

# ONLINE VOTING SYSTEM with MULTIPLE SECURITY LAYERS

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**Abstract-** Today's digital society embraces increasing transformation in technologies. With these advancements, comes the concern regarding security and accuracy. This paper considers the same and put forth the solution of the concerns. It investigates the architecture, functionality and security of an online voting system. It considers the architectural design of the system, primarily focusing on the integration of strong security mechanisms. Top priorities of the system include biometric authentication and secure user identification. The study also includes barcode technology, facial recognition, and OTP verification in order to improve system integrity.

## 1. INTRODUCTION

A series of major changes can be seen in many areas including the conduct of democratic elections. The possible reason largely include the global shift towards the technological integration. This paper presents an innovative online voting system which is based on Django, MySQL, HTML, CSS and JavaScript with multiple layers of security. The system is an integration of biometrics, secure user authentication, OTP verification[3], facial recognition using dlib library, barcode recognition OpenCV and Pyzbar library [4], and more to ensure the integrity and credibility of the voting process. The system works to improve the reliability and effectiveness of voting system in the digital age.

## 2. EXISTING SYSTEM

EVMs(Electronic Voting Machines) form the foundation of primary voting system but have concerns including possibility of tampering, their security and absence of thorough electoral control. Even programs like VVPAT(Voter Verifiable Paper Verification) which aims to promote transparency fails to convince people with its security and openness. Although, existing electoral systems are widely used, yet face constant criticism. They need to guarantee democratic processes by being more

transparent and credible. Another major issue with traditional systems is the accessibility. People residing outside the country, disabled people, undercover agents, etc fail to cast their vote as they are unable to reach the polling booths.

## 3. PROPOSED SYSTEM

The proposed system for online voting has multiple security layers which helps to strengthen the election process. The system strongly emphasize on uncompromising security measures by using Django for back-end, MySQL for database, and HTML, CSS, JavaScript for front-end development. It also offers secure user authentication by using OTPs(One Time Passwords), biometric verification like facial [2],[3] recognition using dlib library and barcode voting ID verification using OpenCV and Pyzbar library.

The described security measures are taken in order to make the online voting platform user-friendly, transparent, accessible, and credible.

## 4. OBJECTIVE

- The foremost aim of the project is to design and develop a sophisticated online voting system which includes a wide range of security layers.
- The system seeks to enable voter ID and Aadhaar card authentication along with gathering personal information and password creation to streamline user registration process.[1]
- It uses authentication technology that includes face recognition and voter ID barcode scanning.
- It aims at providing a safe user login process that combines registration credentials with OTP(One Time Password) verification[3].
- It also intends to put in place a framework for voters in order to keep the track of number of votes casted.

## 5. SCOPE

- Providing a safe and easy to use system for online voting is the primary goal of the project.
- It also aims at providing several security features which include facial recognition, barcode scanning and OTP verification in order to make the process of user authentication more reliable
- It will also enable users for distant voting meanwhile ensuring scalability, dependability, credibility. Other aspects include creation of effective, easily accessible, user-friendly system for online voting along with supporting real-time voter participation tracking.
- CSRF token is used in the application in order to mitigate CSRF (Cross-Site Request Forgery) attacks. The combined mechanism of CSRF token and server side validation helps to ensure that the requests accepted are legitimate and from the same user's session and website.

## 6. METHODOLOGY

### 6.1 Iterative Waterfall Model

- The development approach for the proposed system is chosen to be iterative waterfall model. It is an extension of traditional waterfall model. It prioritises methodological development in discrete steps. This process of development starts with a feasibility study which covers all the three aspects including technical, operational and economical. Next phase is the requirement gathering and analysis followed by the design phase.
- The project can be readily modified as this approach of development is iterative and thereby backtracking the phases is possible unlike in the traditional waterfall model, hence the changing requirements of the project can be accommodated.
- Afterwards, the application is tested, deployed and put into use in order to guarantee user response. The salient features of the model include testing, stakeholder interaction, and integration of robust security measures at every stage which helps the developers identify the issues early and react quickly for the changing requirements.

### 6.2 Advantages of the Development Model

- The iterative waterfall model's merits come from its iterative nature, which allows for alterations and enhancements at any phase of the

development process as per the changing requirements of the clients.

- Early testing and stakeholder engagement enable to identify problems and integrate continual input
- It also emphasizes periodic security tests and upgrades, ensuring strong security controls throughout the development process.
- This iterative process reduces documentation time while increasing design refinement time, allowing for early problem detection, continual improvement, and seamless adaptation to changing project needs
- Every iteration is itself a mini-cycle of development, hence includes all the phases namely planning, designing, coding, testing, and deployment. Thereby risks can be identified at early stages only and hence overall risk of the project can be reduced.
- While the development process, clients and end-users are in constant interaction with the developers hence it makes sure that the final product so developed is closely aligned with the expectations of the users.

### 6.3 Dlib Library

Dlib is a versatile C++ library which has various prominent capabilities including image processing, computer vision, machine learning, etc. It has been proved to be a powerful tool when it comes to face detection and recognition due to its robust features.

For face detection, a HOG(Histogram of Oriented Gradients)[6] descriptor is employed by the module. This helps in accurately detecting faces in images even if the lighting is not sufficient, facial expressions or poses are changing or varying. Dlib is a module that helps to represent facial features in the form of numerics by using deep metric learning techniques. The generated embeddings capture the characteristics which are unique thereby helping in comparison and identification.

A pre-trained deep neural network is employed for the computation of face embeddings which processes the images through multiple layers. This is done by feeding aligned face images through the network. A high dimensional numerical format is used to represent the unique facial features. Further, these face embeddings can be used to recognise or verify by comparing them with a database. It can be widely used in applications which may include various tasks such as face alignment, emotional analysis, video surveillance, etc.

### 6.4 OpenCV and Pyzbar Library

The web application consists of a barcode recognition feature which decodes the barcode and verifies whether the user is valid or not. This feature is built using OpenCV and Pyzbar libraries.

OpenCV [4],[5] or Open Source Computer Vision Library is a robust library which is widely used in image processing and computer vision tasks. It is used in the application to handle the input image of the barcode in real time when the user scans the barcode of his voter ID card. It processes the image and then passes it for the recognition process.

For the recognition process of the barcode, Pyzbar library[4], which is a Python library is used. It takes the image processed by OpenCV as input and decodes it. Thereby it extracts the relevant information in order to complete the user verification process. This process is efficient, ultra smooth and accurate.

## 7. SYSTEM DESIGN

### 7.1 E-R Diagram

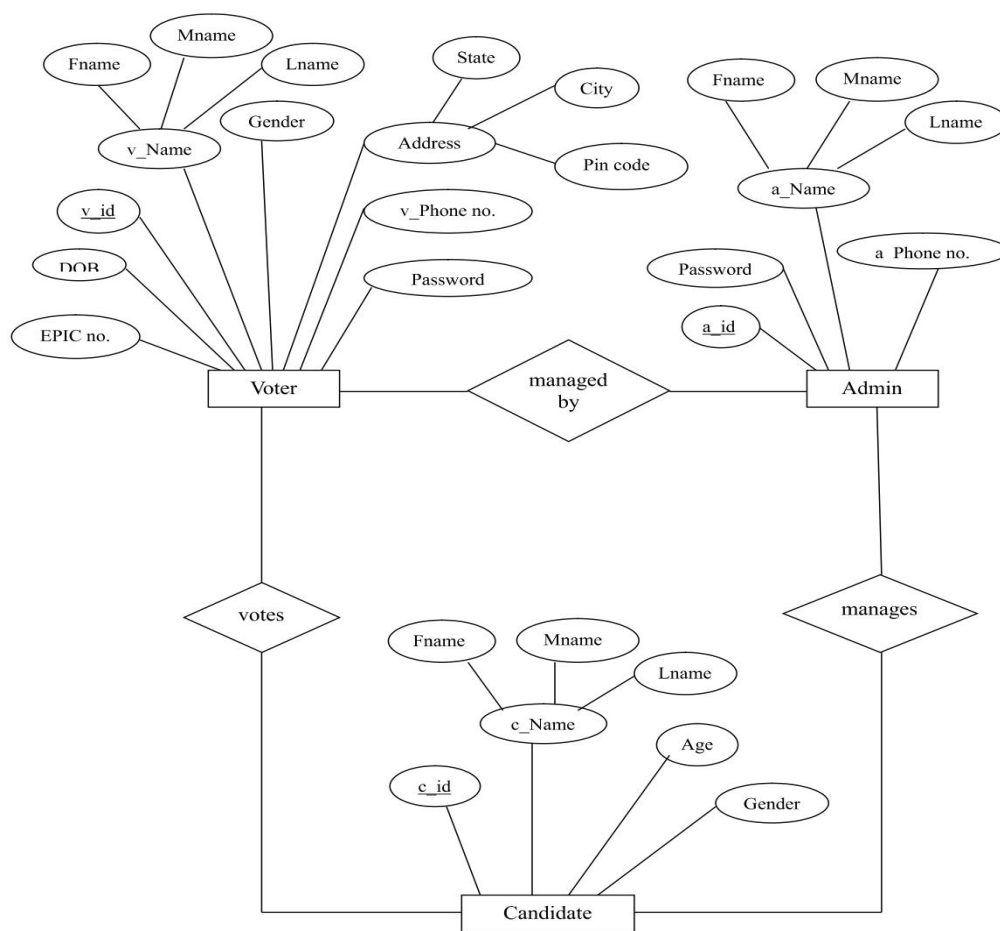


Fig. 1 E-R diagram

### 7.2 Use Case Diagram

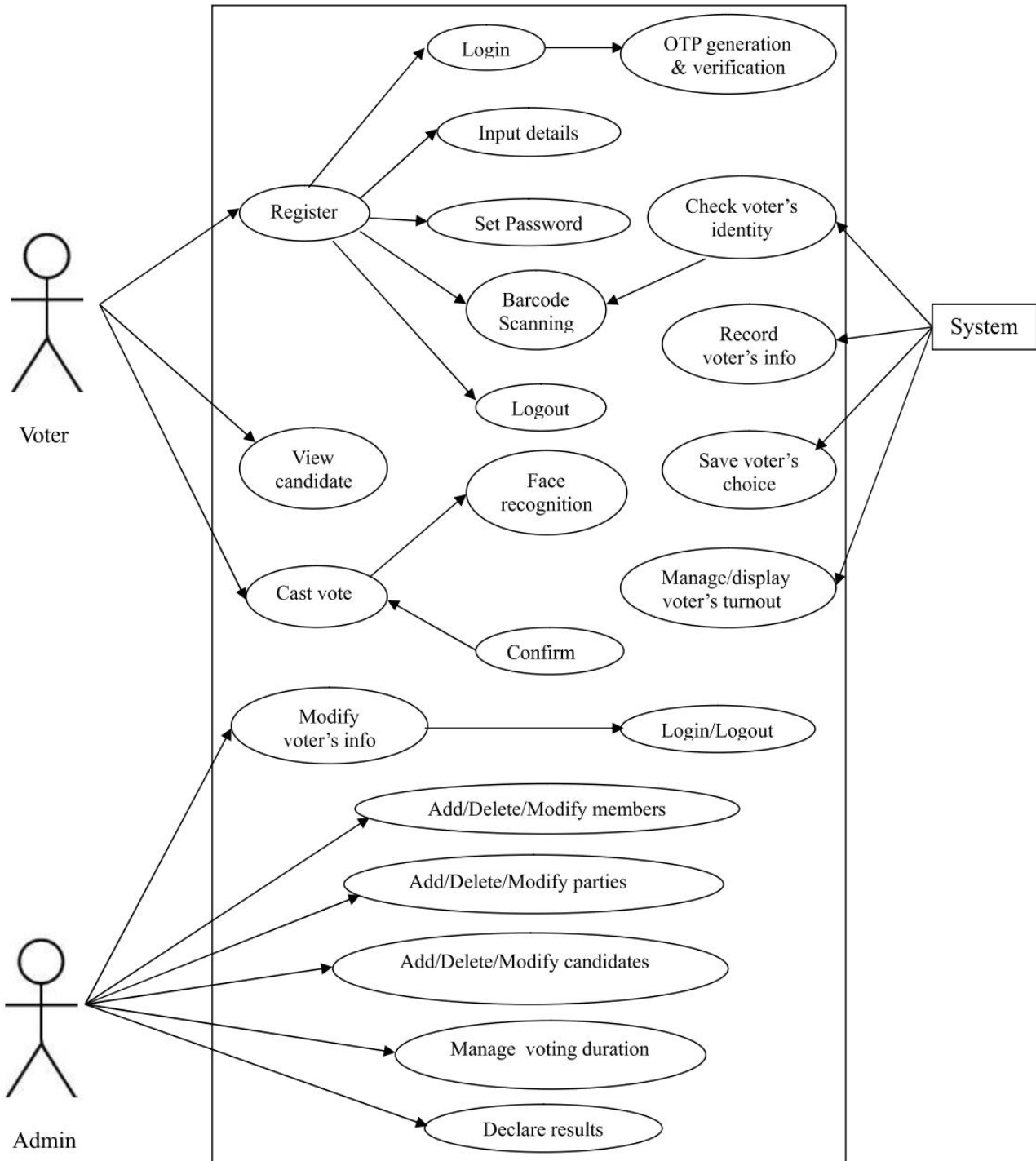


Fig. 2 Use Case Diagram

7.3 Dfd

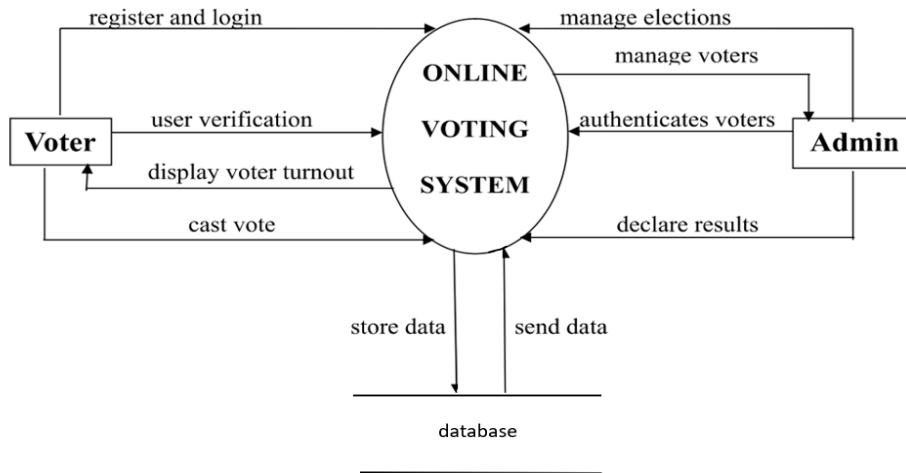


Fig. 3 0 level dfd

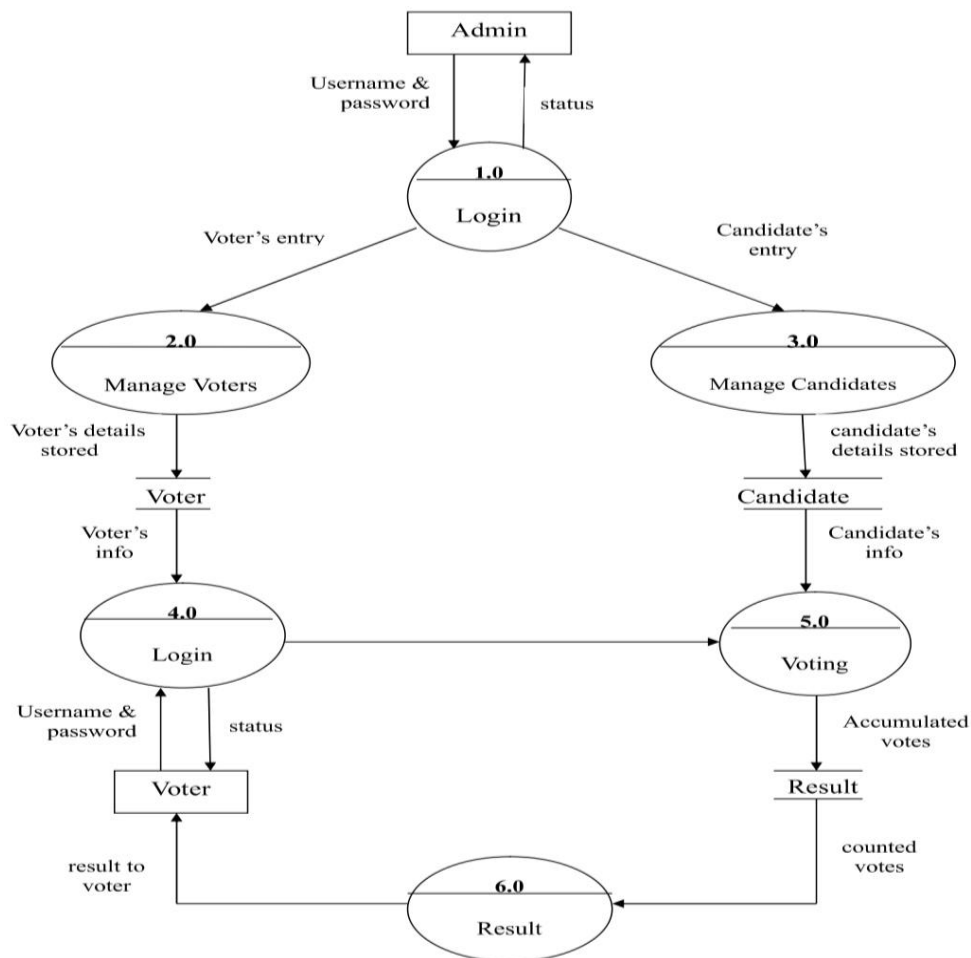


Fig. 4 1 level dfd



## 8. IMPLEMENTATION

1. On viewing the web application, user will be able to see the home page where he/she can opt to sign-up or sign-in or view the voters' turnout.

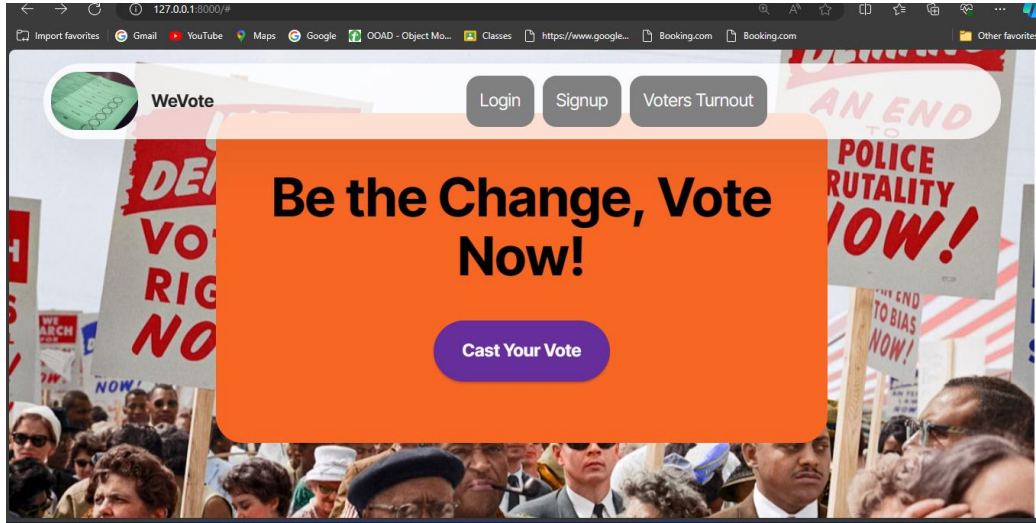


Fig. 5 Home Page

2. New users are required to register themselves by giving their personal details. While registering, user requires to verify the OTP and capture face for later verification.

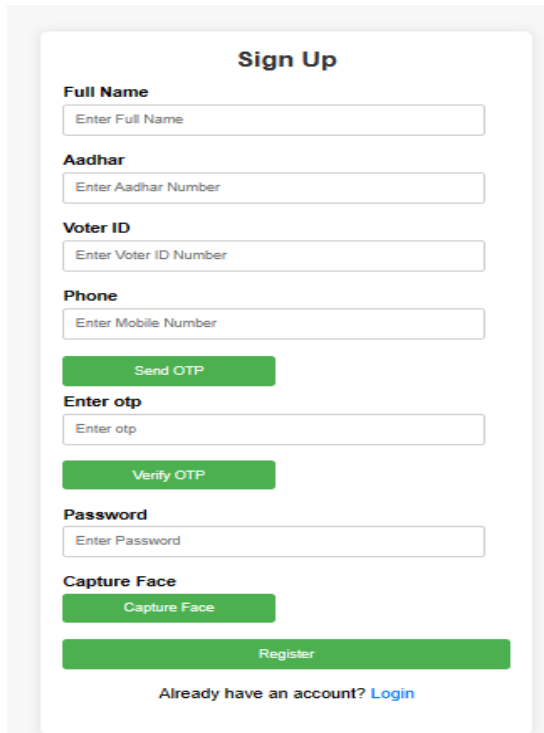


Fig. 6 Sign-up page

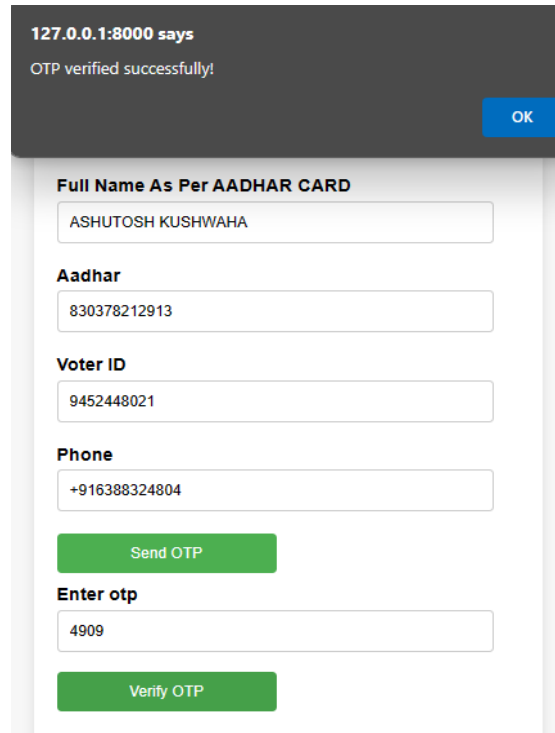


Fig. 7 OTP verification

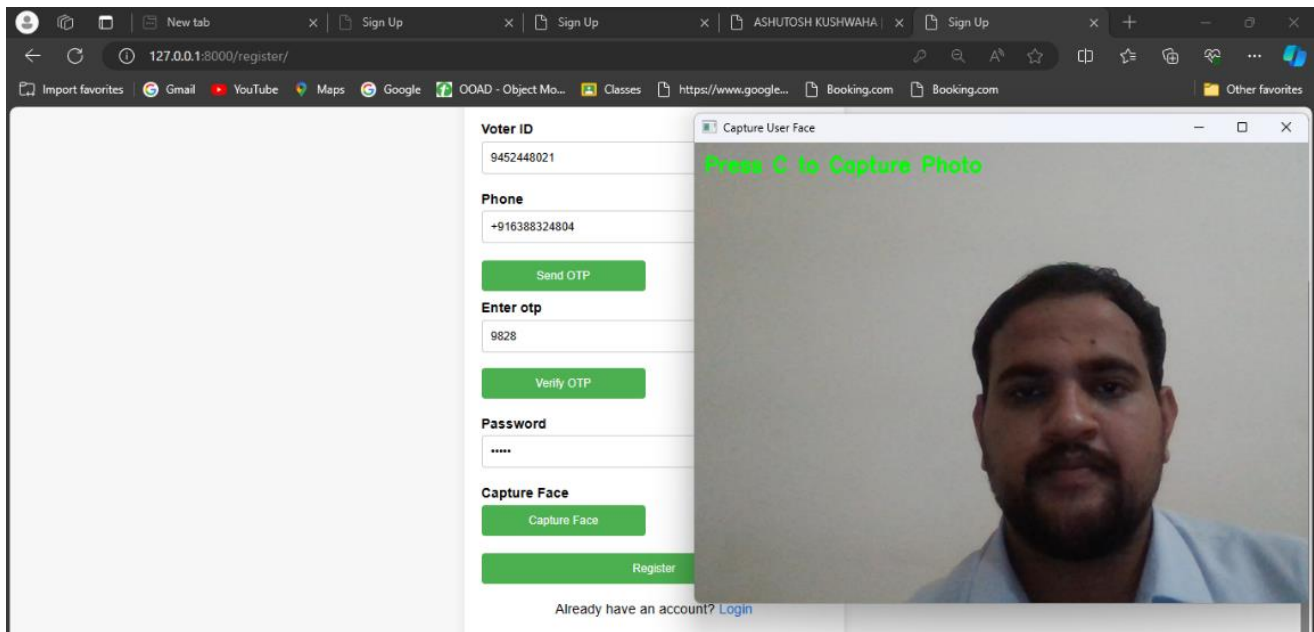


Fig.8 Face capturing during sign-up

3. On successful registration of the user, he/she will be directed to the login page. To login, user requires to enter the aadhaar no. and password.

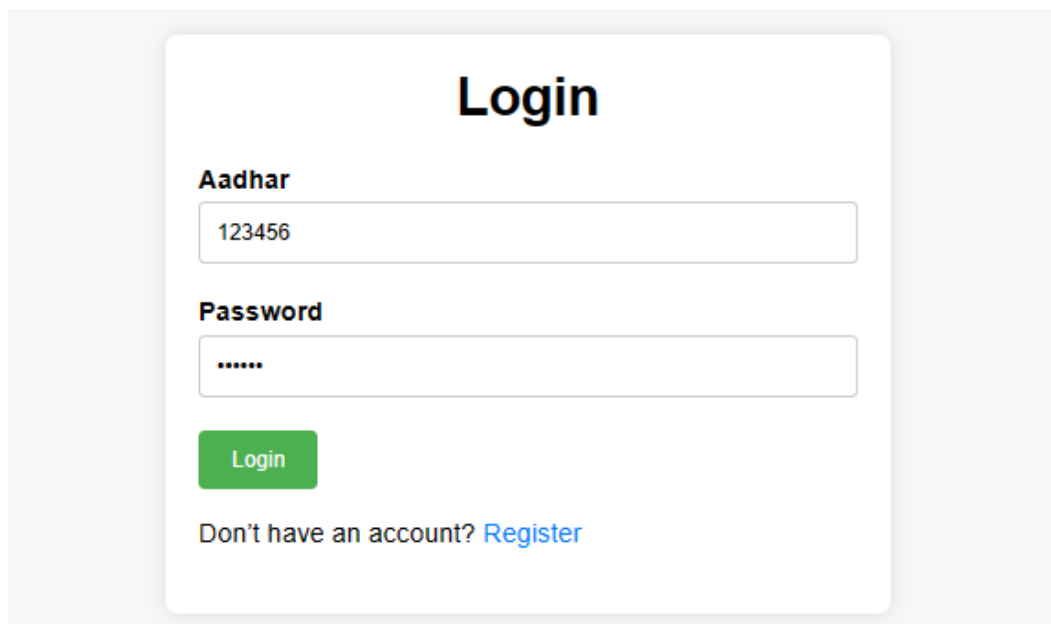


Fig. 9 Login Page

4. After login, barcode of the voter ID card has to be scanned and verified.

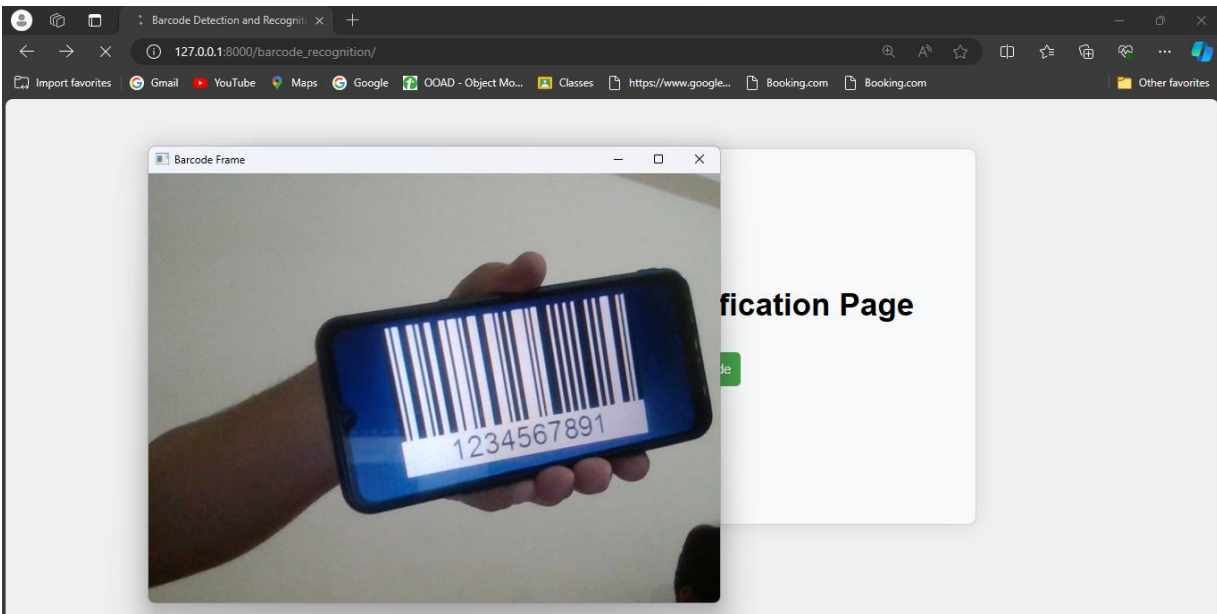


Fig. 10 Barcode scanning & verification

5. After that, user has to verify his face which will be matched with the picture stored at the time of registration.

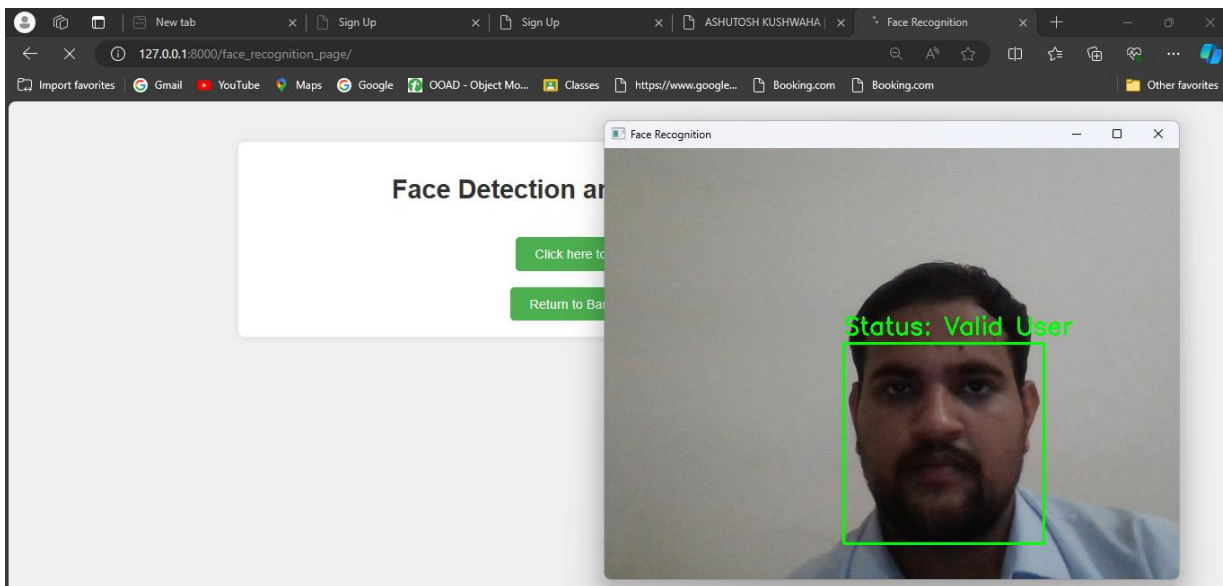


Fig.11 Face verification

6. On successful verification of the face and the barcode, user will be directed to the page where he can cast his vote(only once).



## 9. SYSTEM REQUIREMENTS

### 9.1 for Developers

Hardware Platform: 5th Gen or newer Intel/Ryzen processor, 4 GB or higher RAM, minimum 2 GB free disk space

Software requirements: Visual Studio Code, JetBrains WebStorm, or Eclipse for web development; MySQL, PostgreSQL, or MongoDB for storing user data, candidate info, and voting records, Django, PHP, etc for backend.

Operating System: Windows 7 or later (32-bit or 64-bit)

### 9.2 for Users

Hardware Platform: Core i3 or better processor, 2 GB or higher RAM

Software requirements: Windows 7 or later, Chrome for browsing

## 10. SYSTEM FLOW

Process starts with the registration of the user if the user is new to the web application. User requires to fill up the registration form[1] with the details including the name, phone no., aadhaar no., voter ID no., pan card no., etc.

Registration process is finalised by clicking user's image for verification in the next step and by OTP verification[3]. If the user is one the existing user, he/she can simply login using his/her credentials. This is followed by OTP verification.

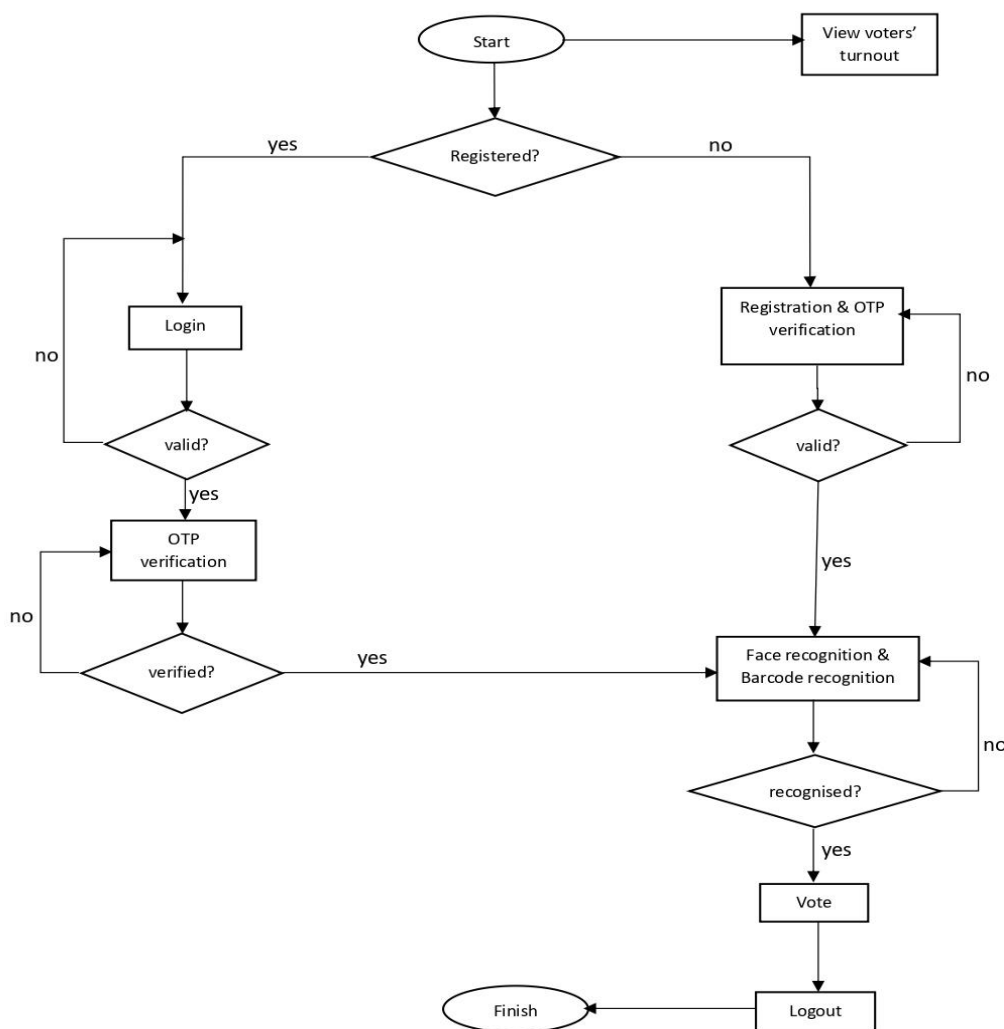


Fig. 12 System flow diagram

Afterwards, the next step is for facial recognition[2],[3] of the user. For this, user requires to capture his/her picture in real time. This picture is then matched with the one stored in the database at the time of registration. If the picture is a match, user can move to the next step, otherwise he has to recapture the picture.

Facial recognition is followed by the barcode detection. After the successful facial recognition process, barcode present on the voter ID card has to be verified. For this, user has to scan his voter ID card's barcode using the camera of his device. Once recognised, user can cast his/her vote to the candidate of his choice. Casting of vote has to be done within 1 minute. This timer is to ensure that there is least or no chance of malpractices. After that user can logout.

Voter turnout can be viewed by anyone. One viewing the turnout need not to be an eligible voter or to be an existing user of the application.

## 11. RESULT

The online voting system is an effective way to conduct elections digitally due to its security, scalability, accessibility and user-friendliness. This system is a successful integration of OTP verification, biometric verification and barcode recognition that helps in ensuring enhanced integrity and confidentiality of the voting process. On whole, this system is potent enough to add to efficiency and transparency of the electoral process along with remarkably reducing the malpractices.

## 12. CONCLUSION

The development approach of the system for online voting which has multiple security layers, requires to be structured and carefully done. The chosen development model is iterative waterfall as it works as a robust software development method providing systematic steps which thereby ensure the security, reliability and adaptability of the system. Since, the project aims at creating an efficient and secure online voting platform hence, this development is carefully followed. It also emphasizes on strict security measures in every development phase to prevent and handle risks associated with it. This facilitates in early error detection, required modifications, and seamless adaptation to changing requirements and thereby the reliability and security is enhanced further.

Through this project, we aim at providing an online platform for voting which adheres to the security standards along with meeting the operational requirements. Since it facilitates in remote voting hence

enables expatriates, the disabled, and military personnels to vote securely from anywhere. It can be utilised to hold emergency elections. Being easily accessible, this system will help in increasing the participation of people in electoral processes. This system ultimately contributes to the reliability and integrity of the electoral process.

## REFERENCES

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