
Login
Aadhar Face Voting Server
Login
ECI Authority
Login
Login
Login
Add Booth Details
Pooloing Officer
Citizen
Preceeding Officer
Returning Officer
Start / Stop Cast Vote
Add & Assign Officers
Verify Voter
Cast Vote
Control One Booth
Control Regional Booth

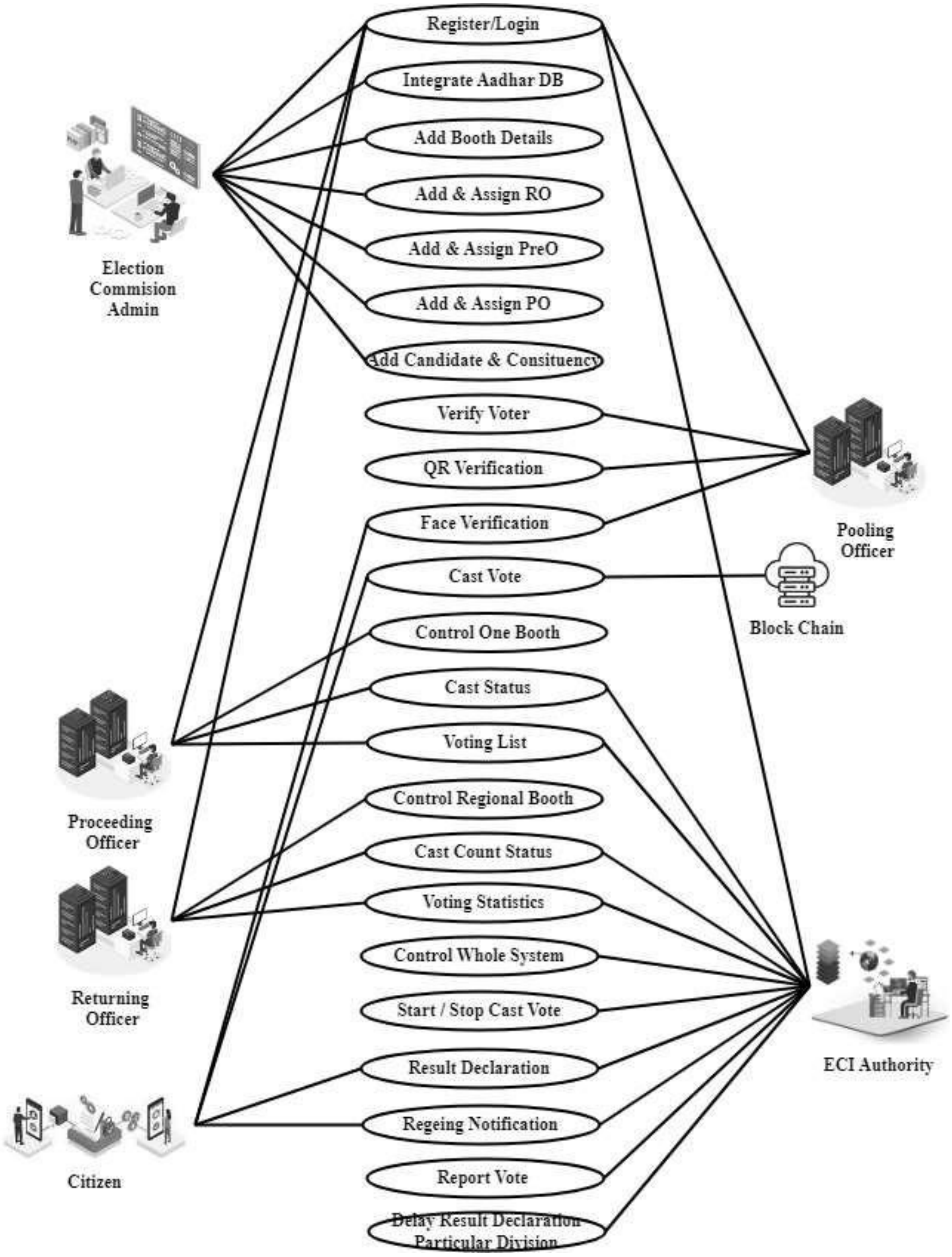
LEVEL 2



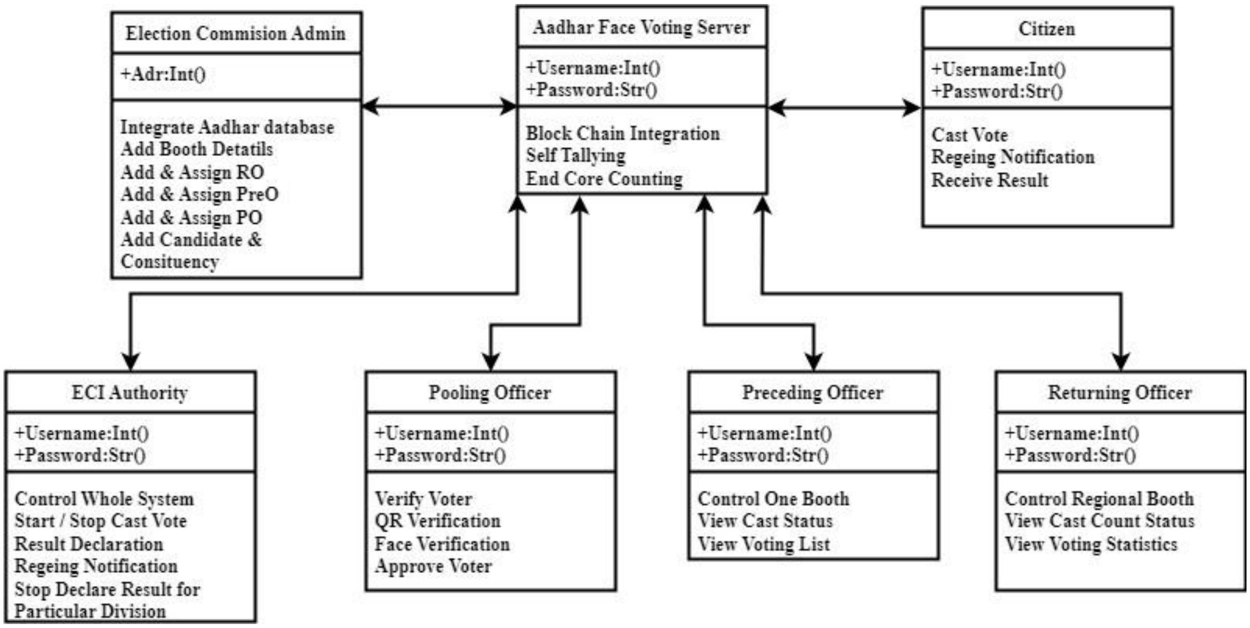
tb_admin
tb_ro
tb_eci authority
tb_po
tb_preo
Election Commission Authority
Login
Login
Aadhar Face Voting Server
Login
Login
Login
ECI Authority
Add Booth Details
Pooloing Officer
Citizen
Preceeding Officer
Returning Officer
Start / Stop Cast Vote
Add & Assign PO
Verify Voter
Cast Vote
tb_blockchain integration
Control One Booth
Control Regional Booth
Result Dclaration
tb_result announcement
Add & Assign PreO
Face Verification
Receive Regeing Notification
View Cast Status
View Cast Count Status
Receive Regeing Alert
tb_voting process
tb_notification
Add & Assign RO
QR Verification
Receive Declare Result
View Voting List
View Voting Statistics
Stop Declare Result
Add Constitution & Candidates
Approve Voter
tb_voter authentication

5.3. UML DIAGRAM

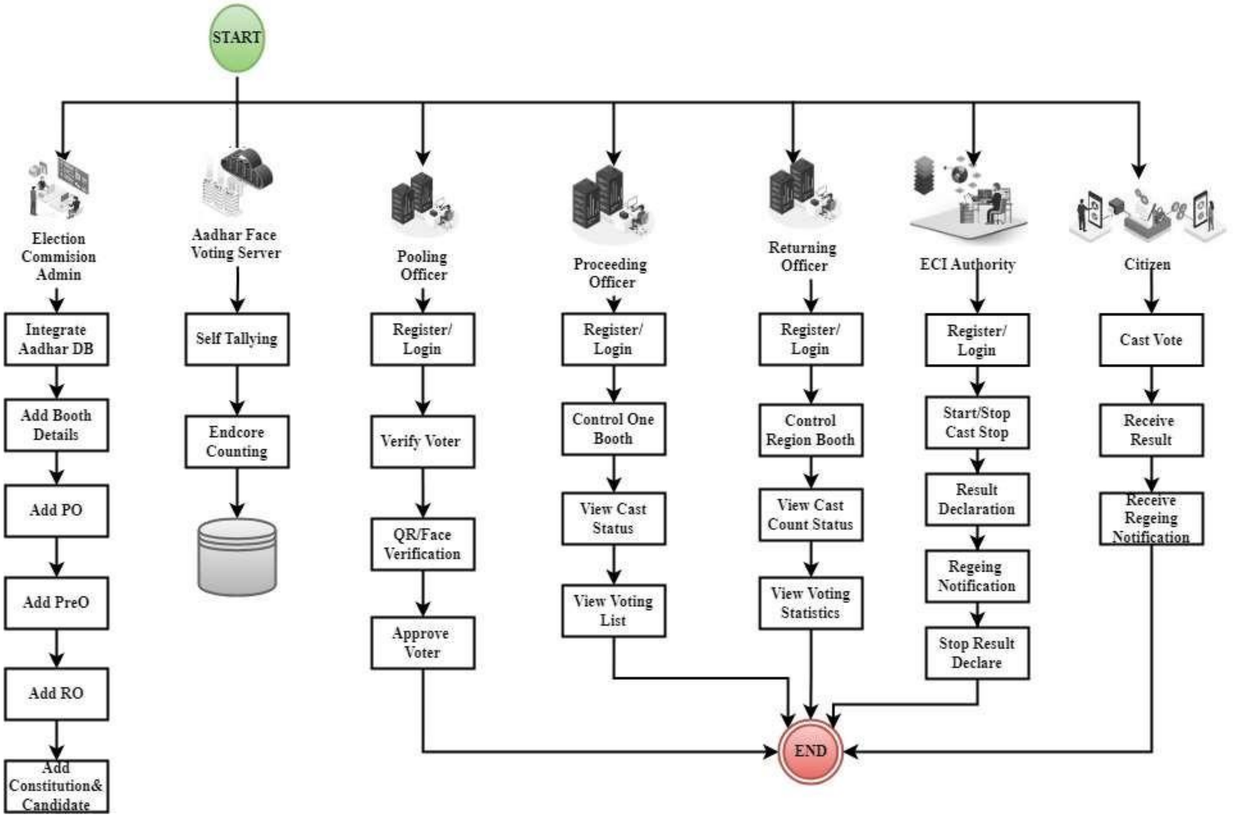
5.3.1. USE CASE



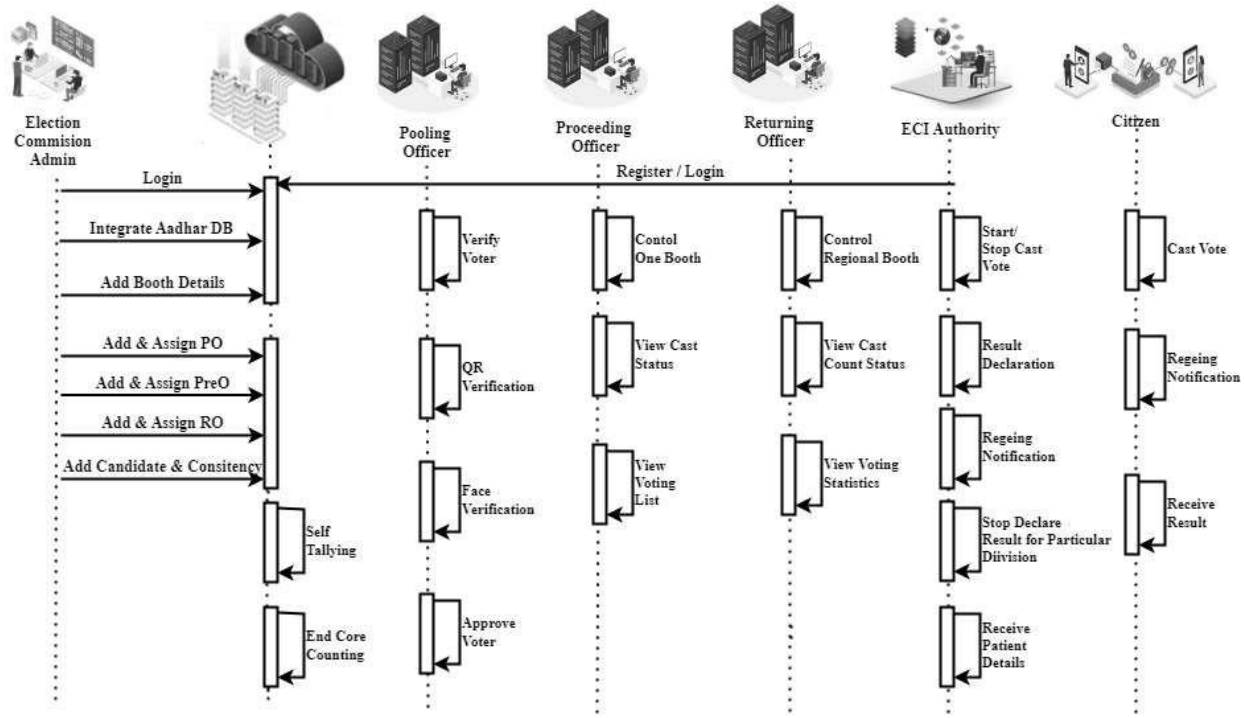
5.3.2. CLASS DIAGRAM



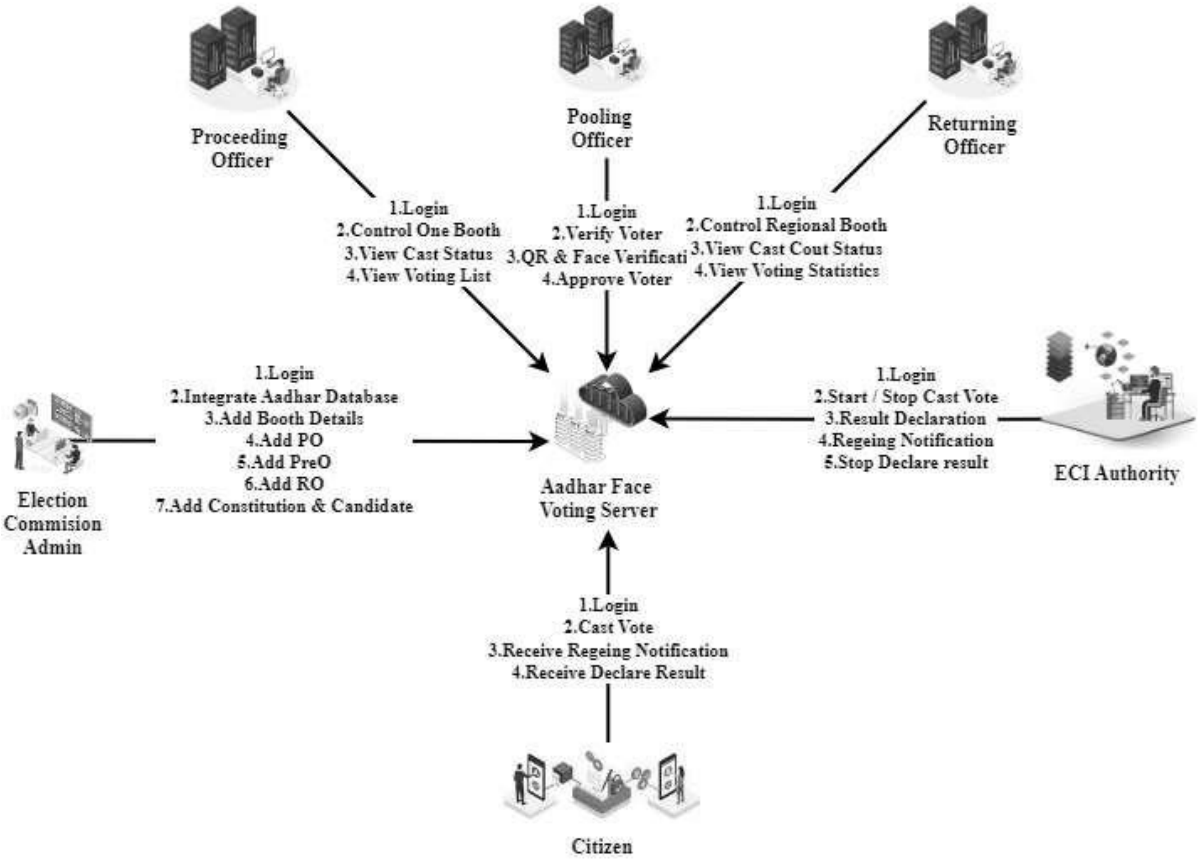
5.3.3. ACTIVITY DIAGRAM



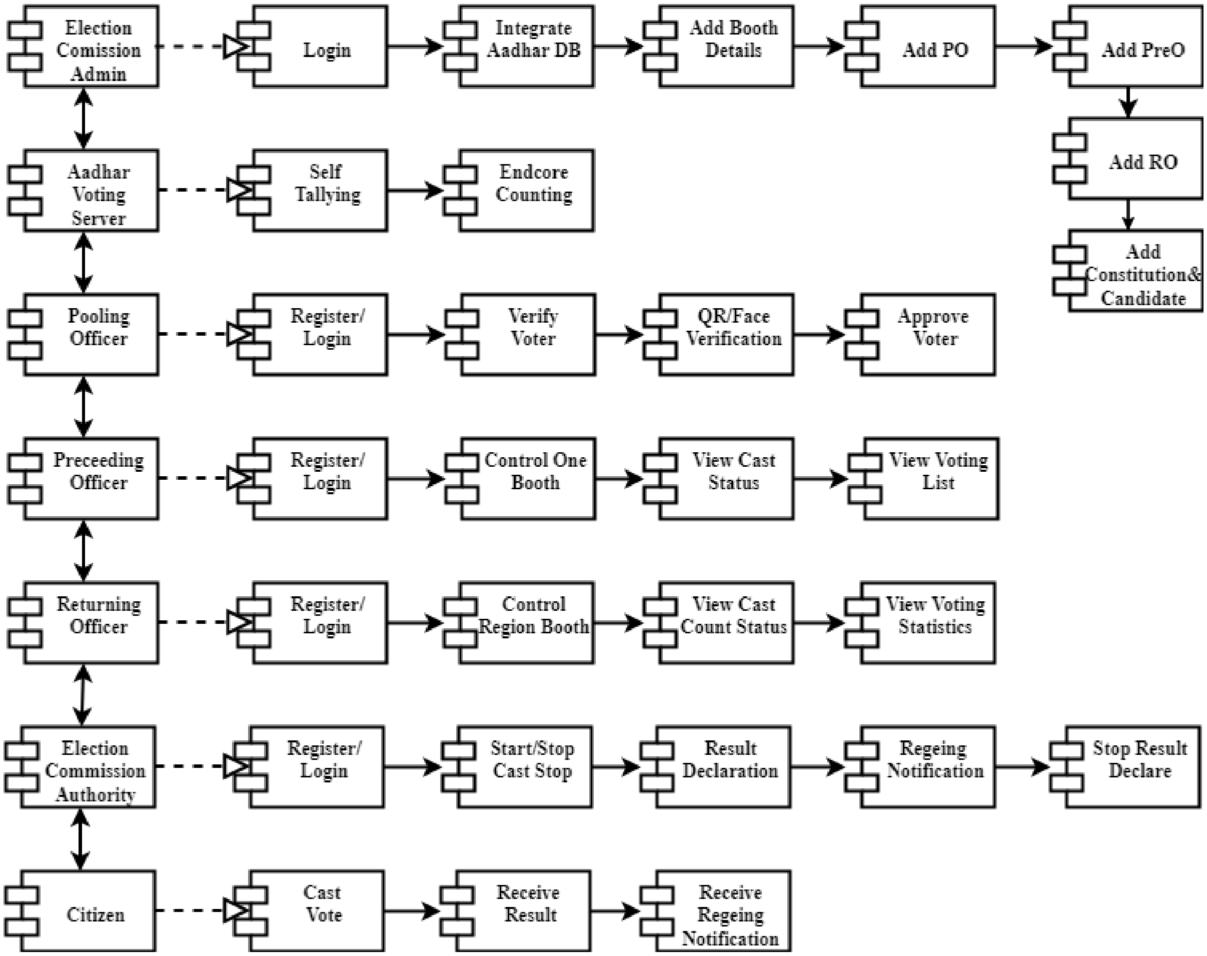
5.3.4. SEQUENCE DIAGRAM



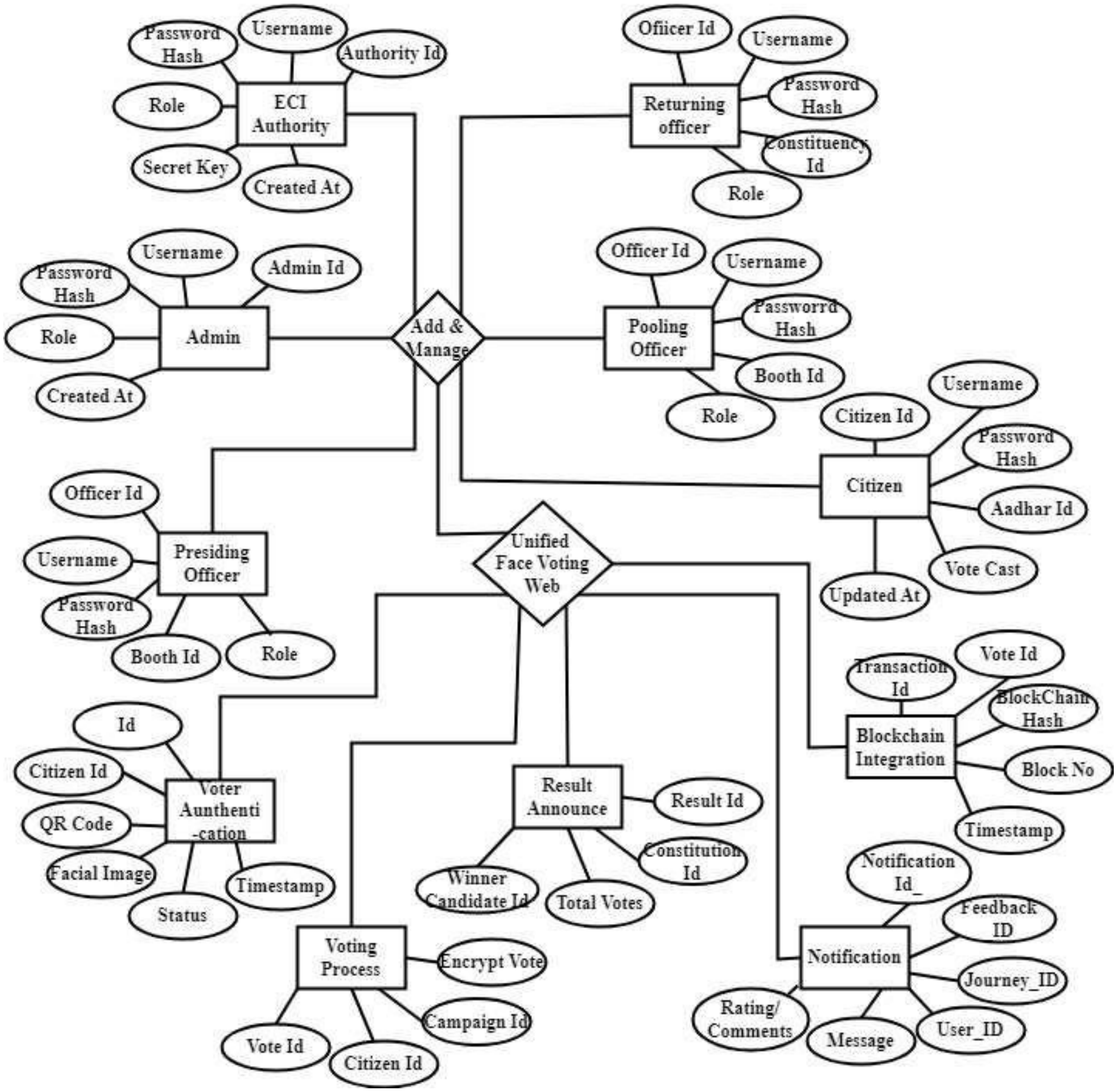
5.3.5. COLLABORATION DIAGRAM



5.3.6. COMPONENT DIAGRAM



5.4. ER DIAGRAM



CHAPTER 6

SYSTEM TESTING

6.1. SOFTWARE TESTING

Software testing is a critical phase in the development of the blockchain-based online voting system, ensuring its reliability, functionality, and security. The testing process validates the system's ability to meet user requirements, function seamlessly under various conditions, and protect sensitive voter data.

6.1.1. Testing Techniques

- **Unit Testing**

Unit testing focuses on individual components of the system, such as voter authentication, blockchain hash generation, and vote submission. Each unit is independently validated to ensure it functions as intended. For example, voter registration is tested by providing valid Aadhar numbers and verifying successful registration messages.

- **Integration Testing**

This technique ensures that modules like voter authentication, vote casting, and blockchain storage interact correctly. For instance, data flow from the front-end to the blockchain is tested to verify accurate vote recording.

- **System Testing**

System testing evaluates the system as a whole, ensuring it meets both functional and non-functional requirements. Functional testing validates core operations, such as user registration and vote tallying, while non-functional testing assesses performance, scalability, and security under varying conditions.

- **Regression Testing**

Regression testing is conducted to confirm that changes or updates to the system do not adversely impact existing functionalities. Automated testing tools like Selenium are often used to streamline this process.

- **Security Testing**

Security testing identifies vulnerabilities and ensures the system is resistant to threats like unauthorized access or SQL injection. It involves penetration testing, encryption validation, and assessments for secure hash generation to protect voter and election data.

- **Usability Testing**

Usability testing verifies that the system is user-friendly and accessible. This includes assessing the ease of navigation, clarity of instructions, and efficiency in completing the voting process.

6.1.2. Performance Testing

Performance testing is conducted to ensure the system performs efficiently under varying load conditions. Metrics like response time and transaction throughput are evaluated during peak voting periods. Load testing with tools like Apache JMeter helps determine the system's ability to handle thousands of concurrent users without performance degradation.

6.2. TEST CASES

1. Test Case ID: BV001

Input: Enter a valid Aadhar number, name, and date of birth during voter registration.

Expected Result: Voter registration is successful, and a confirmation message is displayed.

Actual Result: Voter registration completed successfully, and confirmation message displayed.

Pass: Yes

2. Test Case ID: BV002

Input: Enter an invalid Aadhar number (e.g., less than 12 digits).

Expected Result: The system displays an error message: "Invalid Aadhar number. Please try again."

Actual Result: Error message displayed as expected.

Pass: Yes

3. Test Case ID: BV003

Input: Login using a registered Aadhar number and valid OTP.

Expected Result: The user is successfully logged in and redirected to the voting page.

Actual Result: User login successful, and voting page displayed.

Pass: Yes

4. Test Case ID: BV004

Input: Login using an incorrect OTP.

Expected Result: The system displays an error message: "Invalid OTP. Please try again."

Actual Result: Error message displayed as expected.

Pass: Yes

5. Test Case ID: BV005

Input: Select a candidate and click "Submit Vote."

Expected Result: The vote is cast successfully, and a confirmation message is displayed.

Actual Result: Vote successfully cast, and confirmation message displayed.

Pass: Yes

6. Test Case ID: BV006

Input: Attempt to vote twice using the same Aadhar number.

Expected Result: The system displays an error message: "You have already voted."

Actual Result: Error message displayed as expected.

Pass: Yes

7. Test Case ID: BV007

Input: Submit a vote and verify its hash in the blockchain ledger.

Expected Result: The hash is generated and stored in the blockchain ledger.

Actual Result: Hash successfully generated and stored in the blockchain.

Pass: Yes

8. Test Case ID: BV008

Input: Attempt to manually tamper with the blockchain hash.

Expected Result: The system detects tampering and raises an alert.

Actual Result: Tampering detected, and alert raised.

Pass: Yes

9. Test Case ID: BV009

Input: Simulate 5,000 concurrent users logging in and casting votes.

Expected Result: The system remains responsive, with no downtime or errors.

Actual Result: System performed efficiently under concurrent load.

Pass: Yes

10. Test Case ID: BV010

Input: Simulate a network failure during vote submission.

Expected Result: The system queues the vote and submits it once the network is restored.

Actual Result: Vote successfully queued and submitted after network restoration.

Pass: Yes

6.3. TEST REPORT

Introduction

The purpose of this test report is to present the results and conclusions of the comprehensive testing conducted on the Blockchain-Based Online Voting System. The system leverages blockchain technology to ensure secure, transparent, and tamper-proof voting. The primary goal of the testing was to validate the system's ability to accurately handle voter registration, vote casting, and data integrity via blockchain while ensuring it meets performance, security, and usability requirements. **Test Objective**

The objective of the testing was to ensure that the Blockchain-Based Online Voting System performs as expected across various components, including user authentication, vote recording, and blockchain integrity. Specifically, the system's functionality was tested to verify that votes are securely recorded, voter information is protected, and that the blockchain technology used for vote recording is tamper-resistant.

Test Scope

- **Voter Registration**: Verifying the user registration process with Aadhar and OTP-based authentication.
- **Voting Mechanism**: Ensuring votes are securely cast and recorded on the blockchain.
- **Blockchain Integrity**: Verifying that the blockchain technology maintains vote integrity and prevents tampering.
- **Security**: Ensuring that all personal information and votes are secure and private.
- **User Interface**: Testing the registration, voting process, and results visualization to ensure a smooth user experience.
- **Performance**: Validating the system’s ability to handle a high volume of users and votes without performance degradation.

Test Environment

- **Operating System**: Windows 10
- **Web Browsers**: Google Chrome, Mozilla Firefox, Microsoft Edge
- **Devices**: Desktop computer, laptop, mobile devices
- **Database**: MySQL
- **Blockchain**: Ethereum
- **Testing Tools**: Postman, Python, Flask

Test Conclusion

The project has successfully passed all the comprehensive testing phases, ensuring that the system functions correctly in terms of registration, vote casting, and blockchain integrity. The system performed well under high traffic conditions, handled various edge cases (e.g., multiple votes, invalid data), and maintained robust security features to ensure data privacy and tamper-proof voting. The user interface proved to be intuitive and efficient.

CHAPTER 7
SYSTEM IMPLEMENTATION

7.1. SYSTEM DESCRIPTION

The Blockchain-Based E-Voting System is designed to revolutionize the electoral process by ensuring transparency, security, and accessibility. Utilizing blockchain technology, cryptographic security, and Aadhaar-based authentication, the system eliminates traditional voting challenges such as voter fraud, vote manipulation, and result delays. It features a user-friendly web-based platform with modules including ECI Dashboard, Voter Authentication, Voting Interface, and Real-time Result Display, ensuring a seamless experience for voters and election authorities. Targeting voters, election commission officials, and polling officers, the system tailors its functionalities to meet diverse electoral needs. The core of the system lies in its Blockchain Voting Ledger, which securely records and encrypts votes using SHA-256 and AES-256 cryptography, ensuring immutability and verifiability. The Voter Authentication Module leverages Facial Recognition (CNN-based), QR Code Scanning, and Aadhaar Verification to prevent duplicate and unauthorized voting. Additionally, the Self-Tallying Mechanism automates vote counting and ensures instant, tamper-proof result computation. The Vote Integrity Verifier empowers voters by allowing them to verify their recorded votes, enhancing trust in the electoral process. The Result Announcement Module provides real-time election results via a secure dashboard, ensuring full transparency. The system also includes audit logs and automated reporting tools to facilitate post-election verification and dispute resolution. Overall, the Blockchain-Based E-Voting System is a transformative solution that combines cutting-edge technology with a trustworthy and verifiable voting process, ensuring fair, efficient, and fraud-resistant elections.

7.2. MODULES DESCRIPTION

1. ECI Web Dashboard

The Election Commission of India (ECI) Web Dashboard integrates the electoral server with Aadhaar and Blockchain to conduct elections securely. The server is used to manage the registration process, ensuring voter authentication and vote immutability through blockchain.

2. End-User Module

2.1 Election Commission Admin

The Election Commission Admin (election officer) has the authority to manage election districts, add or delete booth details, and edit information such as reference numbers and booth managers. The admin can monitor voting progress in real-time during the election.

2.2 ECI Authority

The ECI Authority holds the secret key to decrypt votes stored in the blockchain (Ballotchain). The ECI Authority has exclusive rights to start and stop the voting process. After voting ends, they can close the voting and announce the winner by securely counting the votes through automated systems. Results are announced district-wise upon election commission's initiation.

2.3 Returning Officer

The Returning Officer (RO) supervises the election process in each constituency, ensuring the efficient and fair conduct of elections. The RO is responsible for accepting, scrutinizing, and confirming nomination papers. The RO allocates election symbols, supervises polling booths, and announces the final election results.

2.4 Presiding Officers

Presiding Officers oversee the entire polling process at individual polling booths. They ensure that voters can cast their votes freely and securely. After the voting process concludes, they seal the ballot boxes and deliver them to the Returning Officer for further processing.

2.5 Polling Officer

Polling Officers assist the Presiding Officer by ensuring the proper conduct of the voting process. They are responsible for verifying voter identity using Aadhaar before allowing votes to be cast into the ballot box. Each Polling Officer logs into the ballotchain dashboard to track the voting progress.

2.6 Citizen

Citizens have the ability to verify the validity of their votes on the blockchain to ensure the integrity of the voting process. This allows voters to be confident that their votes were accurately recorded and that the electoral process remains transparent.

3 Voter Authentication

This Module ensures secure and accurate voter identification by implementing a multi-level verification process. This includes scanning QR codes provided to each voter and utilizing Facial Recognition powered by Convolutional Neural Networks (CNN). The system cross-verifies the voter’s identity with the Aadhar database to ensure legitimacy, preventing fraudulent participation. By employing CNN for facial verification, the system enhances the accuracy of the identity check, reducing the risk of impersonation and ensuring only eligible voters can cast their votes. This layer of security makes the voting process more trustworthy and foolproof.

4 Voting Process

This Module allows authenticated voters to cast their votes electronically after successful verification. Once voters are authenticated, they are given access to the voting interface, where they can select their preferred candidates. The votes are encrypted using 256-bit SHA hash codes, ensuring that they are secure and tamper-proof. The encrypted votes are then stored on the blockchain, making it impossible to alter the vote once it has been cast. The use of SHA encryption provides an additional layer of security, safeguarding the vote from unauthorized access, manipulation, or corruption.

5 Blockchain Integration

This Module serves as the backbone for secure vote storage. Once the votes are encrypted and cast, they are added to the blockchain in a decentralized and distributed ledger. The blockchain’s inherent properties of data integrity, immutability, and security ensure that votes cannot be altered once they have been recorded. Each vote is linked to a unique transaction ID, creating a traceable and permanent record. The blockchain's tamper-resistant nature provides unparalleled security, making it virtually impossible for malicious actors to change or manipulate the results. This module ensures that the election process is transparent and verifiable at every step.

6 Vote Integrity Verification

This module allows voters to verify the authenticity of their vote after it has been cast. Voters are provided with a Vote Integrity Verifier Link that they can use to check if their vote has been recorded accurately on the blockchain. In case of any discrepancies or tampering, the module automatically triggers an alert or notification to the voter, notifying them of potential issues. This ensures that voters can independently verify their vote and confirms the integrity of the election process. It enhances trust in the system, giving voters peace of mind that their vote is properly counted.

7 Self-Tallying Mechanism Module

This module eliminates the need for manual vote counting at the end of the election. Once the voting period is closed, the system automatically tallies all the votes stored on the blockchain. Using automated algorithms, the module quickly aggregates the results, ensuring that there are no delays in vote counting or errors in the process. This mechanism significantly reduces human intervention, making the process more efficient and error-free. It allows for a faster and more accurate result declaration, ensuring that the election results are available on the same day.

8 Result Announcement

This module displays the election results in real-time after the self-tallying process is completed. The results are calculated automatically by the system, and the module updates the results for the voters to view instantly. This ensures transparency in the election process, allowing all stakeholders, including voters, election officers, and the general public, to see the results without delay. This module streamlines the process of result declaration, ensuring that the outcome of the election is communicated quickly and accurately to all parties involved.

9 Notification

The SMS Notification Module serves as an additional layer of transparency and security by sending instant notifications to voters if any tampering or modification of their votes is detected. In case of irregularities or suspicious activity, voters will receive an immediate alert via SMS, which will include details of the issue and actions that need to be taken. This real-time communication helps maintain the transparency of the election, keeping voters informed about the status of their vote and the integrity of the voting process.

10 Audit and Reporting

This module is designed to ensure complete transparency and accountability throughout the election process. It generates detailed reports and audit logs that capture every aspect of the voting system, from voter verification to voting activity and vote tallying. These logs include information such as voter authentication timestamps, the exact votes cast, and any modifications or discrepancies detected in the system. The module provides a comprehensive audit trail, which can be reviewed by election authorities, independent auditors, or stakeholders, ensuring that the election was conducted fairly and without tampering. It offers a transparent overview of the entire voting process, reinforcing the integrity of the system. This module is crucial for maintaining trust in the electoral system and providing verifiable records for future scrutiny or investigations.

CHAPTER 8
FEASIBILITY STUDY

8.1. Technical Feasibility

The required technologies Python, Flask, MySQL, TensorFlow, Keras, OpenCV, and blockchain are widely available and suitable for the project. Python and Flask provide scalable backend development, while TensorFlow and Keras support accurate face recognition with CNNs. Blockchain ensures secure, transparent voting, and OpenCV enables real-time authentication. Skilled developers with expertise in these technologies are readily available for integration and implementation.

8.2. Economic Feasibility

The economic feasibility of the project requires a thorough cost estimation for its development, deployment, maintenance, and operational expenses. The potential revenue streams, including government contracts for implementing the voting platform, maintenance agreements, and subscription services for data analysis and reporting, should be analyzed to assess the financial sustainability of the project. A cost-benefit analysis is essential to determine whether the benefits, such as enhanced security, faster voting processes, real-time results, and increased transparency, outweigh the costs associated with system development, integration, and ongoing support.

8.3. Operational Feasibility

The operational feasibility of the project requires integration with existing election infrastructure, such as Aadhar for voter identification and adaptable blockchain for regional election processes. Available resources include skilled personnel, cloud platforms, and security infrastructure. Governments must invest in server infrastructure and public access points. Stakeholder acceptance is vital, with government approval needed for compliance, and public trust ensured through transparency and pilot programs. Voter accessibility should be prioritized with outreach and education. The election commission must ensure the system meets legal standards and election norms.

CHAPTER 9

CONCLUSION

In conclusion, the project offers a secure, transparent, and efficient alternative to traditional voting systems. The system leverages blockchain technology to ensure the integrity of votes and prevent any tampering or fraud. By integrating Aadhar authentication for secure user verification and OTP for transaction validation, the system guarantees that only eligible voters participate in the election process. Additionally, the use of blockchain ensures that all votes are immutable, providing transparency and accountability in the voting process. The system is designed with several key modules, including the Voter Registration System, Vote Casting System, and Vote Verification System. Each module is carefully crafted to ensure smooth operation and secure functionality. The user-friendly interface and seamless integration with blockchain ensure a smooth experience for both voters and administrators. Through thorough testing, the system demonstrated robust performance under high traffic and successfully passed all functionality, security, and performance tests. The system's scalability allows it to handle elections of varying sizes, making it suitable for both small organizations and large-scale governmental elections. This innovative system has significant advantages over traditional voting methods, offering enhanced security, transparency, and trust. Furthermore, it can serve as the foundation for future electoral systems, reducing administrative overhead and increasing voter participation. With its potential for further development, including integration with other security measures, the Blockchain-Based Online Voting System is poised to revolutionize the voting process, ensuring a safer and more reliable electoral environment.

9.2. FUTURE ENHANCEMENT

Future enhancements for the project could focus on increasing accessibility, enhancing security, and broadening its functionality. Some potential improvements include:

- **Integration with Multi-Factor Authentication (MFA)**: Incorporating multi-factor authentication mechanisms such as one-time passwords (OTPs) or mobile app-based authentication will provide an extra layer of security to ensure voter identity verification.
- **Support for Global Elections**: The system could be expanded to support international elections by incorporating different languages, electoral laws, and cultural contexts, thus broadening its potential usage for global elections.
- **Inclusion of Voter Education Tools**: Integrating a voter education module within the platform can help inform users about the voting process, candidates, and election-related events. This could increase voter engagement and informed decision-making.
- **Real-time Election Monitoring**: Future versions of the system could include real-time monitoring and reporting features to track voting progress and results. This can help election officials ensure the integrity of the voting process.
- **Integration with Digital Identity Systems**: Integrating with decentralized identity systems, such as Decentralized Identifiers (DIDs), can offer a more secure, user-controlled way to verify voter identities while respecting privacy and autonomy.
- **Post-Election Audit Capabilities**: Enabling the system to support transparent, blockchain-backed audit trails of the entire election process can help validate results and increase public trust in the election system.
- **Integration with Election Commission Systems**: The system can be integrated with national and local election commission systems to streamline election data management, reporting, and compliance with electoral regulations.
- **Mobile Voting Support**: Future enhancements could include a mobile app, allowing voters to cast their votes from smartphones. This would make the system more accessible, especially for voters in remote areas or those with disabilities.

APPENDICES

Packages

Face Template – Training

```
#Preprocessing
@app.route('/view_photo',methods=['POST','GET'])
def view_photo():
ff1=open("photo.txt","w")
ff1.write("1")
ff1.close()
vid=""
value=[]
if request.method=='GET':
vid = request.args.get('vid')
mycursor = mydb.cursor()
mycursor.execute("SELECT * FROM vt_face where vid=%s",(vid, ))
value = mycursor.fetchall()
if request.method=='POST':
print("Training")
vid=request.form['vid']
cursor = mydb.cursor()
cursor.execute("SELECT * FROM vt_face where vid=%s",(vid, ))
dt = cursor.fetchall()
for rs in dt:
##Preprocess
path="static/frame/"+rs[2]
path2="static/process1/"+rs[2]
mm2 = PIL.Image.open(path).convert('L')
rz = mm2.resize((200,200), PIL.Image.ANTIALIAS)
rz.save(path2)
'''img = cv2.imread(path2)
dst = cv2.fastNlMeansDenoisingColored(img, None, 10, 10, 7, 15)
```

```
path3="static/process2/"+rs[2]
cv2.imwrite(path3, dst)'''
img = cv2.imread(path2)
gray = cv2.cvtColor(img,cv2.COLOR_BGR2GRAY)
ret, thresh = cv2.threshold(gray,0,255,cv2.THRESH_BINARY_INV+cv2.THRESH_OTSU)
# noise removal
kernel = np.ones((3,3),np.uint8)
opening = cv2.morphologyEx(thresh,cv2.MORPH_OPEN,kernel, iterations = 2)
# sure background area
sure_bg = cv2.dilate(opening,kernel,iterations=3)
# Finding sure foreground area
dist_transform = cv2.distanceTransform(opening,cv2.DIST_L2,5)
ret, sure_fg = cv2.threshold(dist_transform,0.7*dist_transform.max(),255,0)
# Finding unknown region
sure_fg = np.uint8(sure_fg)
segment = cv2.subtract(sure_bg,sure_fg)
img = Image.fromarray(img)
segment = Image.fromarray(segment)
path3="static/process2/"+rs[2]
segment.save(path3)
image = cv2.imread(path2)
gray = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)
edged = cv2.Canny(gray, 50, 100)
image = Image.fromarray(image)
edged = Image.fromarray(edged)
path4="static/process3/"+rs[2]
edged.save(path4)
```

Add Voter

```
<?php
include("include/protect.php");
include("include/dbconnect.php");
```

```
extract($_REQUEST);
$rdate=date("d-m-Y");
$m=date("m");
$y=date("y");
if(isset($btn)){
$mq=mysqli_query($connect,"select max(id) from vt_voter");
$mr=mysqli_fetch_array($mq);
$id=$mr['max(id)']+1;
$vid="V".$m.$y;
$rno=str_pad($id,3,"0",STR_PAD_LEFT);
$voterid=$vid.$rno;
$pp1=substr($name,0,3);
$pp1=strtolower($pp1);
$pp2=rand(100,999);
$pass=$pp1.$pp2;
$dd=explode("-",$dob);
$dob1=$dd[2]."-".$dd[1]."-".$dd[0];
include 'phpqrcode/qrlib.php';
$text = $id;
$path = 'images/';
$fn="Q".$id.".png";
$file = $path.$fn;
// $ecc stores error correction capability('L')
$ecc = 'L';
$pixel_Size = 10;
$frame_Size = 10;
$text=$aadhar;
// Generates QR Code and Stores it in directory given
$img=QRcode::png($text, $file, $ecc, $pixel_Size, $frame_size);
$qry=mysqli_query($connect,"insert into
vt_voter(id,division,voterid,name,gender,dob,address,area,city,contact,email,aadhar,pass,rdate)
values($id,'$division','$voterid','$name','$gender','$dob1','$address','$area','$city','$contact','$ema
il','$aadhar','$pass','$rdate')");
if($qry)
{
$q3=mysqli_query($connect,"select * from vt_blockchain order by id desc limit 0,1");
$r3=mysqli_fetch_array($q3);
$prid=$r3['id'];
if($prid=="") {
$pre_hash="00000000000000000000000000000000";}
Else {
$q4=mysqli_query($connect,"select * from vt_blockchain where id=$prid");
$r4=mysqli_fetch_array($q4);
$pre_hash=$r4['hash_value'];}
$mq2=mysqli_query($connect,"select max(id) from vt_blockchain");
$mr2=mysqli_fetch_array($mq2);
$id2=$mr2['max(id)']+1;
$data="Voter ID:$voterid,Name:$name,Reg. Date:$rdate,Division:$division,Aadhar:$aadhar";
$hash=md5($data);
#$hash=bin2hex(Encode($data,"xyz"));
mysqli_query($connect,"insert into vt_blockchain(id,block_id,pre_hash,hash_value,sdata,status)
values($id2,'$id','$pre_hash','$hash','$data','reg')");
header("location:add_finger.php?id=".$id);}
?>
```

Add Dataset for Division

```
<?php
session_start();
include("include/dbconnect.php");
extract($_REQUEST);
mysqli_query($connect,"delete from vt_division");
if (isset($argv[1])){
$Filepath = $argv[1];}
```

```
elseif (isset($_GET['File'])) {
$Filepath = $_GET['File'];}
else {
if (php_sapi_name() == 'cli'){
echo 'Please specify filename as the first argument'.PHP_EOL; }
else {
echo 'Please specify filename as a HTTP GET parameter "File", e.g., "/test.php?File=test.xlsx"';}
exit;}
// Excel reader from http://code.google.com/p/php-excel-reader/
require('spreadsheet-reader-master/php-excel-reader/excel_reader2.php');
require('spreadsheet-reader-master/SpreadsheetReader.php');
date_default_timezone_set('UTC');
$StartMem = memory_get_usage();
try {
$Spreadsheet = new SpreadsheetReader($Filepath);
$BaseMem = memory_get_usage();
$Sheets = $Spreadsheet -> Sheets();
$Time = microtime(true);
$k=0;
$Spreadsheet -> ChangeSheet($Index);
$sum1=0;
$sum2=0;
$sum3=0;
$sum4=0;
$sum5=0;
$sum6=0;
$district[0]="";
$year[0]="";
foreach ($Spreadsheet as $Key => $Row) {
//echo $Key.': ';
if ($Row){
```

```
$mq = mysqli_query($connect,"select max(id) as maxid from vt_division");
$mr = mysqli_fetch_array($mq);
$id = $mr['maxid']+1;
$q1="insert into vt_division(id,district,division) values($id,'$Row[0]','$Row[1]')";
mysqli_query($connect,$q1);
}//Row
}//for }
catch (Exception $E){
//echo $E -> getMessage();}
?>
<script language="javascript">
//alert("Uploaded Successfully");
window.location.href="add_candidate.php";
</script>
```

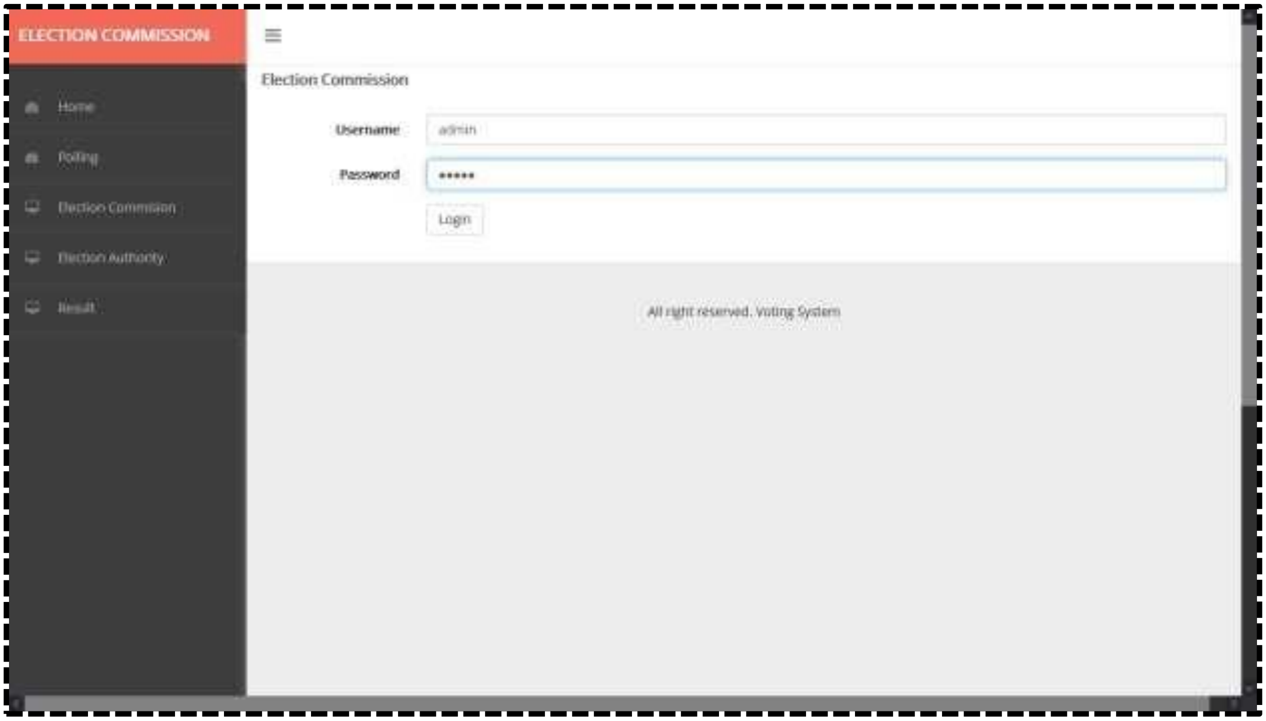
Election Process

```
<?php
$aq1=mysqli_query($connect,"select * from vt_admin where username='admin'");
$ar1=mysqli_fetch_array($aq1);
$est=$ar1['election_st'];
if($est=="1") {
$q1=mysqli_query($connect,"select * from vt_division");
while($r1=mysqli_fetch_array($q1)) {
$cap=array();
$cn=array();
$vv=array();
$cn1=array();
$cn2=array();
$vv1=array();
$vv2=array();
$q2=mysqli_query($connect,"select distinct(caption) from vt_candidate");
while($r2=mysqli_fetch_array($q2)) {
```

```
$cap[]=$r2['caption'];
$cn[]=rand(100,500);
$cn1[]=rand(5,50);
$cn2[]=rand(51,100); }
$bg1=0;
$bg2=0;
for($g=0;$g<count($cn);$g++) {
if($cn[$g]>$bg) {
$bg=$cn[$g]; }
if($cn1[$g]>$bg1) {
$bg1=$cn1[$g];}
if($cn2[$g]>$bg2{
$bg2=$cn2[$g];}}
for($k=0;$k<count($cap);$k++){
if($bg==$cn[$k]){
$capt=$cap[$k];
break;}}
for($k=0;$k<count($cap);$k++){
if($bg1==$cn1[$k]) {
$capt1=$cap[$k];
break;}}
for($k=0;$k<count($cap);$k++){
if($bg2==$cn2[$k]) {
$capt2=$cap[$k];
break;}}
$j=0;
foreach($cap as $cp) {
$vv[]=$cp."-".$cn[$j];
$vv1[]=$cp."-".$cn1[$j];
$vv2[]=$cp."-".$cn2[$j]$j++;}
$rn1=rand(10,200);
```

```
$asum=array_sum($cn);
$vnt=$asum+$rn1;
$value=implode(",",$vv);
$asum1=array_sum($cn1);
$vnt1=$asum1;
$value1=implode(",",$vv1);
$asum2=array_sum($cn2);
$vnt2=$asum2;
$value2=implode(",",$vv2);
//$rn1=rand(1500,2500);
mysqli_query($connect,"update vt_division set
vcount=0,vcount2=$vnt,detail='$value',caption='$capt',vnt1='$vnt1',vnt2='$vnt2',detail1='$value
1',caption1='$capt1',detail2='$value2',caption2='$capt2' where id=".$r1['id'].""); }
mysqli_query($connect,"update vt_admin set election_st=2 where username='admin'"); }
if($est=="2") {
$q3=mysqli_query($connect,"select * from vt_division");
$k=0;
$per_sum=0;
while($r3=mysqli_fetch_array($q3)) {
$rn1=rand(20,100);
$q4=mysqli_query($connect,"select * from vt_division where id=".$r3['id']."");
$r4=mysqli_fetch_array($q4);
$vc=$r4['vcount'];
$vc2=$r4['vcount2'];
$per=($vc/$vc2)*100;
$per1=ceil($per);
$per_sum+=$per1;
$k++;
//mysqli_query($connect,"update vt_division set percent=$per1 where id=".$r3['id'].""); }
$all_per=$per_sum/$k; } ?>
```

SCREENSHOT

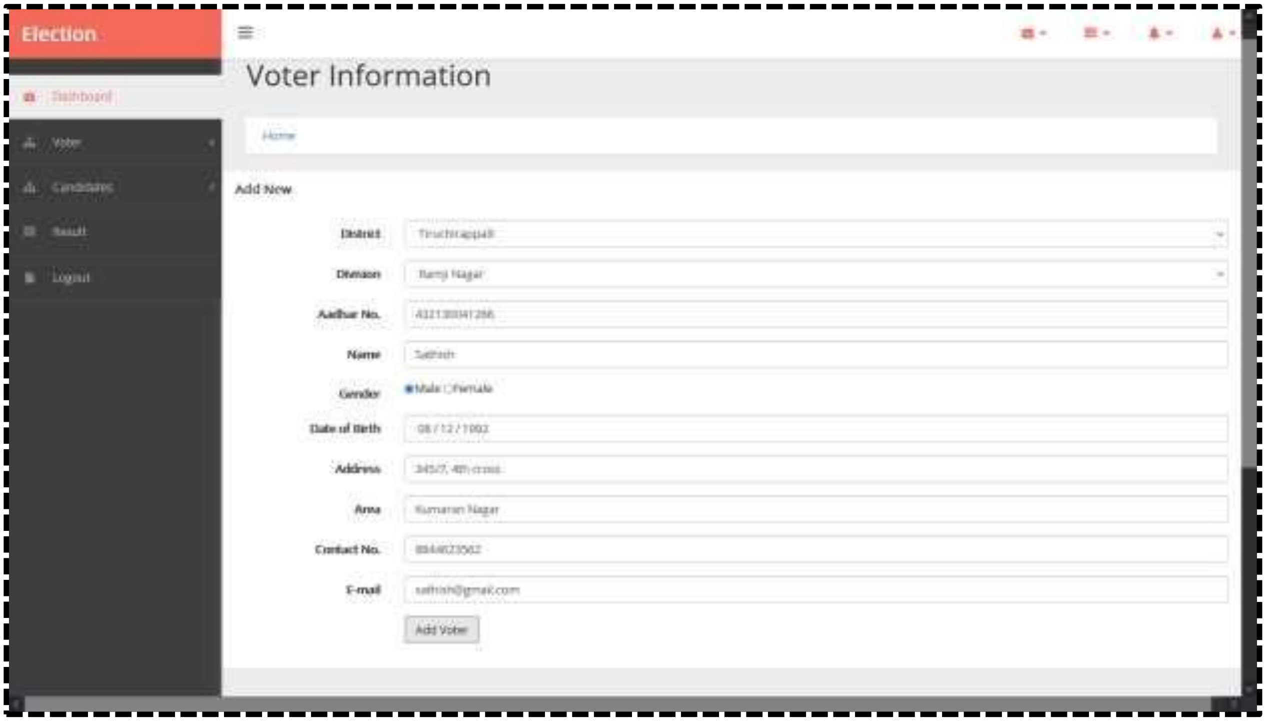


Election Commission

Username: admin

Password: *****

All right reserved. Voting System



Voter Information

Add New

District: Tiruchirappalli

Division: Ramji Nagar

Aadhar No.: 432130041266

Name: Sathish

Gender: ● Male ○ Female

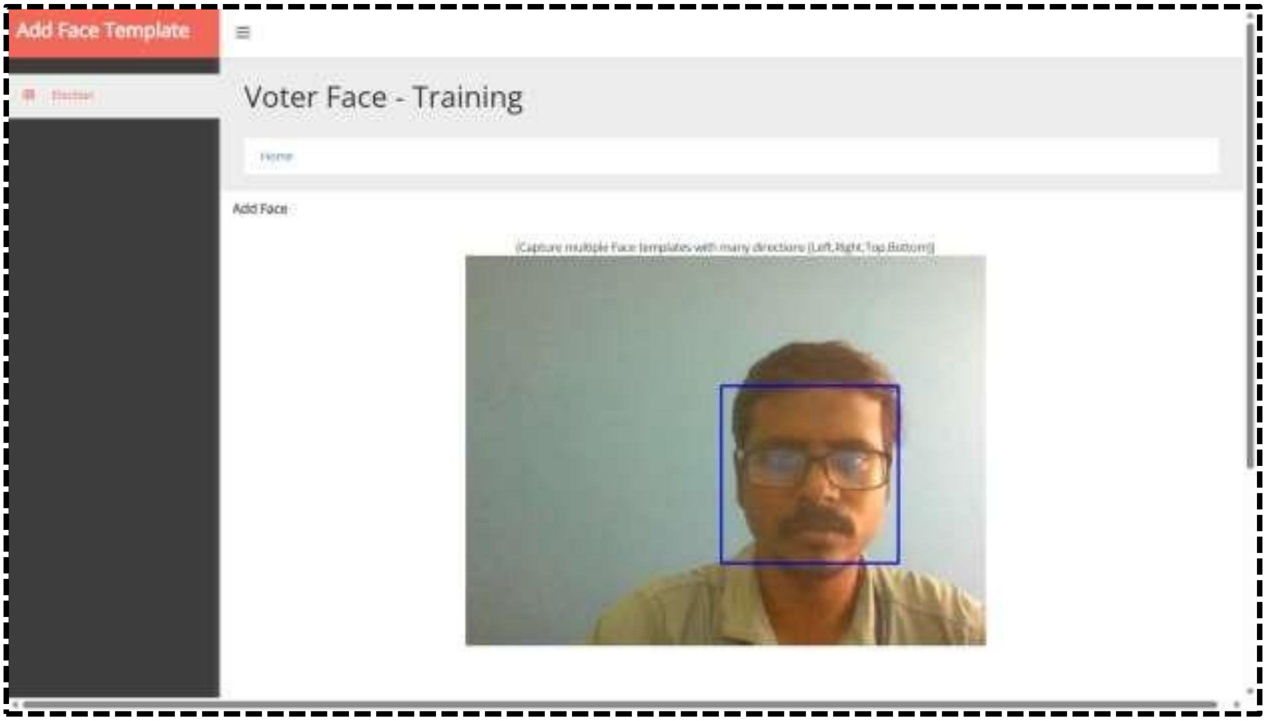
Date of Birth: 08 / 12 / 1992

Address: 345/7, 4th cross

Area: Kumaran Nagar

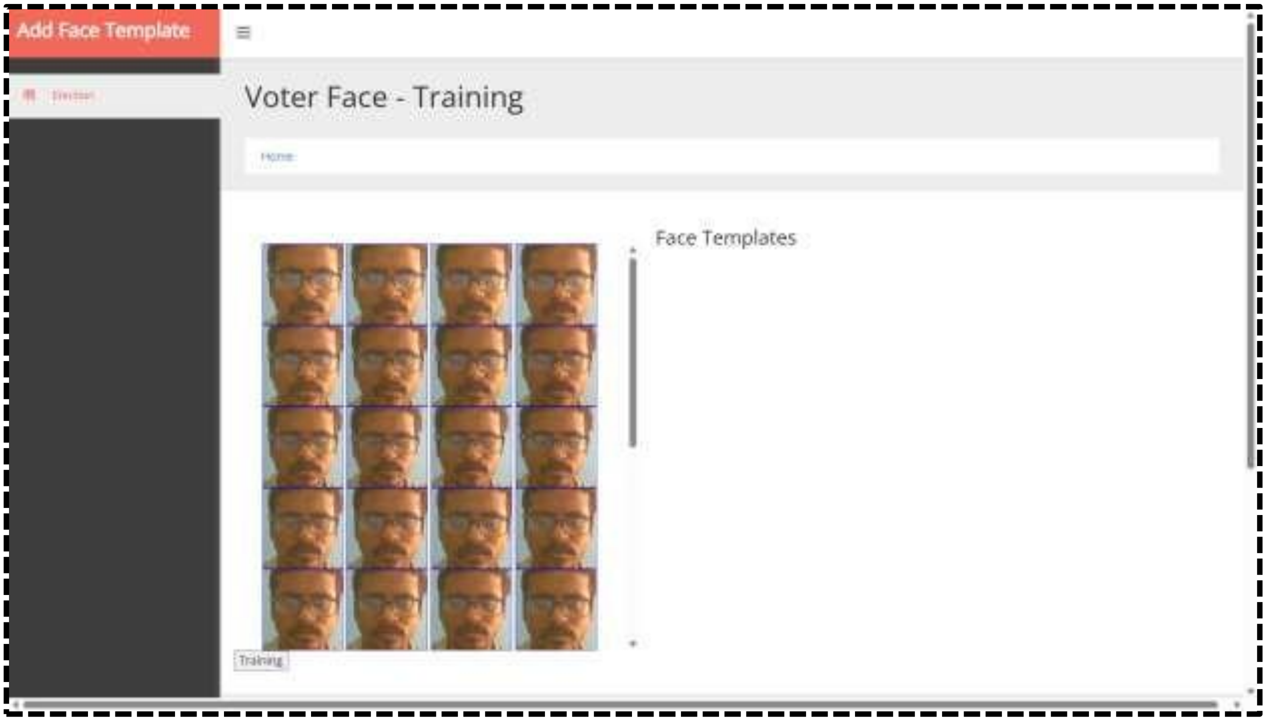
Contact No.: 8848023562

E-mail: sathish@gmail.com

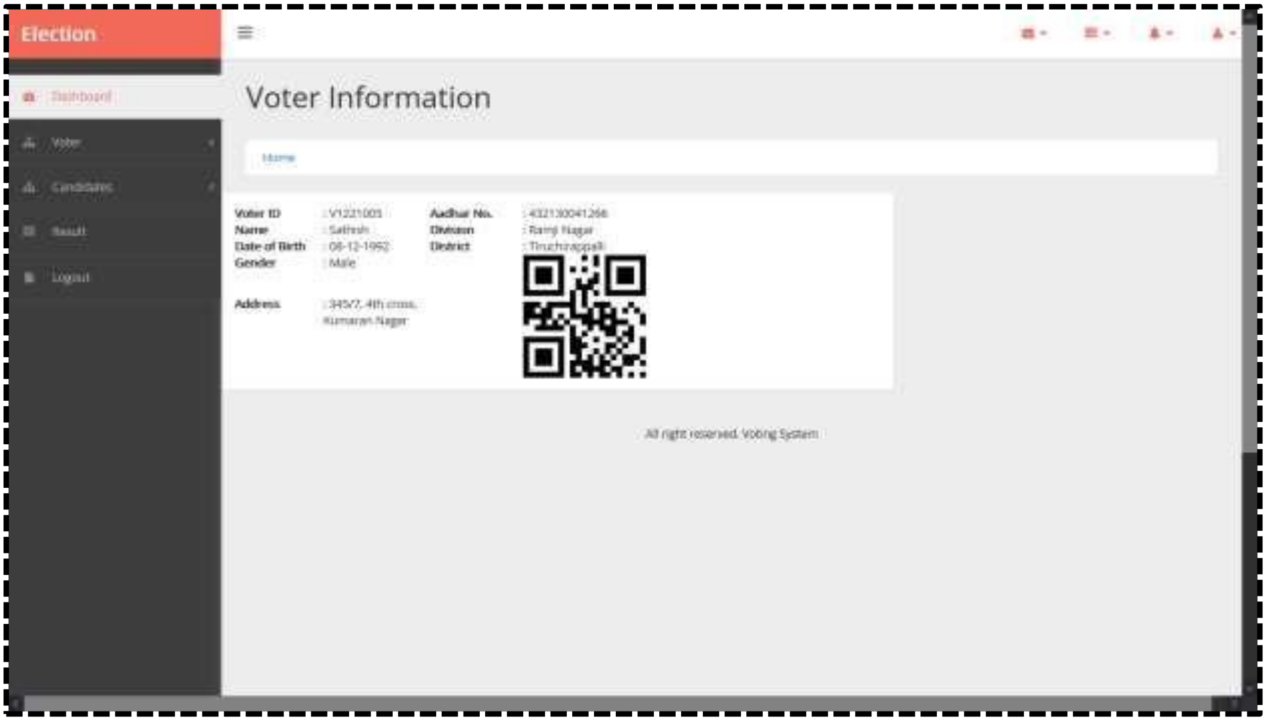


Voter Face - Training

(Capture multiple Face templates with many directions (Left,Right,Top,Bottom))



Voter Face - Training

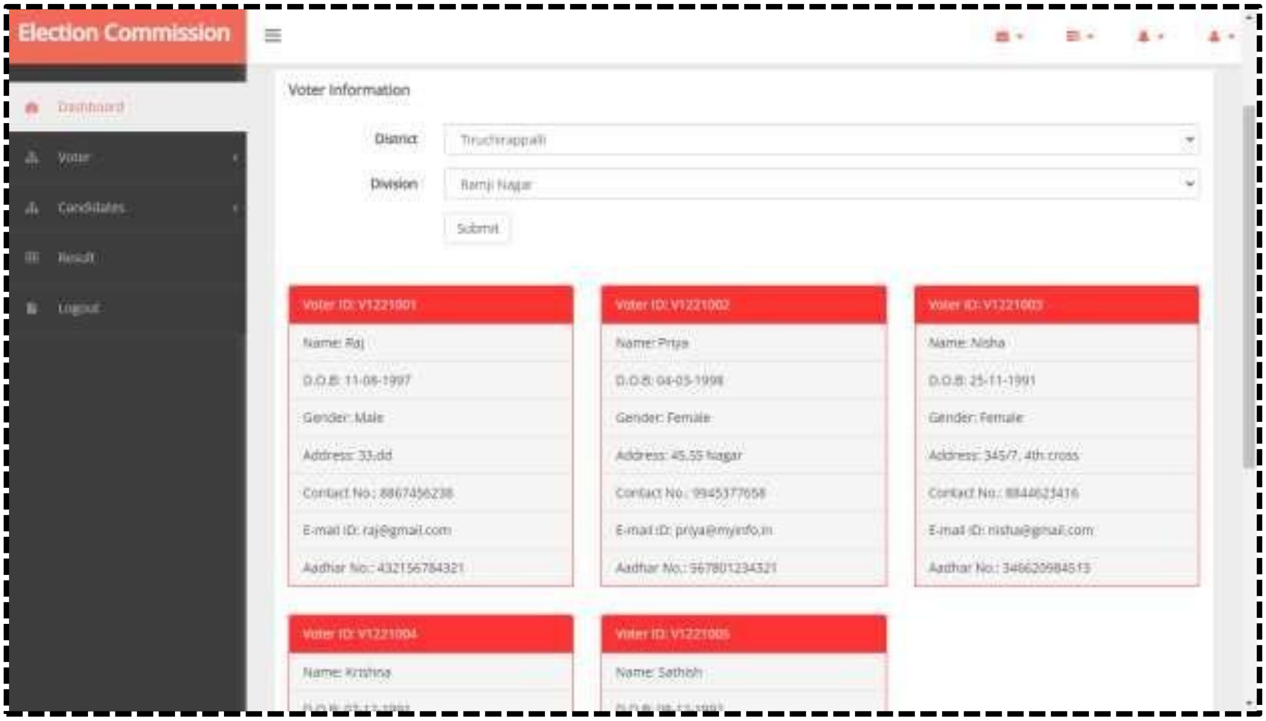


Voter Information

Voter ID : V1221005
Name : Sathish
Date of Birth : 08-12-1992
Gender : Male
Address : 345/7, 4th cross, Kumaran Nagar

Aadhar No. : 432130041266
Division : Ramji Nagar
District : Tiruchirappalli

All right reserved. Voting System



Voter Information

District Tiruchirappalli

Division Ramji Nagar

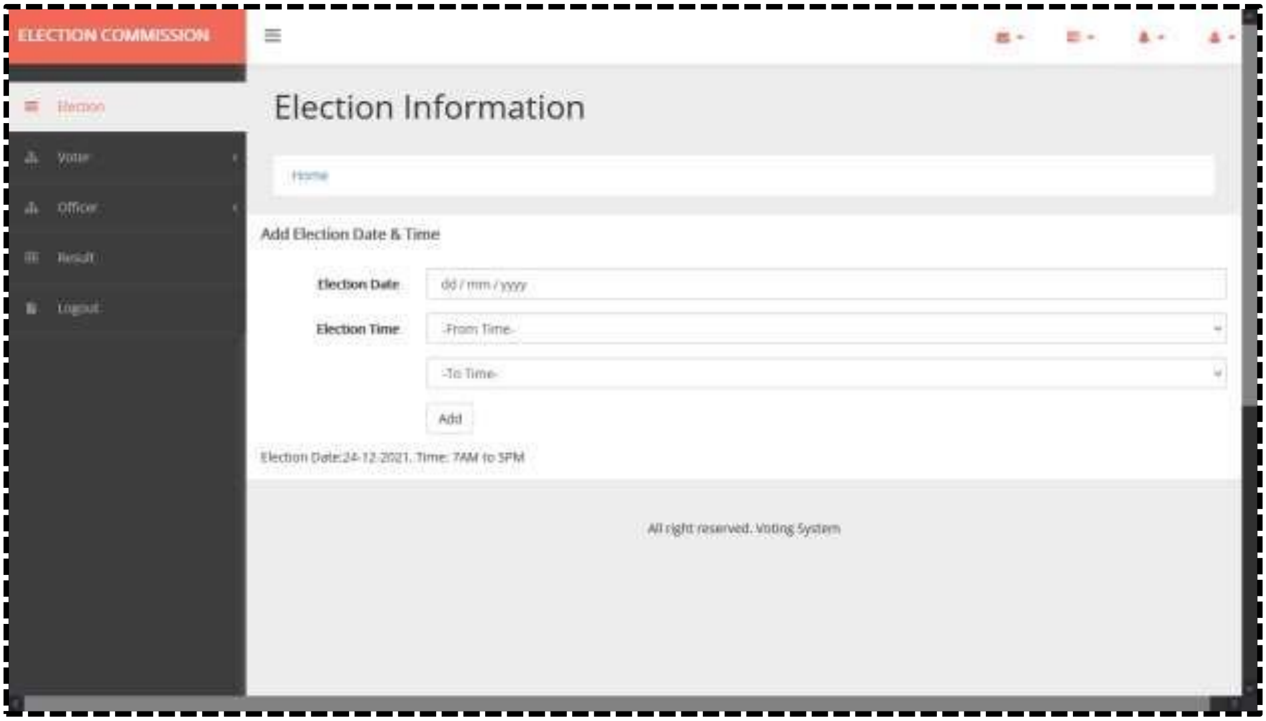
Voter ID: V1221001
Name: Raj
D.O.B: 11-08-1997
Gender: Male
Address: 33,dd
Contact No.: 8867456238
E-mail ID: raj@gmail.com
Aadhar No.: 432156784321

Voter ID: V1221002
Name: Priya
D.O.B: 04-05-1998
Gender: Female
Address: 45,55 Nagar
Contact No.: 9945377658
E-mail ID: priya@myinfo.in
Aadhar No.: 567801234321

Voter ID: V1221003
Name: Nisha
D.O.B: 25-11-1991
Gender: Female
Address: 345/7, 4th cross
Contact No.: 8844623416
E-mail ID: nisha@gmail.com
Aadhar No.: 346620984513

Voter ID: V1221004
Name: Krishna
D.O.B: 07-12-1993

Voter ID: V1221005
Name: Sathish
D.O.B: 08-12-1992



Election Information

Add Election Date & Time

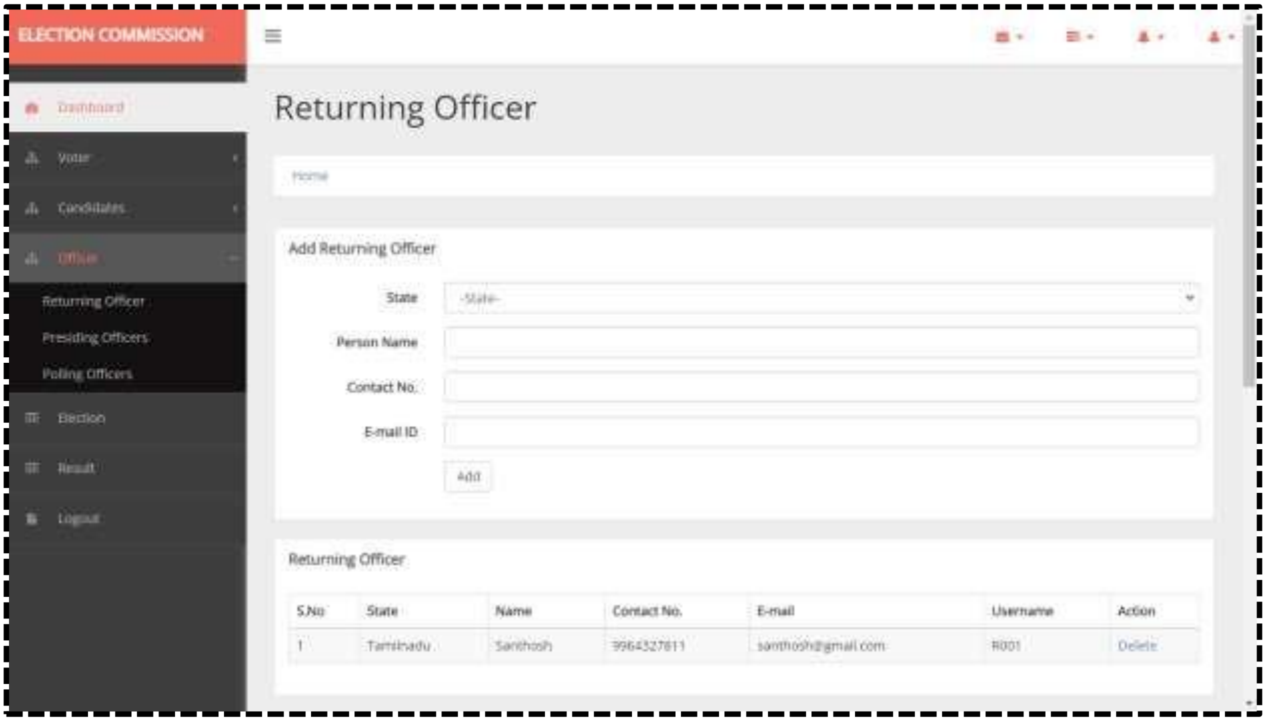
Election Date: dd / mm / yyyy

Election Time: -From Time-

-To Time-

Election Date:24-12-2021. Time: 7AM to 5PM

All right reserved. Voting System



Returning Officer

Add Returning Officer

State: -State-

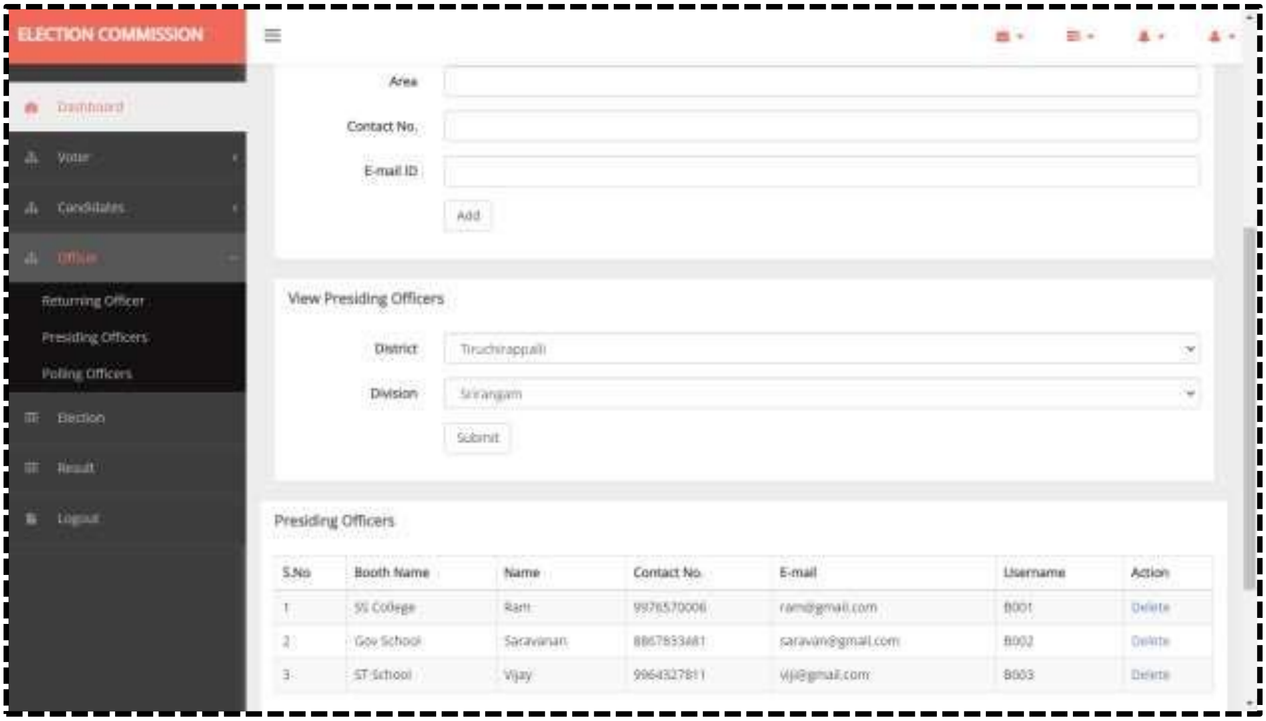
Person Name:

Contact No.:

E-mail ID:

Returning Officer

S.No	State	Name	Contact No.	E-mail	Username	Action
1	Tamilnadu	Santhosh	9964327811	santhosh@gmail.com	R001	Delete



Area

Contact No.

E-mail ID

Add

View Presiding Officers

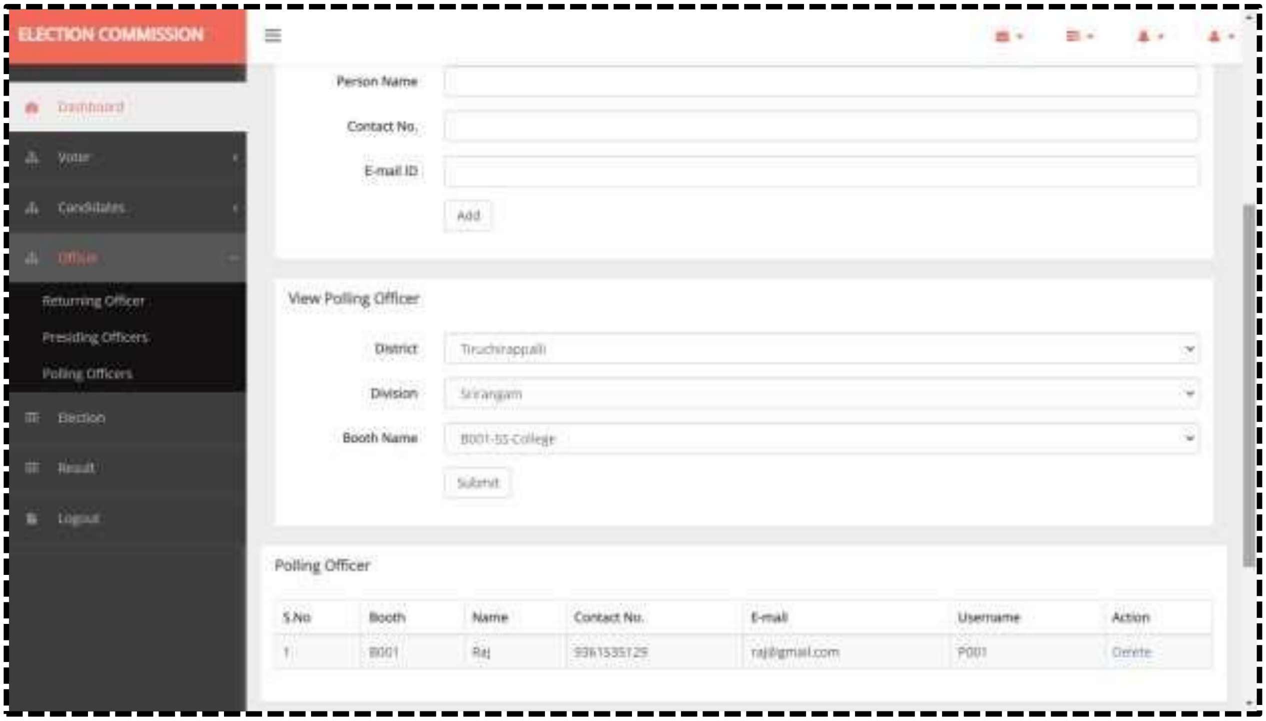
District: Tiruchirappalli

Division: Srirangam

Submit

Presiding Officers

S.No	Booth Name	Name	Contact No.	E-mail	Username	Action
1	SS College	Ram	9976570006	ram@gmail.com	B001	Delete
2	Gov School	Saravanan	8867833481	saravan@gmail.com	B002	Delete
3	ST School	Vijay	9964327811	viji@gmail.com	B003	Delete



Person Name

Contact No.

E-mail ID

Add

View Polling Officer

District: Tiruchirappalli

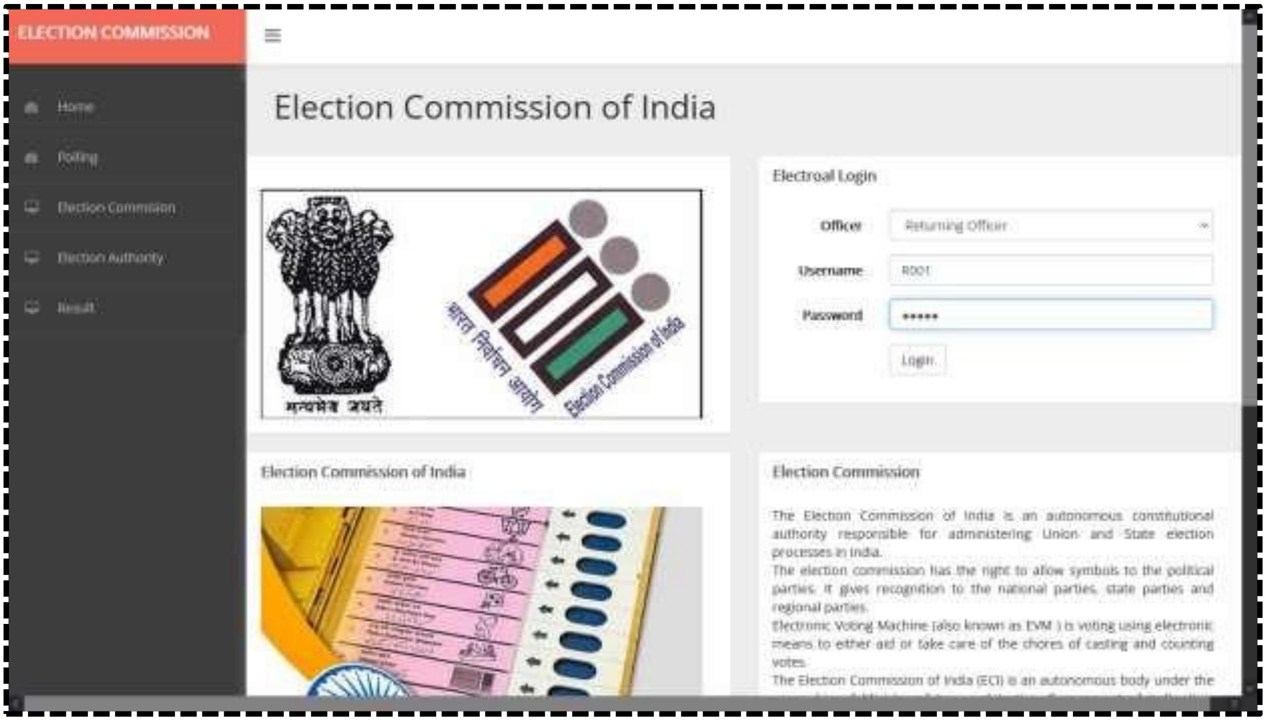
Division: Srirangam

Booth Name: B001-SS-College

Submit

Polling Officer

S.No	Booth	Name	Contact No.	E-mail	Username	Action
1	B001	Raj	9361535129	raj@gmail.com	P001	Delete



Election Commission of India

Electroal Login

Officer: Returning Officer

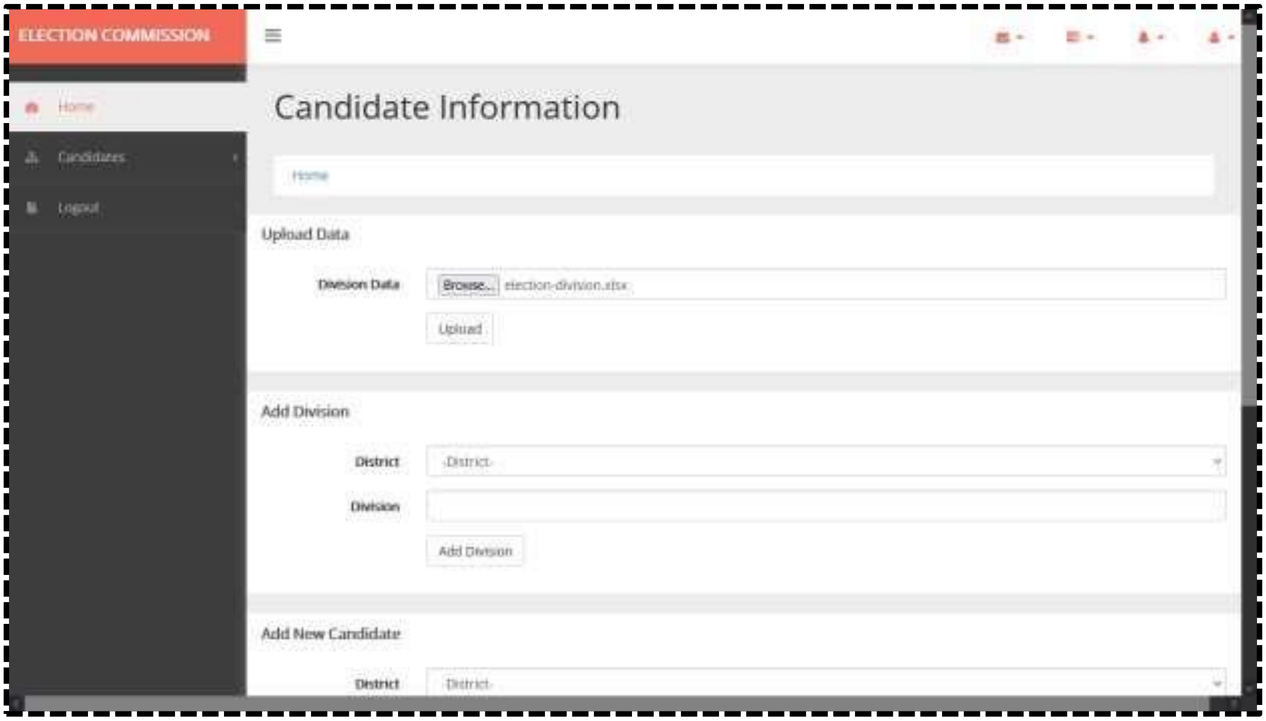
Username: R001

Password: •••••

Election Commission of India

Election Commission

The Election Commission of India is an autonomous constitutional authority responsible for administering Union and State election processes in India.
The election commission has the right to allow symbols to the political parties. It gives recognition to the national parties, state parties and regional parties.
Electronic Voting Machine (also known as EVM) is voting using electronic means to either aid or take care of the chores of casting and counting votes.
The Election Commission of India (ECI) is an autonomous body under the



Candidate Information

Upload Data

Division Data: election-division.xlsx

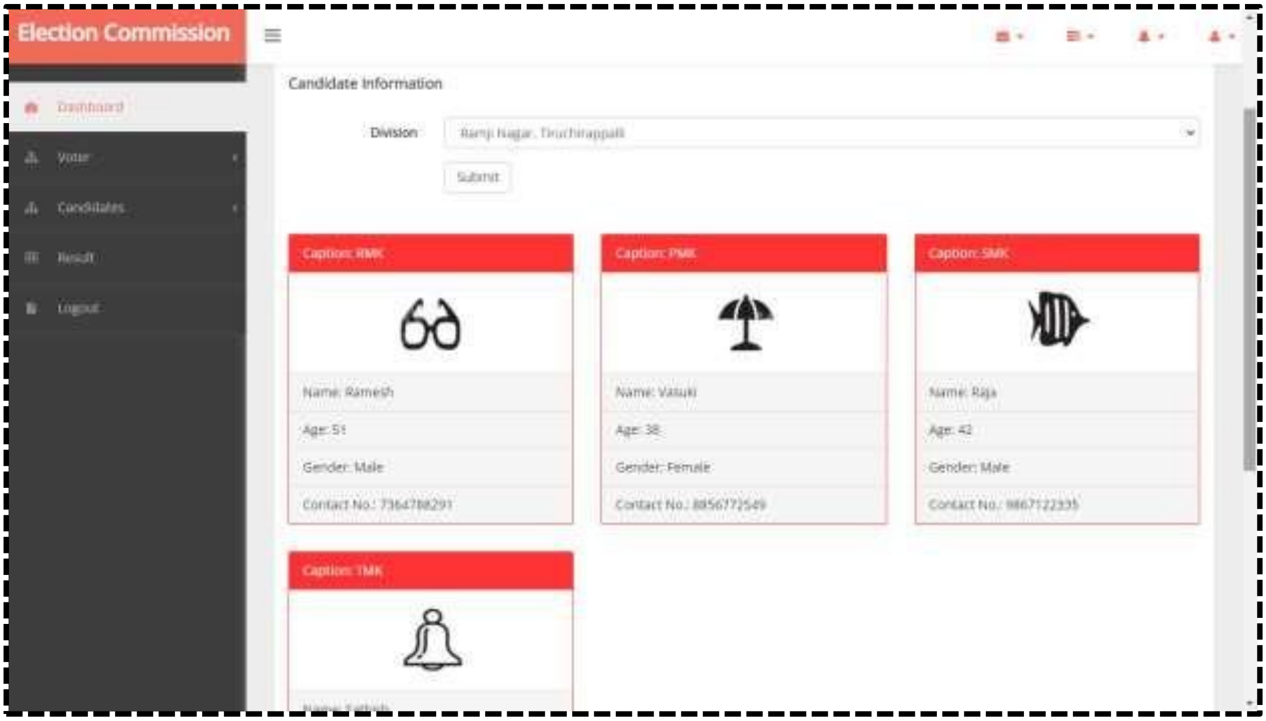
Add Division

District: -District-

Division:

Add New Candidate

District: -District-

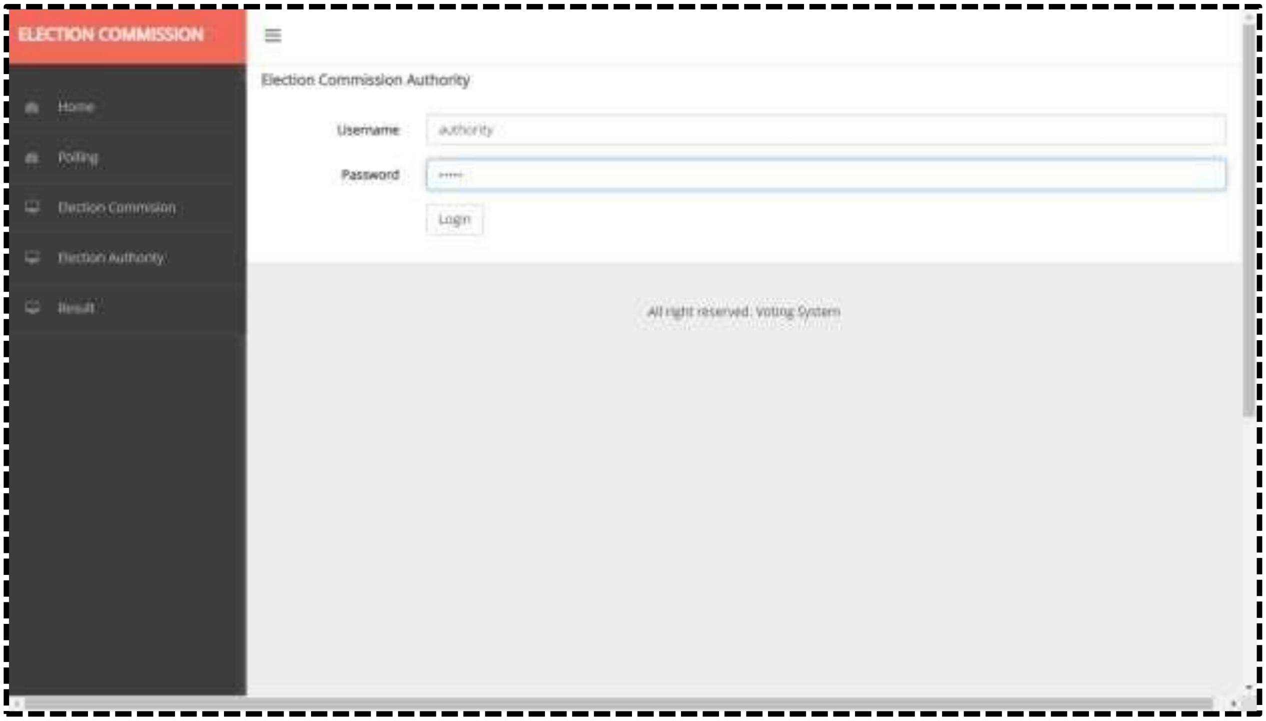


Candidate Information

Division: Ramji Nagar, Tiruchirappalli

Caption: RMK	Caption: PMK	Caption: SMK
Name: Ramesh	Name: Vasuki	Name: Raja
Age: 51	Age: 38	Age: 42
Gender: Male	Gender: Female	Gender: Male
Contact No.: 7364788291	Contact No.: 8856772549	Contact No.: 9867122335

Caption: TMK

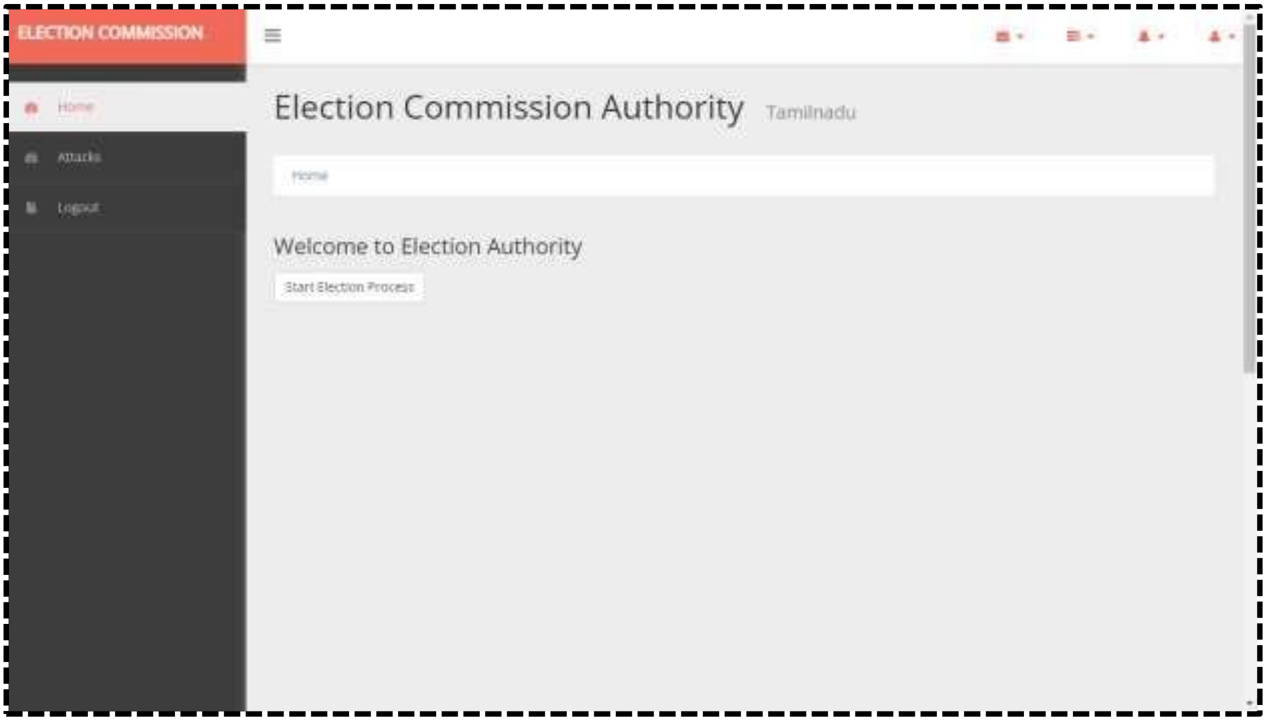


Election Commission Authority

Username: authority

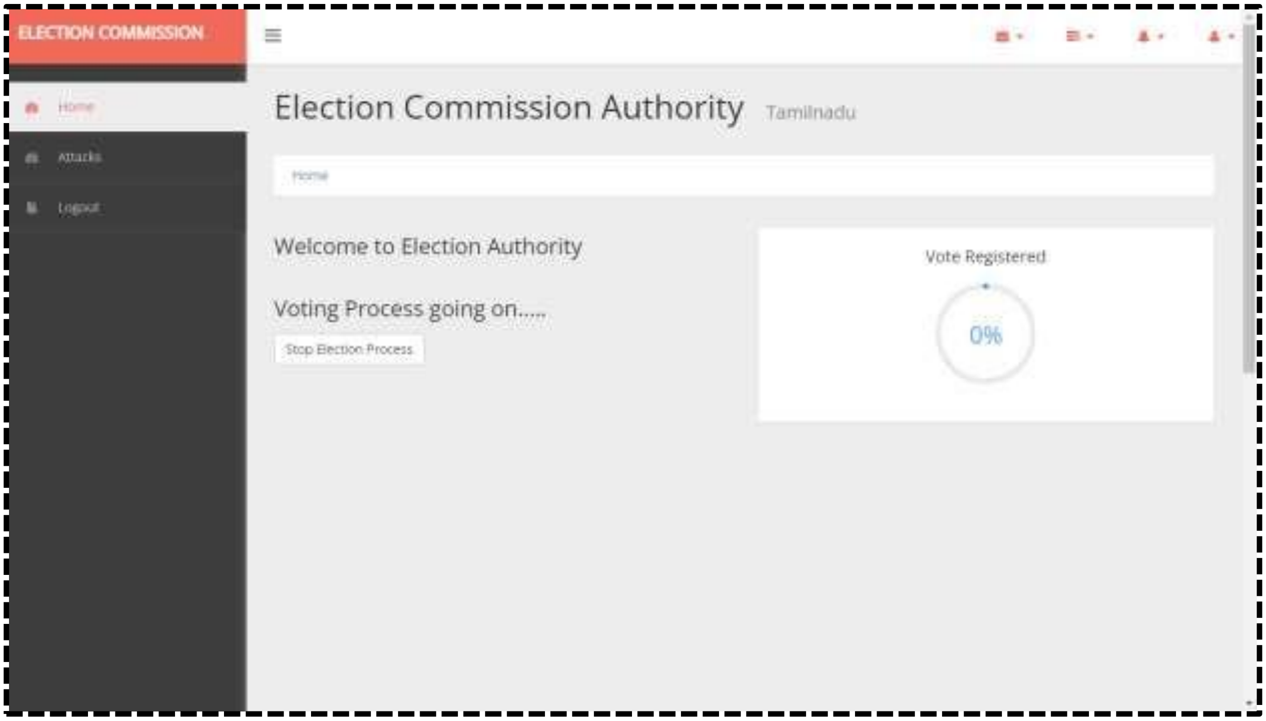
Password: •••••

All right reserved. Voting System



Election Commission Authority Tamilnadu

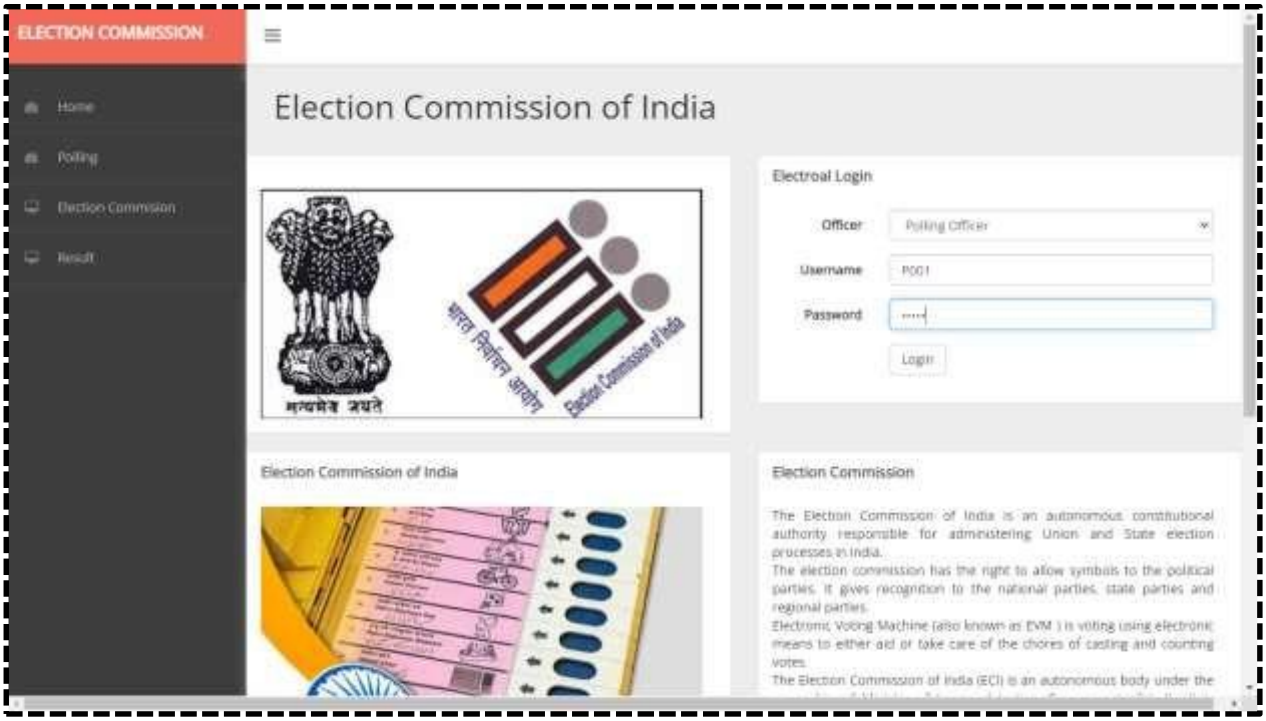
Welcome to Election Authority



Election Commission Authority Tamilnadu

Welcome to Election Authority

Voting Process going on.....



Election Commission of India

Electroal Login

Officer: Polling Officer

Username: P001

Password: •••••

Election Commission of India

Election Commission

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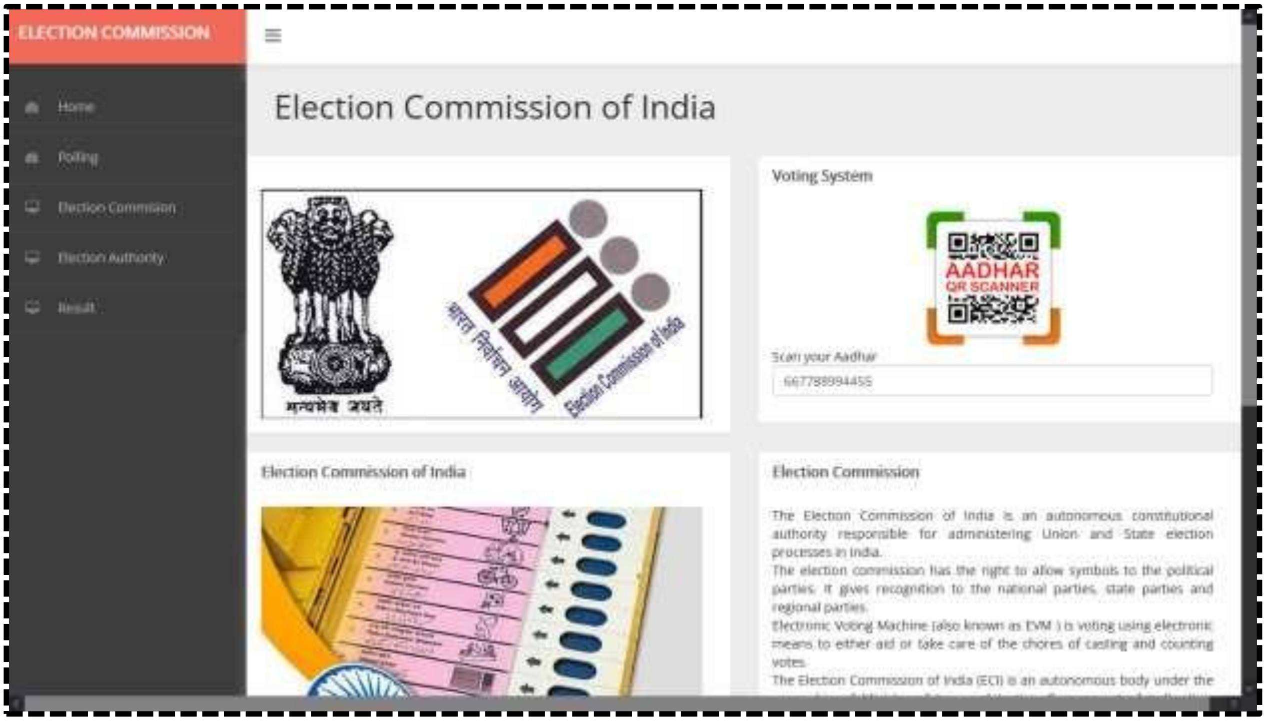

Election Commission of India

Voting System

Scan your Aadhar

667788994455

Election Commission of India

Election Commission

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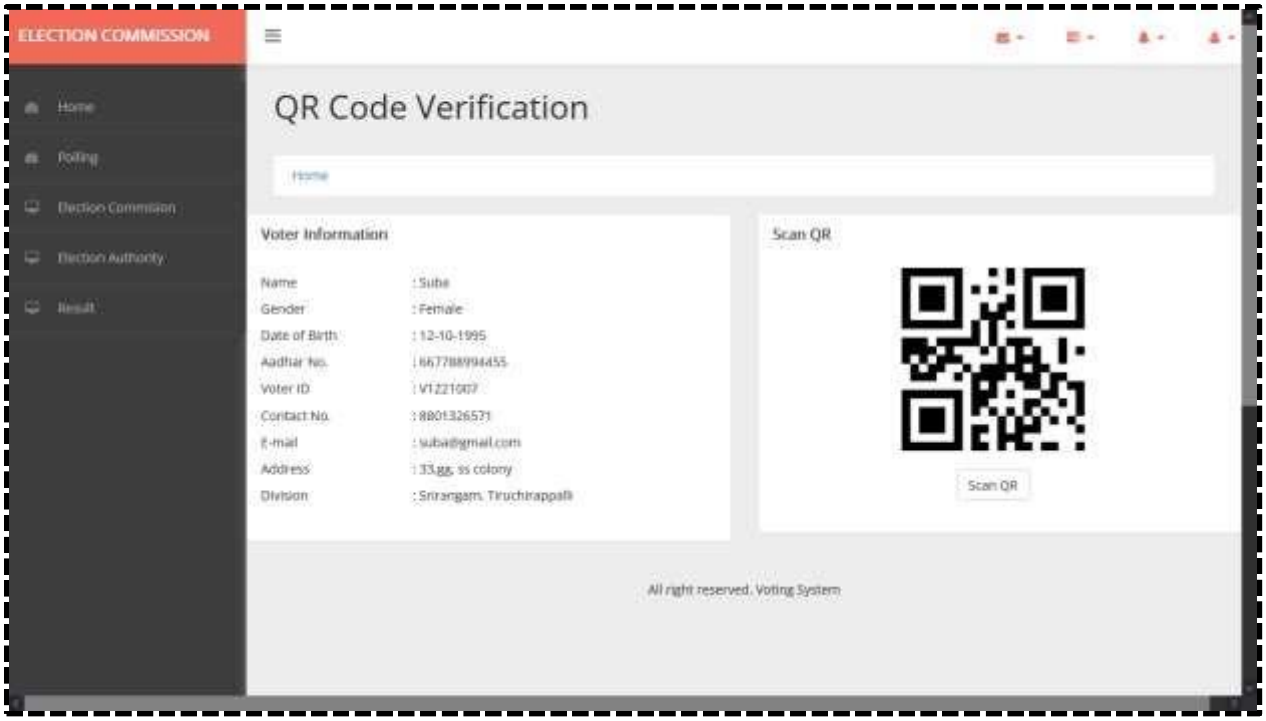
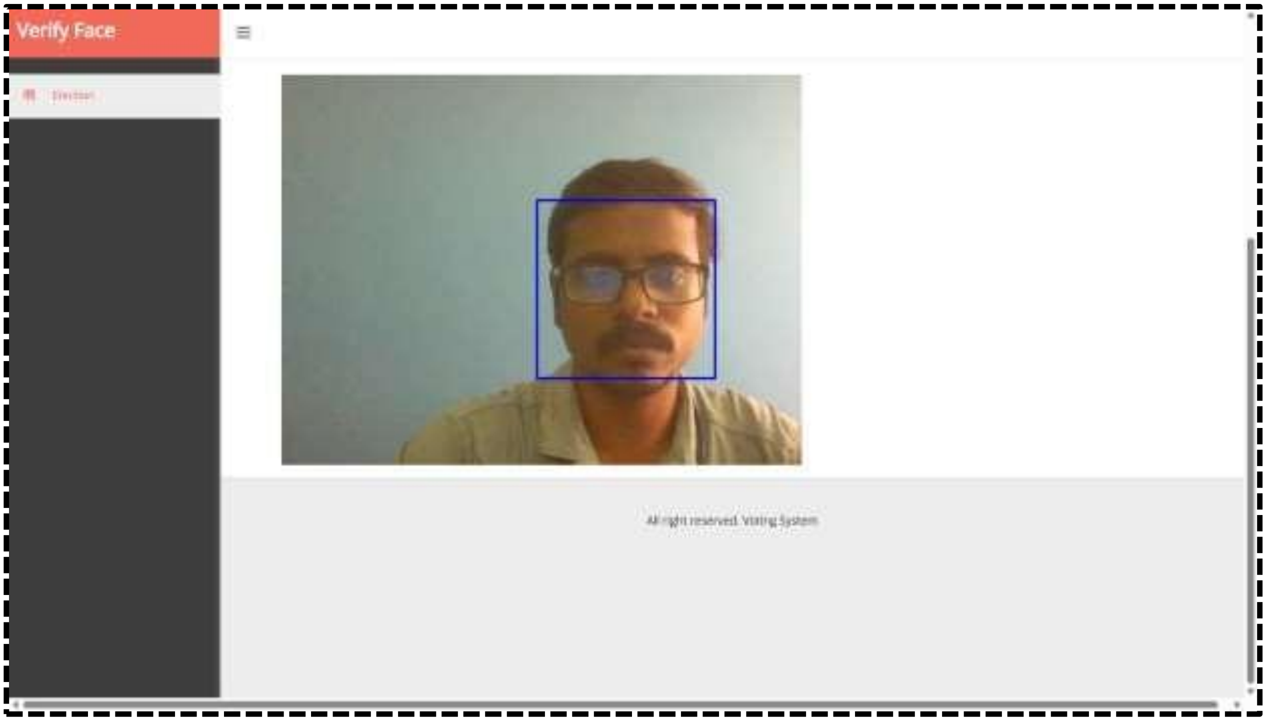


QR Code Verification

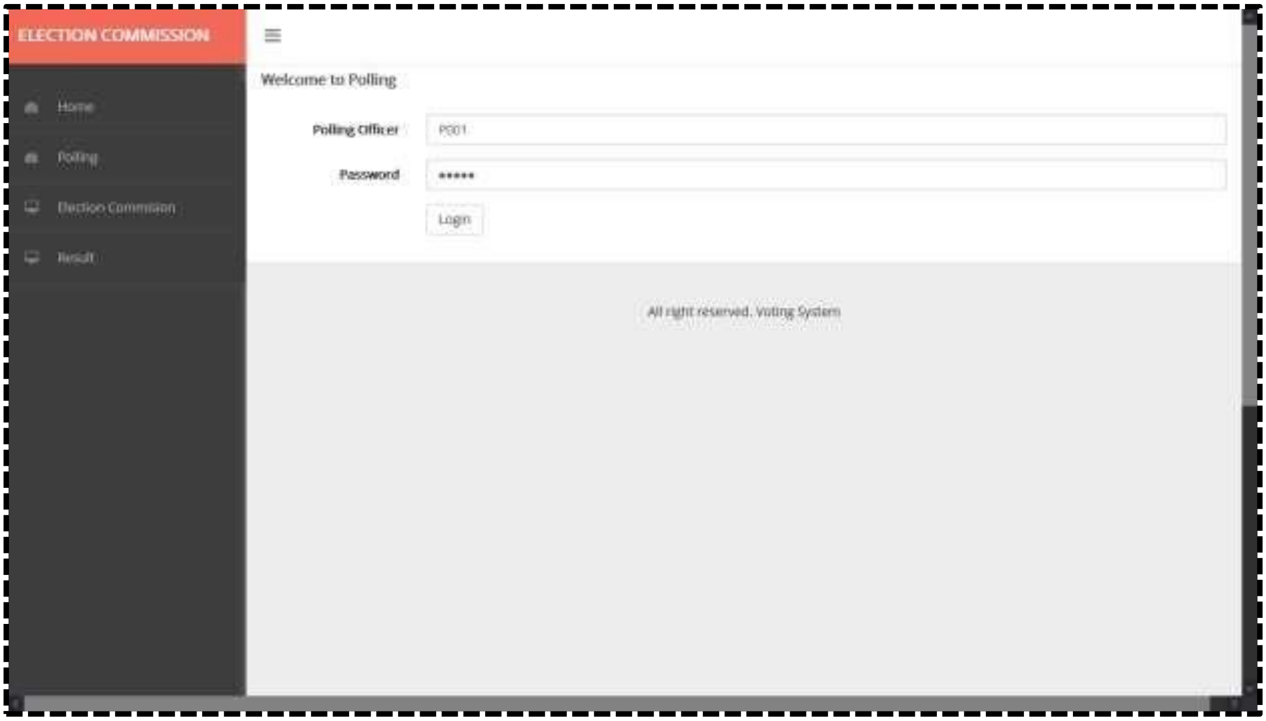
Voter Information

Name	: Suba
Gender	: Female
Date of Birth	: 12-10-1995
Aadhar No.	: 667788994455
Voter ID	: V1221007
Contact No.	: 8801326571
E-mail	: suba@gmail.com
Address	: 33,gg, ss colony
Division	: Srirangam, Tiruchirappalli

All right reserved. Voting System



All right reserved. Voting System

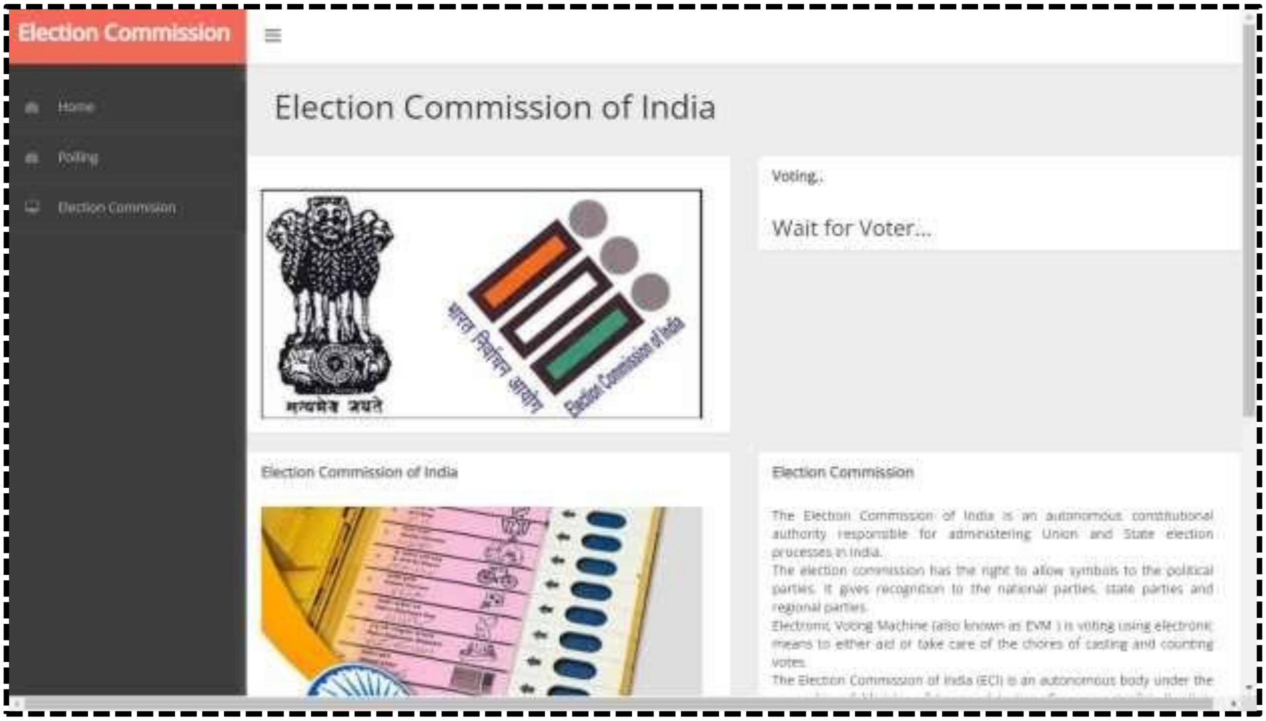


Welcome to Polling

Polling Officer: P001

Password: *****

All right reserved. Voting System



Election Commission of India

Voting..

Wait for Voter...

Election Commission of India

Election Commission

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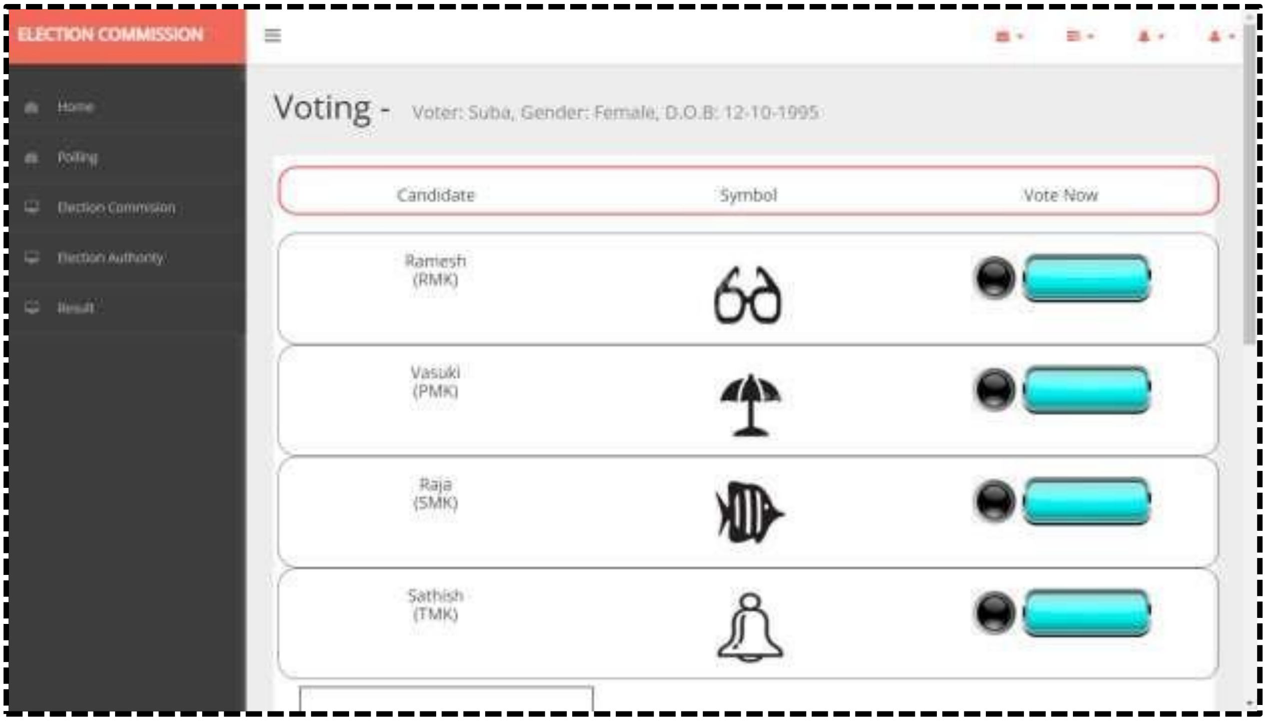
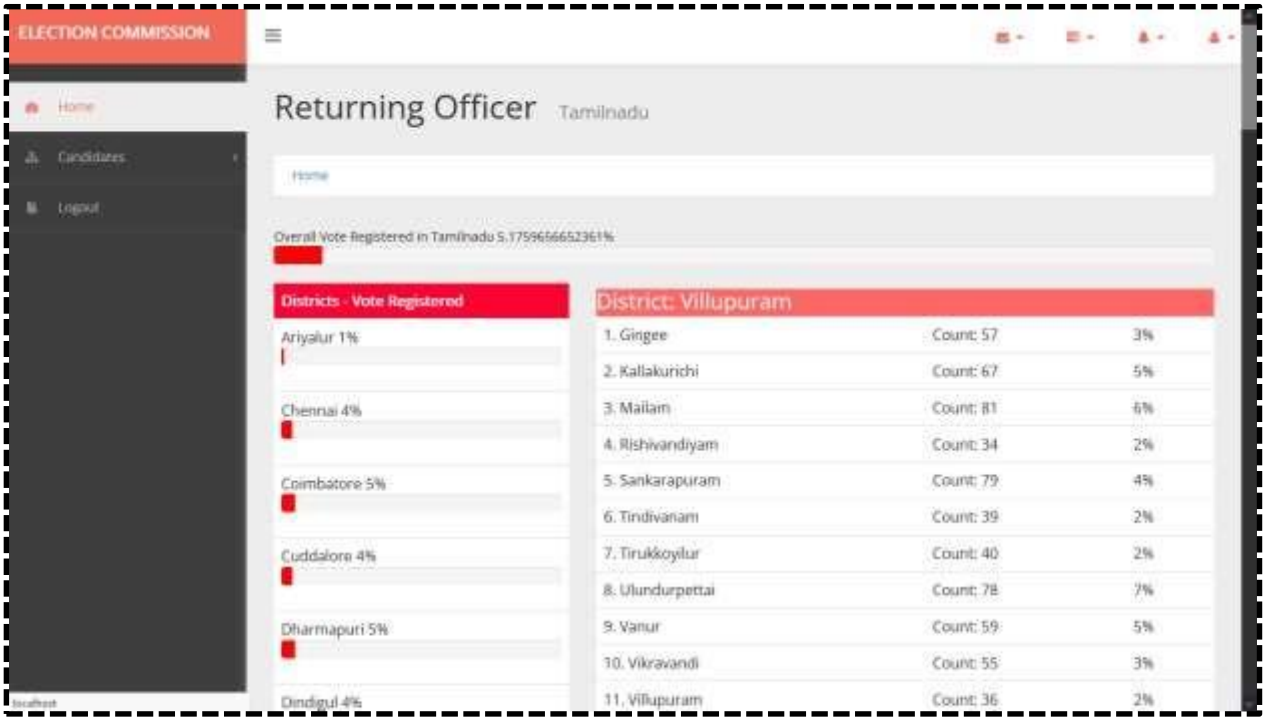
The Election Commission of India (ECI) is an autonomous body under the



Voting - Voter: Suba, Gender: Female, D.O.B: 12-10-1995

Candidate	Symbol	Vote Now
Ramesh (RMK)		●
Vasuki (PMK)		●
Raja (SMK)		●
Sathish (TMK)		●

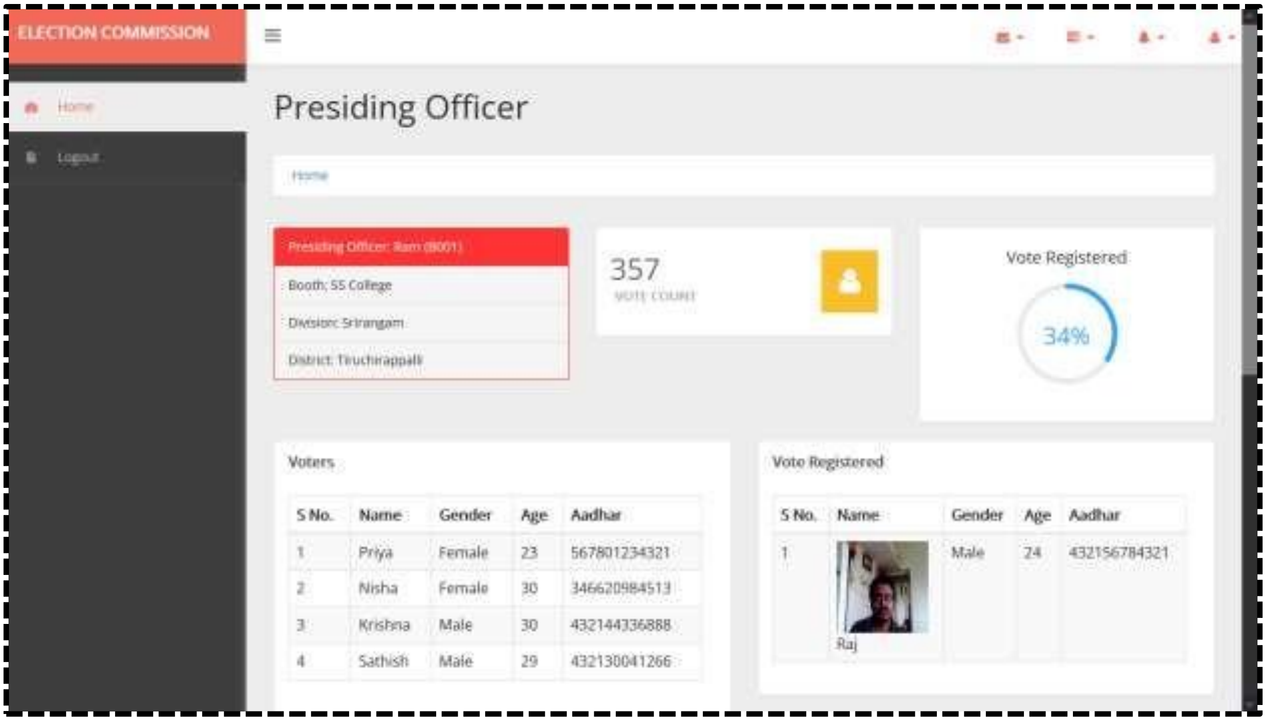


Returning Officer Tamilnadu

Overall Vote Registered in Tamilnadu 5.1759656652361%

Districts - Vote Registered
Ariyalur 1%
Chennai 4%
Coimbatore 5%
Cuddalore 4%
Dharmapuri 5%
Dindigul 4%

District: Villupuram		
1. Gingee	Count: 57	3%
2. Kallakurichi	Count: 67	5%
3. Mailam	Count: 81	6%
4. Rishivandiyam	Count: 34	2%
5. Sankarapuram	Count: 79	4%
6. Tindivanam	Count: 39	2%
7. Tirukkoyilur	Count: 40	2%
8. Ulundurpettai	Count: 78	7%
9. Vanur	Count: 59	5%
10. Vikravandi	Count: 55	3%
11. Villupuram	Count: 36	2%



Presiding Officer

Home

Presiding Officer: Ram (8001)

Booth: SS College

Division: Srirangam

District: Tiruchirappalli

357
VOTE COUNT

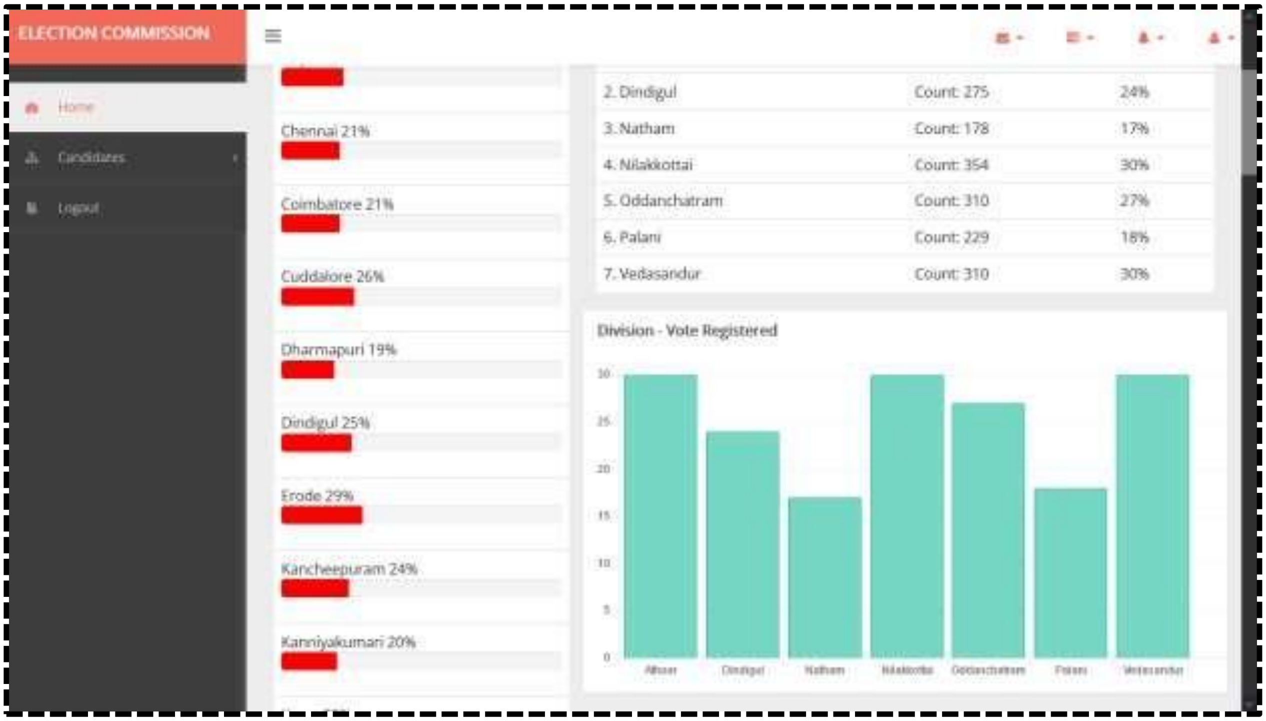
Vote Registered
34%

Voters

S No.	Name	Gender	Age	Aadhar
1	Priya	Female	23	567801234321
2	Nisha	Female	30	346620984513
3	Krishna	Male	30	432144336888
4	Sathish	Male	29	432130041266

Vote Registered

S No.	Name	Gender	Age	Aadhar
1	Raj	Male	24	432156784321



Chennai 21%

Coimbatore 21%

Cuddalore 26%

Dharmapuri 19%

Dindigul 25%

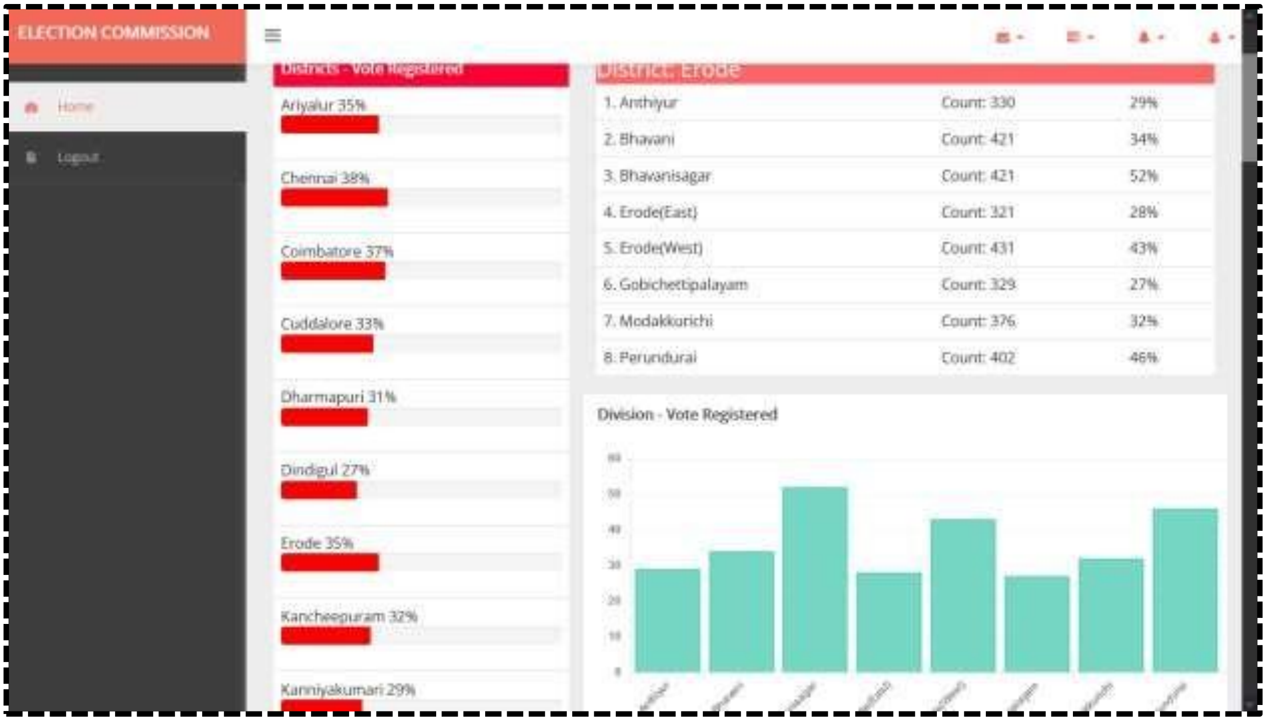
Erode 29%

Kancheepuram 24%

Kanniyakumari 20%

2. Dindigul	Count: 275	24%
3. Natham	Count: 178	17%
4. Nilakkottai	Count: 354	30%
5. Oddanchatram	Count: 310	27%
6. Palani	Count: 229	18%
7. Vedasandur	Count: 310	30%

Division - Vote Registered



Districts - Vote Registered

Ariyalur 35%

Chennai 38%

Coimbatore 37%

Cuddalore 33%

Dharmapuri 31%

Dindigul 27%

Erode 35%

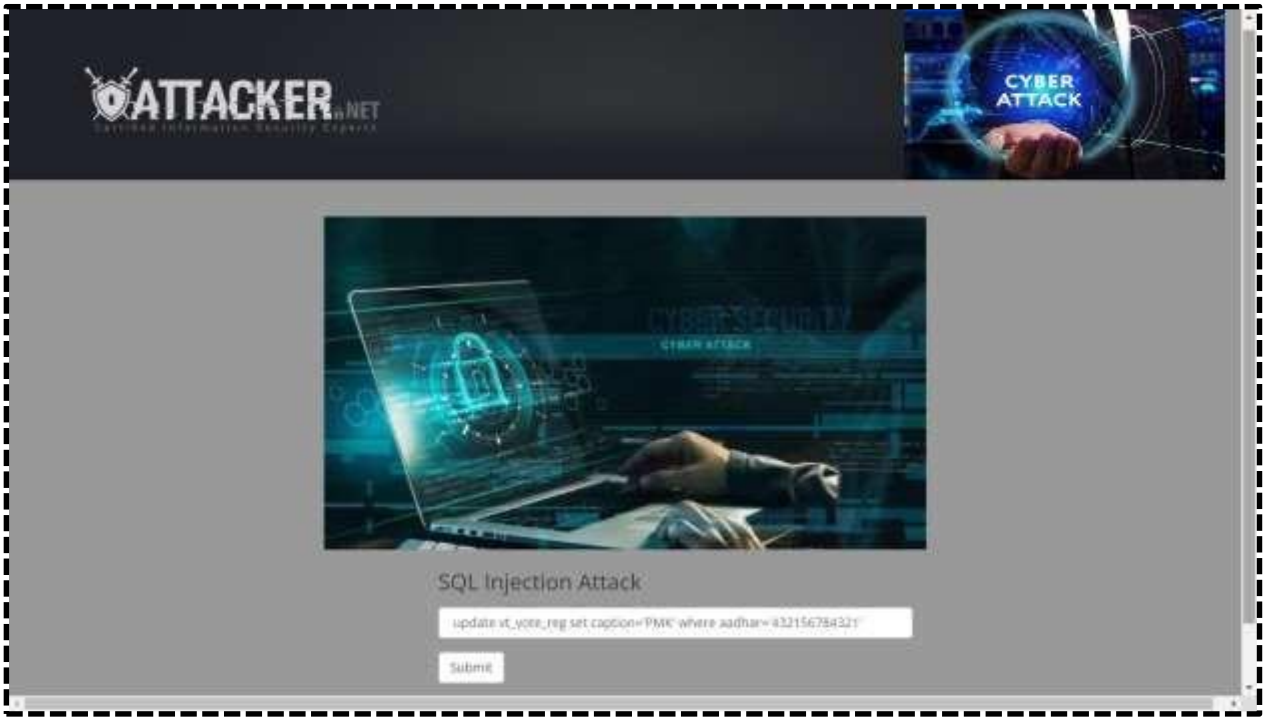
Kancheepuram 32%

Kanniyakumari 29%

District: Erode

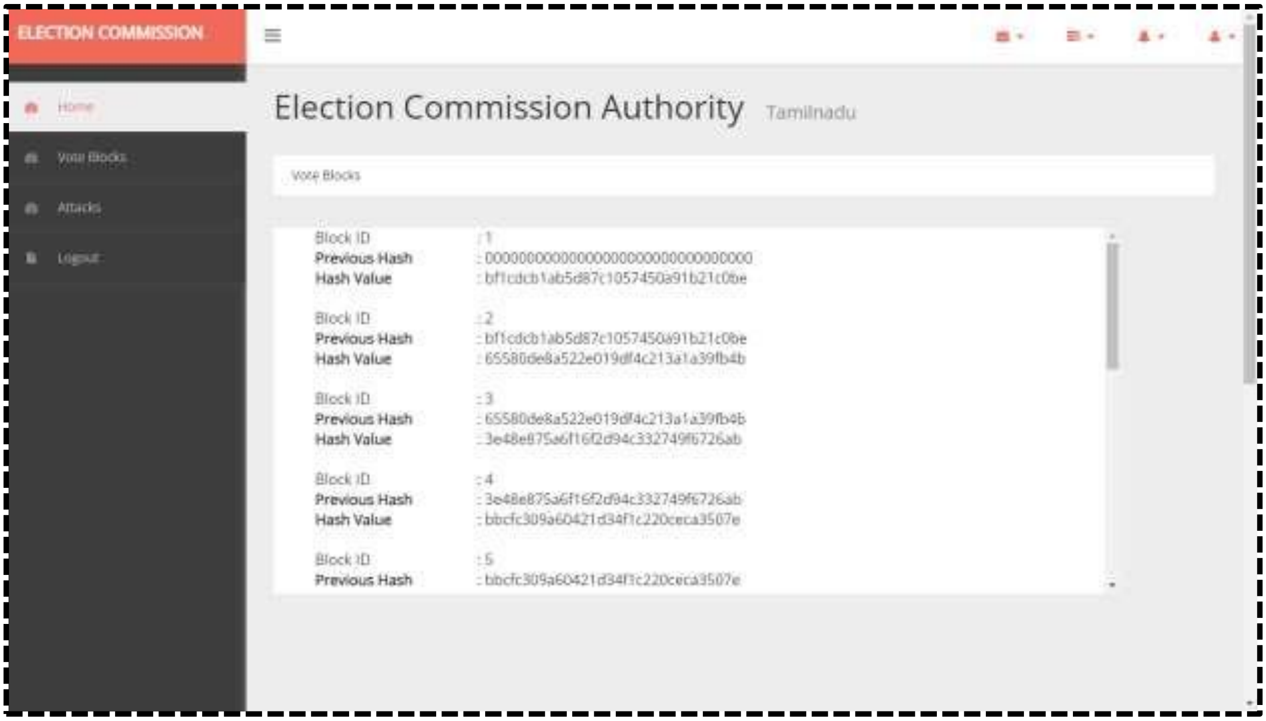
1. Anthiyur	Count: 330	29%
2. Bhavani	Count: 421	34%
3. Bhavanisagar	Count: 421	52%
4. Erode(East)	Count: 321	28%
5. Erode(West)	Count: 431	43%
6. Gobichettipalayam	Count: 329	27%
7. Modakkurichi	Count: 376	32%
8. Perundurai	Count: 402	46%

Division - Vote Registered



SQL Injection Attack

update vt_vote_reg set caption='PMK' where aadhar='432156784321'



Election Commission Authority Tamilnadu

Vote Blocks

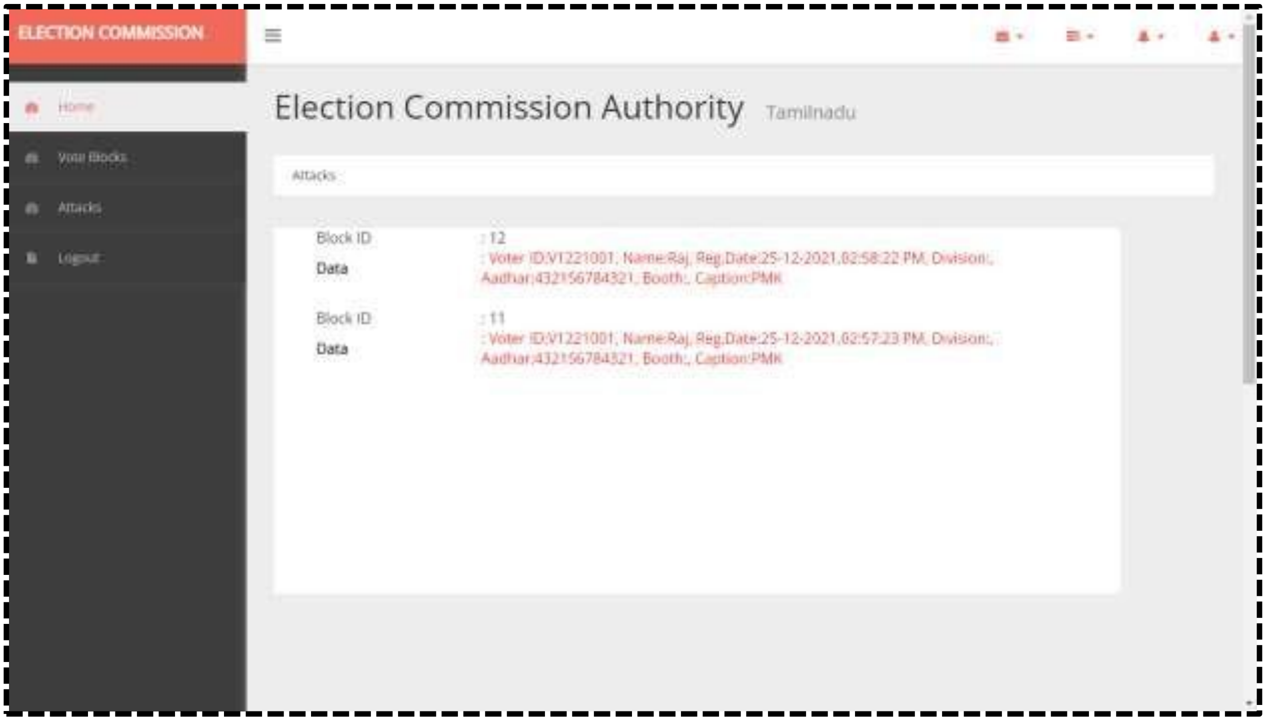
```
Block ID        : 1
Previous Hash   : 00000000000000000000000000000000
Hash Value      : bf1cdcb1ab5d87c1057450a91b21c0be

Block ID        : 2
Previous Hash   : bf1cdcb1ab5d87c1057450a91b21c0be
Hash Value      : 65580de8a522e019df4c213a1a39fb4b

Block ID        : 3
Previous Hash   : 65580de8a522e019df4c213a1a39fb4b
Hash Value      : 3e48e875a6f16f2d94c332749f6726ab

Block ID        : 4
Previous Hash   : 3e48e875a6f16f2d94c332749f6726ab
Hash Value      : bbcfc309a60421d34f1c220ceca3507e

Block ID        : 5
Previous Hash   : bbcfc309a60421d34f1c220ceca3507e
```

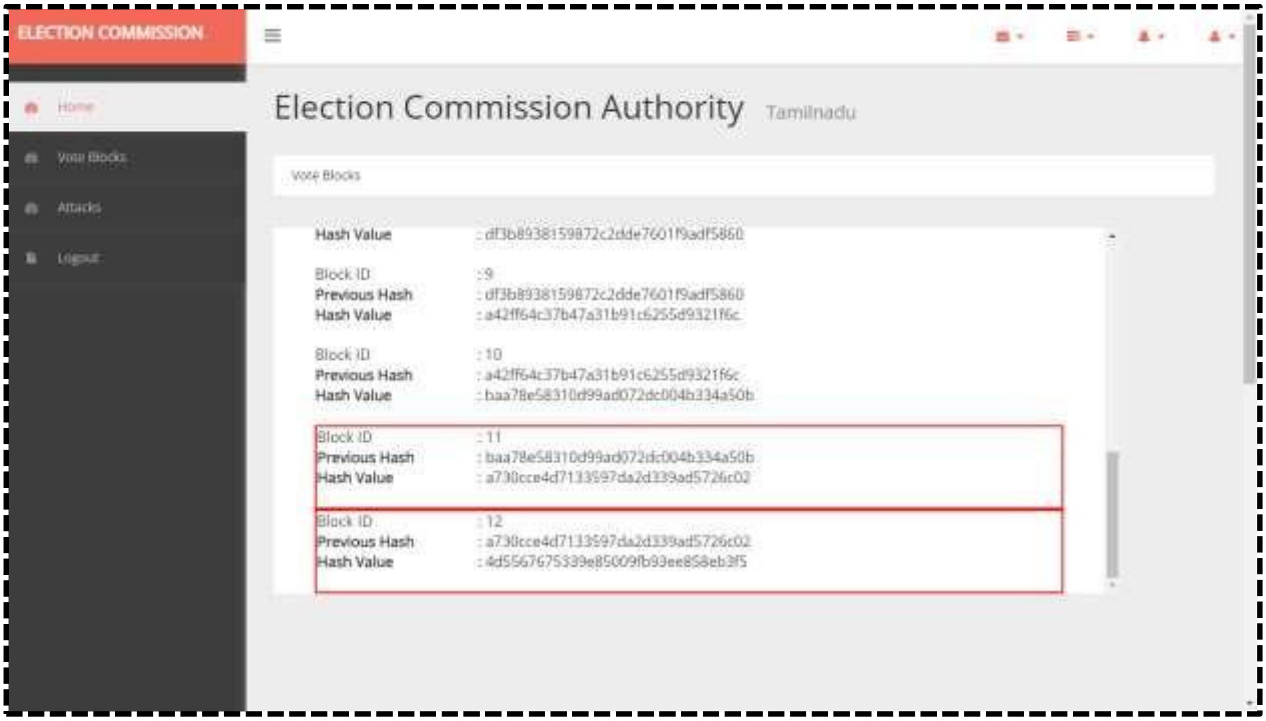


Election Commission Authority Tamilnadu

Attacks

```
Block ID        : 12
Data            : Voter ID:V1221001, Name:Raj, Reg.Date:25-12-2021,02:58:22 PM, Division:,
                  Aadhar:432156784321, Booth:, Caption:PMK

Block ID        : 11
Data            : Voter ID:V1221001, Name:Raj, Reg.Date:25-12-2021,02:57:23 PM, Division:,
                  Aadhar:432156784321, Booth:, Caption:PMK
```



Election Commission Authority Tamilnadu

Vote Blocks

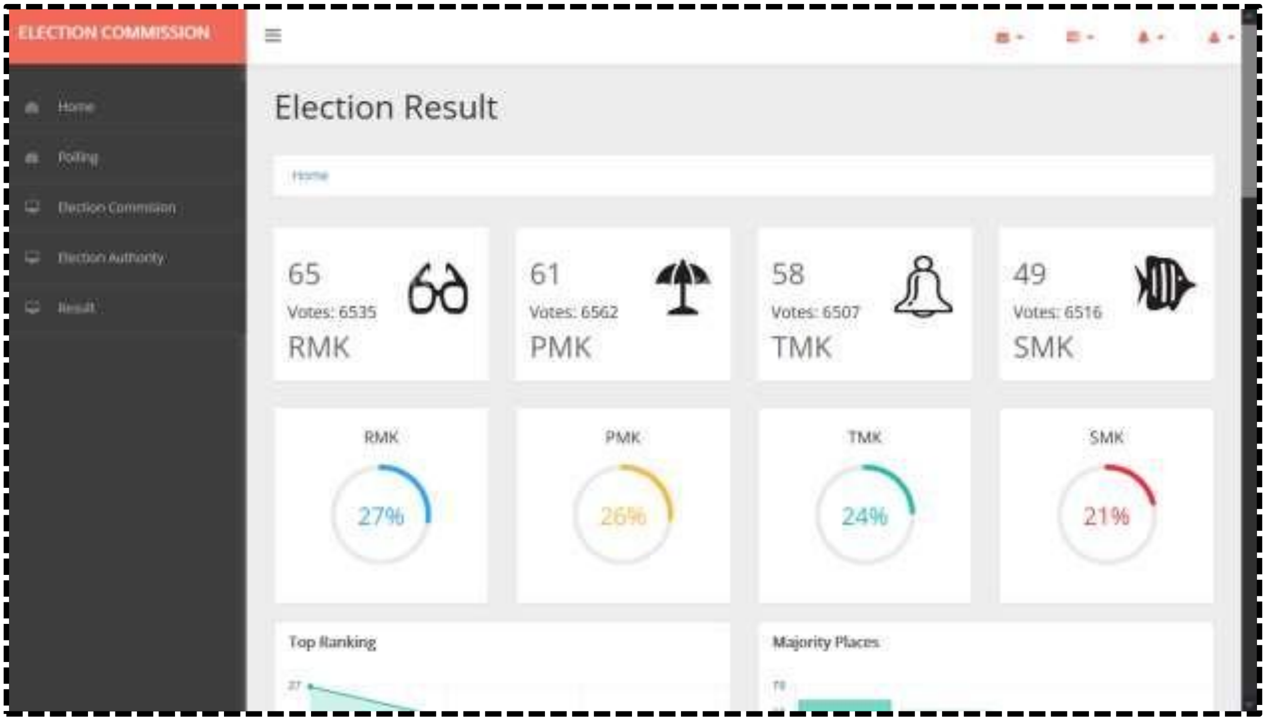
```
Hash Value       : df3b8938159872c2dde7601f9adf5860

Block ID         : 9
Previous Hash    : df3b8938159872c2dde7601f9adf5860
Hash Value       : a42ff64c37b47a31b91c6255d9321f6c

Block ID         : 10
Previous Hash    : a42ff64c37b47a31b91c6255d9321f6c
Hash Value       : baa78e58310d99ad072dc004b334a50b

Block ID         : 11
Previous Hash    : baa78e58310d99ad072dc004b334a50b
Hash Value       : a730cce4d7133597da2d339ad5726c02

Block ID         : 12
Previous Hash    : a730cce4d7133597da2d339ad5726c02
Hash Value       : 4d5567675339e85009fb93ee858eb3f5
```



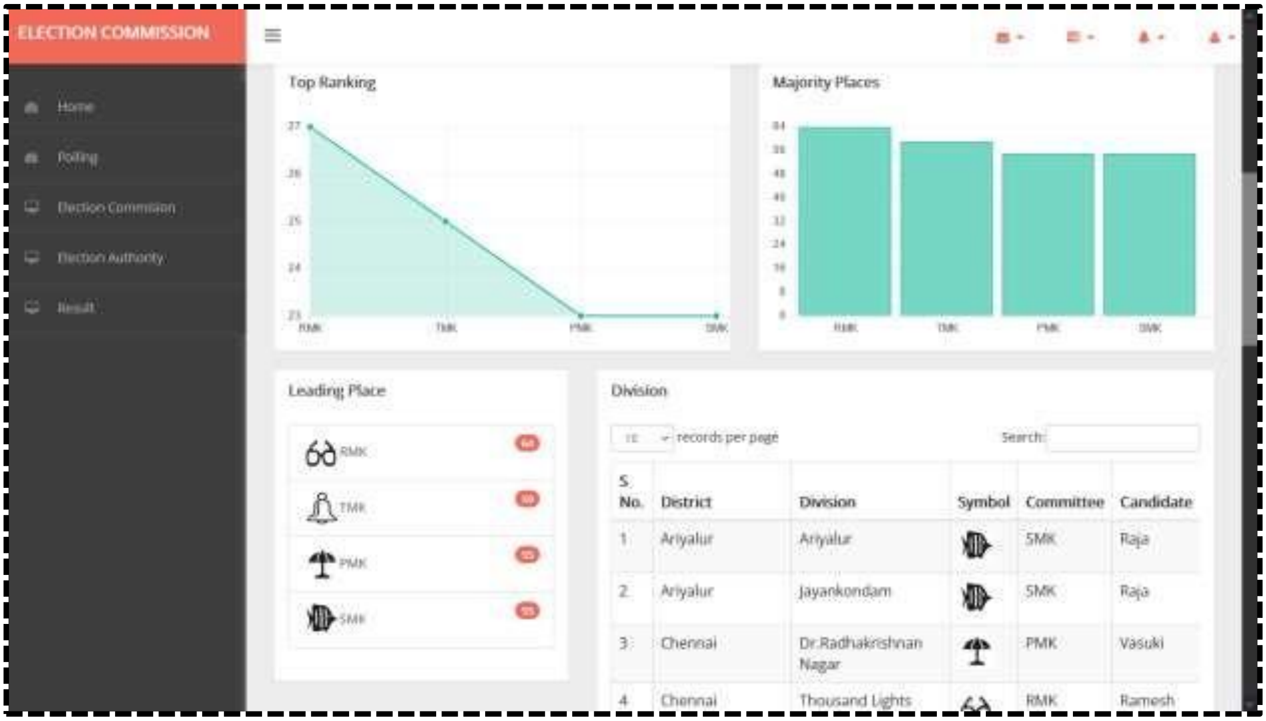
Election Result

Home

65 Votes: 6535 RMK	61 Votes: 6562 PMK	58 Votes: 6507 TMK	49 Votes: 6516 SMK
RMK 27%	PMK 26%	TMK 24%	SMK 21%

Top Ranking

Majority Places

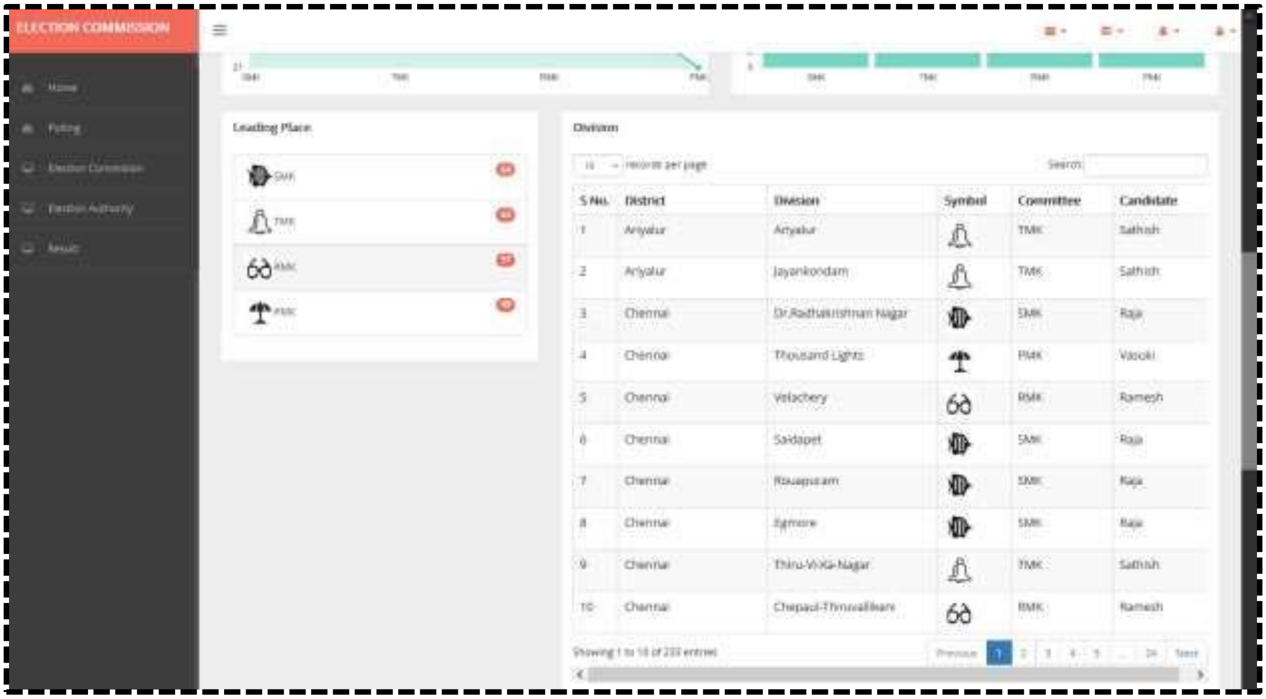


ELECTION COMMISSION

Division

10 records per page Search:

S No.	District	Division	Symbol	Committee	Candidate
1	Ariyalur	Ariyalur		SMK	Raja
2	Ariyalur	Jayankondam		SMK	Raja
3	Chennai	Dr.Radhakrishnan Nagar		PMK	Vasuki
4	Chennai	Thousand Lights		RMK	Ramesh



ELECTION COMMISSION

Division

10 records per page Search:

S No.	District	Division	Symbol	Committee	Candidate
1	Ariyalur	Ariyalur		TMK	Sathish
2	Ariyalur	Jayankondam		TMK	Sathish
3	Chennai	Dr.Radhakrishnan Nagar		SMK	Raja
4	Chennai	Thousand Lights		PMK	Vasuki
5	Chennai	Velachery		RMK	Ramesh
6	Chennai	Saidapet		SMK	Raja
7	Chennai	Royapuram		SMK	Raja
8	Chennai	Egmore		SMK	Raja
9	Chennai	Thiru-Vi-Ka-Nagar		TMK	Sathish
10	Chennai	Chepauk-Thiruvallikeni		RMK	Ramesh

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1. "Flask Web Development" by Miguel Grinberg

This book is an excellent resource for anyone developing web applications with Flask. It covers everything from the basics to more advanced topics, making it a great choice for integrating Flask with MySQL and other web technologies.

2. "Learning Python" by Mark Lutz

A comprehensive guide to Python programming, this book is perfect for both beginners and experienced developers. It dives into Python's syntax, data structures, and object-oriented programming, which is foundational for building applications in your project.

3. "Python for Data Analysis" by Wes McKinney

This book provides a detailed introduction to using Python and its libraries like Pandas for data manipulation and analysis, which is essential for your project involving data preprocessing and machine learning.

4. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron

A must-have resource for anyone using machine learning libraries such as Scikit Learn, Keras, and TensorFlow. This book will help you implement machine learning algorithms in your project and integrate them with your system.

5. "Deep Learning with Python" by François Chollet

This book by the creator of Keras focuses on deep learning using Python and TensorFlow. It's an ideal resource for building advanced machine learning models and neural networks.

6. "OpenCV 4 with Python Blueprints" by Michael Beyeler

This book provides an in-depth guide to building computer vision projects using OpenCV with Python. It's perfect for integrating computer vision techniques into your project.

7. “Bootstrap 4 Quick Start" by Jacob Lett

A beginner-friendly guide to Bootstrap, this book will help you design responsive, mobile-first web applications that are an essential part of your project’s front-end.

8. "MySQL Cookbook" by Paul DuBois

This is a practical book that provides solutions for using MySQL effectively. It covers a wide range of topics from query optimization to database management, perfect for integrating MySQL into your project.

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