A Project Report on
E-Voting System for Online Elections

Submitted in partial fulfilment for the award of the degree of

B.Tech (Computer Science)

By

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SCHOOL OF COMPUTER SCIENCE & ENGINEERING

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Abstract

The voting system is the backbone of every democracy and organization. The main goal of voting (in a scenario involving the citizens of a given country) is to come up with leaders of the people's choice. There are various voting techniques used such as Paper Ballot Voting System, E-Voting System also known as Electronic Voting System, Internet Voting System, SMS and Miss Calls Voting System. Some of the problems involved include ridging votes during the election, insecure or inaccessible polling stations, inadequate polling materials and also inexperienced personnel. In this paper, we have tried to seek out issues faced by multi various voting systems and make it work multiplatform on any operating system.

This online voting/polling system seeks to address the above issues. It should be noted that with this system in place, the users, citizens, in this case, shall be given ample time during the voting period. They shall also be trained on how to vote online before the election time.

Acknowledgement

I take immense pleasure in thanking Dr G. Viswanathan, my beloved Chancellor, VIT University and respected Dean, Dr R. Saravanan, for having permitted me to carry out the project.

I express gratitude to my guide, Dr Deepikaa S, for guidance and suggestions that helped me to complete the project on time. Words are inadequate to express my gratitude to the faculty and staff members who encouraged and supported me during the project. Finally, I would like to thank my ever-loving parents for their blessings and my friends for their timely help and support.

Signature of Student

Rahul (18BCE0018)

Srinivas Natarajan (18BCE0048)

Rachit Trilok(18BCE0873)

Introduction

i. Motivation

As we know that Election procedure in India is a very hectic one. So many people stand in lines for hours, waiting to exercise their right to vote. Reaching the polling booth is also not a very easy feat. During the election days, the traffic reaches its peak and there are tonnes of traffic jams, which might cause a person to reach late and miss their voting chance. Also, it is not possible for everyone to go to a polling booth to cast their vote, the reason being that the person might be elderly or disabled. It is also possible that someone lives at a very remote location where there is no possibility of creating a polling booth. While all these situations have existed for a very long time, some very new problems have arrived in the last year, as we know that the Coronavirus Pandemic is at its peak, and the social distancing is of utmost importance during these days. Using the same voting machine by everyone is not at all sanitary. Also, during the lockdown period, it is not possible to conduct elections on a large scale, without risking the lives of people.

The solution to all these problems can be an Aadhar based Online Voting System for Online Elections. The Internet reach has increased very widely due to the Digital India Program and one of its best uses would be to conduct online elections. Everyone can vote from the ease of their home and without risking their health in the process. The unique encryption system provides the safety that duplication of the votes is not possible.

All the above-mentioned reasons have been our motivation to create this software.

ii. Aim of proposed Work

Our system provides the end-user (people who are voting) an online registration form with details of the available candidates for their constituencies and collects their vote for their preferred candidate. It allows System administrators to Add / Remove users from the Database of eligible votes, Add / Remove candidates from various parties who are standing for elections along with their respective details.

iii. Objectives

The objectives of the Online Voting System are:

- The system must be robust without vulnerabilities or crashes.
- Have a user-friendly interface to simplify the election process.
- Have a user validation system to prevent illegitimate votes for candidates.
- Must be secure from external attacks

Literature Survey

Title	Summary	Gaps Identified
Towards secure e-voting using ethereum blockchain," *2018 6th International Symposium on Digital Forensic and Security (ISDFS)*, Antalya, 2018	With the help of smart contracts, this paper has implemented a voting system using the solidity language based on ethereum. It works based on a user's ethereum wallet treated as a unique identifier for recognising voters and enabling them to vote on any platform including Android.	1. Requires users to have an ethereum wallet. This is difficult as people aren't convinced about the safety and stability of cryptocurrency. 2. Is not very scalable. It can only handle 15-20 transactions per second vs Visa's 45,000.
Blockchain-Based E-Voting System," *2018 IEEE 11th International Conference on Cloud Computing (CLOUD)*, San Francisco, CA, 2018	This paper implements a variation of the ethereum blockchain technology which has been modified to handle 100's of transactions per second. It analyses 3 different protocols of the ethereum blockchain technology: Exonum, Quorum, Geth. Exonum is an extremely robust protocol which can handle 5000 transactions per second. Quorum is a ledger	1. Exonum can only be developed using the RUST programming language. This creates issues in interdependencies down the line and the upgradability of the system. It also makes it more difficult to develop 2. Quorum is a ledger based protocol and hence is slower, supporting only 100's of

	based system based on the Geth design and supports 100's of transactions per second. Geth is one of the 3 original implementations of ethereum and is the most developer friendly.	TPS.
Blockchain Voting and Its Effects on Election Transparency and Voter Confidence" dg.o '17: Proceedings of the 18th Annual International Conference on Digital Government Research June 2017	This paper gives an overview of blockchain technologies and their pros and cons. They analyse the benefits it can offer to the voting process by making it more transparent and auditable. They perform a case study of the issues faced with traditional voting such as the US election in 2000 and the tampering with the 2016 US elections but also admit to the double edged nature of this technology	This paper does not provide a solid implementation of what a blockchain based voting system would look like and only offers theoretical analysis. They identify key cyber security issues but fail to describe any ways to avoid these pitfalls.
E-voting scheme using secret sharing and K-anonymity. *World Wide Web* 22, 1657–1667 (2019)	This paper uses Shamir's secret sharing and k-anonymity, in which the voting system generates a polynomial according to the intention of the voters, computes and divides the shares among candidates. It focuses on security and is robust enough to resist a variety of malicious attacks to protect the sensitive	1. Has a single point of failure which makes it risky to implement for such a vital process 2. There are no implementation standards for Shamir's secret sharing algorithm making it more difficult and time consuming to implement and test for vulnerabilities and

	information.	efficiency. 3. Vulnerable to side channel attacks and lacks auditability, one of the biggest selling points of blockchain voting unlike its competitors such as ethereum.

Proposed System Requirement Analysis and Design

i. Stakeholder Analysis

The following stakeholders were identified during the requirement analysis of the project:

- **Political Parties:** These are the users who will be registering to be represented on our system when they stand for any elections. This will include details regarding local political parties and the constituencies they are standing in.
- **Citizens:** These are the users who will be using our system to cast their votes for representatives for elections. They will be directly interacting with our system through the designed interface.
- **Election commission:** This will be the committee in charge of overseeing the validation of voters and representatives and maintaining order throughout the election process. They will be the client who uses our software. They will be in charge of confirming votes and announcing results.
- **Legislature:** New rules and regulation will have to be passed regarding this form of voting. Legislative bodies are indirect stakeholders.
- **Project Manager:** Will be in charge of planning scope, Activity planning and scheduling, cost and budget estimations, risk analysis and Quality assurances. Will have to take responsibility for the project.

- **Developers:** Will be part of the team responsible for various aspects of the project and are responsible for its functioning and any issues faced down the line.

- **Commission officials:** They will be enforcing the laws regarding our software passed by the legislature and ensure a proper, valid voting process and preventing vote-rigging and other processes which would invalidate the process.

ii. Functional Requirements

- **Convenience**: The system shall allow the voters to cast their votes quickly, in one session, and should not require any special skills or intimidate the voter.

- **User-Interface**: The system shall provide an easy-to-use user-interface. Also, it shall not disadvantage any candidate while displaying the choices.

- **Eligibility**: Only authorized voters, who are registered and authorized, should be able to vote.

- **Uniqueness**: No voter should be able to vote more than once.

- **Voter Confirmation**: The voter shall be able to confirm clearly how his vote is being cast and shall be given a chance to modify his vote before he commits it.

- **No Over-voting**: The voter shall be prevented from choosing more than one candidate. (Only one vote per person).

- **Accuracy**: The system shall record and count all the votes and shall do so correctly.

iii. Non-Functional Requirements

- **Simplicity:** The system should be designed extremely simple.
- **Data integrity:** Ensure that each vote is recorded as intended and cannot be tampered with in any manner, once recorded
- **Reliability**: Election systems should work robustly, without loss of any votes.
- **Transparency**: Voters should be able to possess general knowledge and understanding of the voting process.
- **No vote-selling**: Voters should not be able to prove to others how they voted.

iv. System Requirements

a. Hardware

The following hardware requirements should be met for the software to work in a computing environment:

- Intel Pentium or processor with minimum speed 2.10GHz
- Minimum 1GB RAM
- A minimum capacity of 500MB (Hard Disk)
- A displaying monitor
- Accelerated graphics card
- Better performance with 250MB and above

b. Software

The following software requirements need to be met for actuating the application within the system:

- Any operating system with GUI (Graphical User Interface) compatible
- Browser for accessing the website
- DirectX 9 for better display
- Frontend – HTML 5, CSS 3 and JavaScript
- Backend – NodeJS and Express framework
- Database- mongo DB 4.2.8

v. Process Model

As we already know that the Online Voting System project may consist of various attributes thus making itself a big project and for such a project, we need a constant review analysis by the customers using the software. Hence process models supporting the size of big/large projects must be consulted for such a process. Therefore, a **Spiral Model** is required for such projects.

The following steps are needed for the spiral analysis:

1. It helps to identify and understand the requirements.
2. Risk analysis.
3. We need a constant review analysis by the customers
4. Build and test the software.
5. Evaluate the software when it meets the customer needs

Why the Spiral Model

As an E-voting system is a large-scale project with an enormous amount of risks and vulnerabilities to consider, the Spiral Model is chosen for development.

- Risks Involved: The project requires constant risk analysis of each model as any mistakes / vulnerabilities existing in the project can compromise the entire system and by extension, the entire election process.
- Scale of the project: An E-voting system can scale to be an enormous system considering the size of the user base. For such a large-scale model, the Spiral Software Development Model is most appropriate.
- Software Testing: By adopting this model, a working version of the software is produced earlier in the SDLC and hence testing of components can be started early before it is scaled up. These mistakes can be corrected early on making the software more likely to be bug free once scaled to size.

vi. Work Breakdown Structure

a. Deliverable Oriented Work Breakdown Structure (Noun Based)

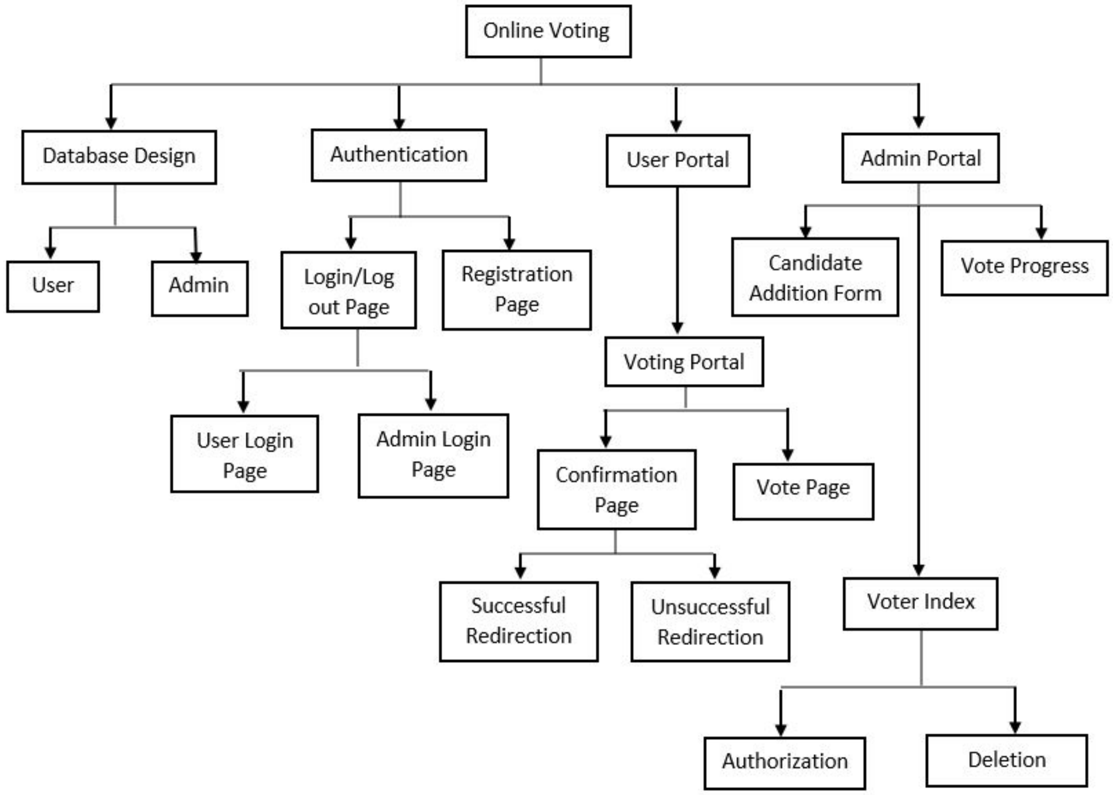


Fig 1: Noun based Work breakdown Structure

b. Task-Oriented Work Breakdown Structure (Verb Based)

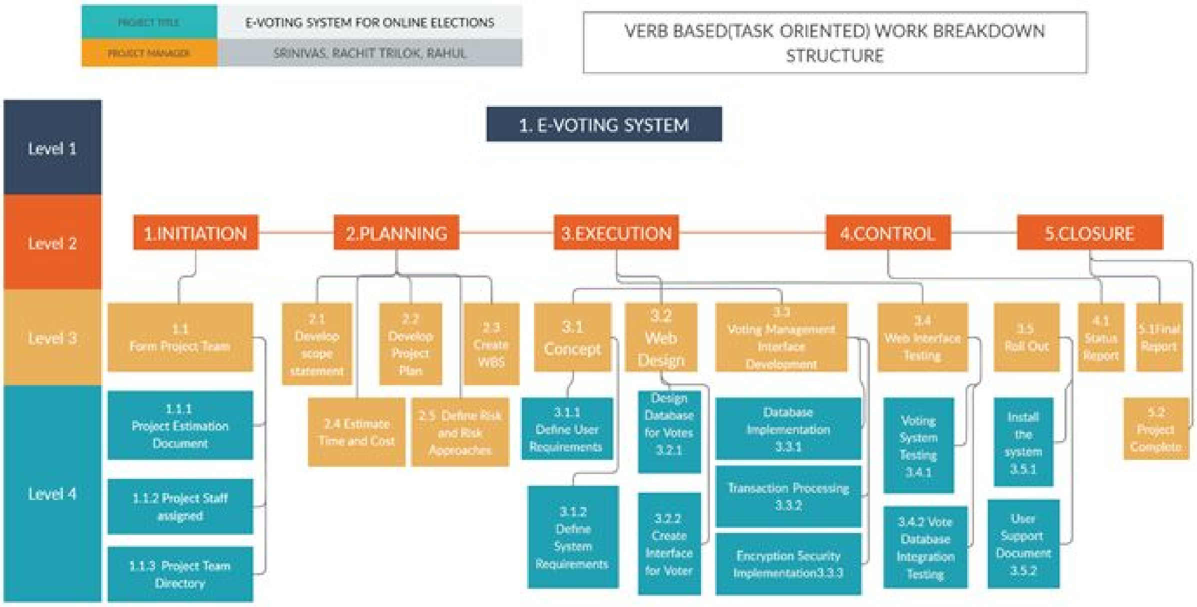

PROJECT TITLE
E-VOTING SYSTEM FOR ONLINE ELECTIONS
PROJECT MANAGER
SRINIVAS, RACHIT TRILOK, RAHUL
VERB BASED(TASK ORIENTED) WORK BREAKDOWN STRUCTURE
Level 1
Level 2
Level 3
Level 4
1. E-VOTING SYSTEM
1.INITIATION
2.PLANNING
3.EXECUTION
4.CONTROL
5.CLOSURE
1.1 Form Project Team
1.1.1 Project Estimation Document
1.1.2 Project Staff assigned
1.1.3 Project Team Directory
2.1 Develop scope statement
2.2 Develop Project Plan
2.3 Create WBS
2.4 Estimate Time and Cost
2.5 Define Risk and Risk Approaches
3.1 Concept
3.1.1 Define User Requirements
3.1.2 Define System Requirements
3.2 Web Design
Design Database for Votes 3.2.1
3.2.2 Create Interface for Voter
3.3 Voting Management Interface Development
Database Implementation 3.3.1
Transaction Processing 3.3.2
Encryption Security Implementation3.3.3
3.4 Web Interface Testing
Voting System Testing 3.4.1
3.4.2 Vote Database Integration Testing
3.5 Roll Out
Install the system 3.5.1
User Support Document 3.5.2
4.1 Status Report
5.1Final Report
5.2 Project Complete

Fig 2: Verb based Work breakdown Structure

c. Time Phased Work Breakdown Structure

WBS	Task description	Work Duration (in hours)	Start Date	Finish Date	People Assigned
1	**E-Voting System Project**	**122h**	**15/07/2020**	**20/09/2020**	**Srinivas, Rahul, Rachit**
1.1	**Project initiation**	**16h**	**15/07/2020**	**18/07/2020**	
1.1.1	Formulate Questions	8h	15/07/2020	16/07/2020	Srinivas, Rahul, Rachit
1.1.2	Analyse voter demands	8h	17/07/2020	18/07/2020	Srinivas, Rahul, Rachit
1.2	**Project Planning**	**12h**	**19/07/2020**	**22/07/2020**	
1.2.1	Create a Project Management Plan	3h	19/07/2020	19/07/2020	Srinivas, Rahul
1.2.2	Create Work Breakdown Structure	3h	20/07/2020	20/07/2020	Rahul, Rachit
1.2.3	Create a Gantt Chart and Project Schedule	3h	21/07/2020	21/07/2020	Srinivas, Rachit
1.2.4	Review Project Plan with consumers	3h	22/07/2020	22/07/2020	Srinivas, Rahul
1.3	**Project Development**	**58h**	**23/07/2020**	**31/08/2020**	
1.3.1	Create the Database	16h	24/07/2020	28/07/2020	Rachit

1.3.1.1	Make the User Schema	8h	24/07/2020	25/07/2020	Rachit
1.3.1.2	Make the Admin Schema	8h	26/07/2020	28/07/2020	Rachit
1.3.2	Create the Authentication page	12h	29/07/2020	5/8/2020	Srinivas
1.3.2.1	Create Log in/Logout Page	6h	29/27/2020	1/08/2020	Srinivas
1.3.2.1.1	Create User Login Page	3h	29/07/2020	30/07/2020	Srinivas
1.3.2.1.2	Create Admin Login Page	3h	31/07/2020	01/08/2020	Srinivas
1.3.2.2	Create Registration Page	6h	2/08/2020	3/08/2020	Srinivas
1.3.3	Create User Portal	12h	4/08/2020	7/08/2020	Rahul
1.3.3.1	Create a Voting Portal	12h	4/08/2020	5/08/2020	Rahul
1.3.3.1.1	Create Confirmation Page	6h	5/08/2020	06/08/2020	Rahul
1.3.3.1.2	Create Vote Page	6h	6/08/2020	7/08/2020	Rahul
1.3.4	Create Admin Portal	18h	08/08/2020	13/8/2020	Rahul
1.3.4.1	Create Candidate Addition Form	6h	08/08/2020	10/08/2020	Rahul
1.3.4.2	Create Voter Index	6h	11/08/2020	16/8/2020	Rachit
1.3.4.2.1	Create voter authorization page	3h	11/08/2020	13/8/2020	Srinivas

1.3.4.2.2	Create voter deletion page	3h	14/8/2020	16/8/2020	Srinivas
1.3.4.2	Create Vote Progress Page	6h	17/8/2020	20/8/2020	Rachit
1.3.5	Connecting the Frontend with the Database	12h	21/8/2020	31/8/2020	
1.3.5.1	Connecting the Voter Portal with the voter table	6h	21/8/2020	25/8/2020	Rahul, Rachit
1.3.5.2	Connecting the Admin Portal with the admin table	6h	26/8/2020	31/8/2020	Srinivas, Rahul
1.4	**Project Final Testing**	**24h**	**1/09/2020**	**10/09/2020**	
1.4.1	Unit Testing	6h	1/09/2020	3/09/2020	Srinivas, Rahul, Rachit
1.4.2	Integration Testing	6h	4/09/2020	06/09/2020	Srinivas, Rahul, Rachit
1.4.3	System testing	6h	7/09/2020	9/09/2020	Srinivas, Rahul, Rachit
1.4.4	Performance Testing	6h	09/10/2020	13/10/2020	Srinivas, Rahul, Rachit
1.5	Project Completion	12h	14/10/2020	20/10/2020	
1.5.1	Final demonstration	12h	14/10/2020	20/10/2020	Srinivas, Rahul, Rachit

d. Pert Chart

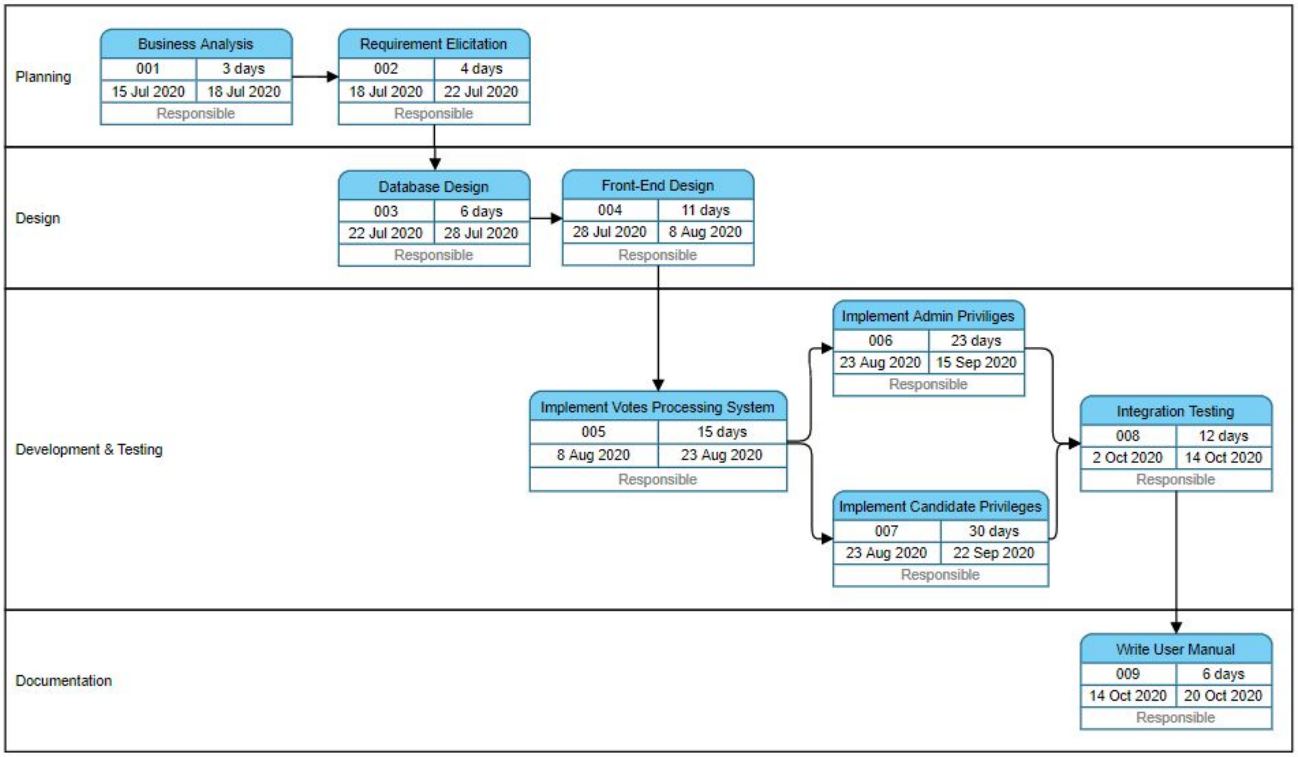


Fig 3: Pert Chart

Activity/Task	Duration(Days)
Business Analysis	3
Requirement Elicitation	4
Database Design	6
Front-End Design	11
Implementing Vote Processing System	15
Implementing Admin Privileges	23
Implementing Candidate Privileges	30
Integration Testing	12
User Manual	6

e. Gantt Chart

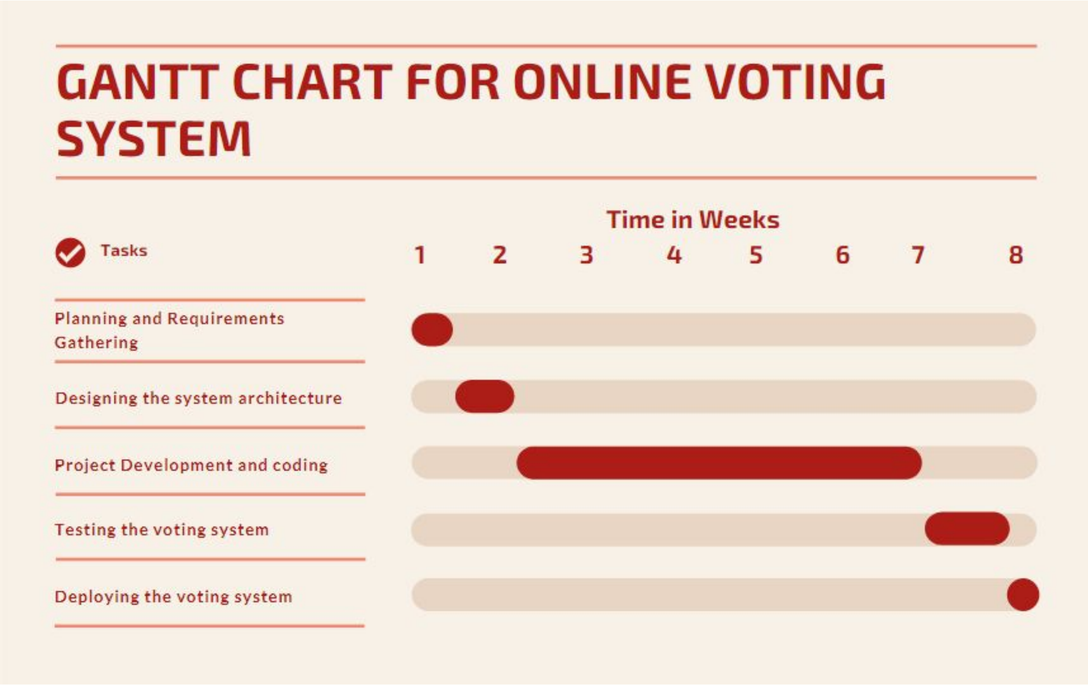


Fig 4: Gantt Chart

Design of Proposed System

i. High-Level Design

a. Architecture Design and Diagram

The project follows a data-oriented approach where the data referenced includes details such as candidate name and details, party name and symbol, voter's personal details and their cast votes. Each constituency houses a database collection which stores all relevant information with the lenient being the devices people use to register/login/vote.

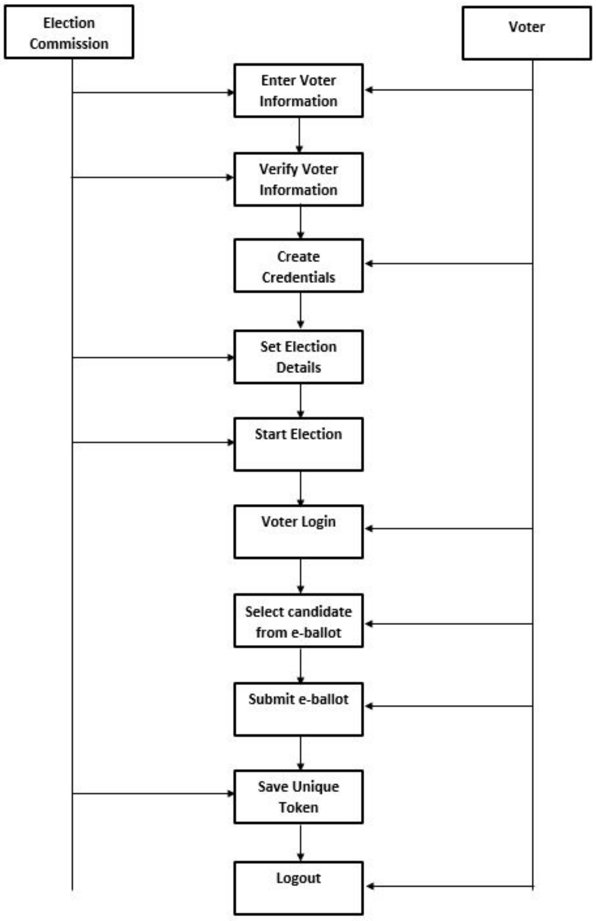


Fig 5.1: Architecture Diagram

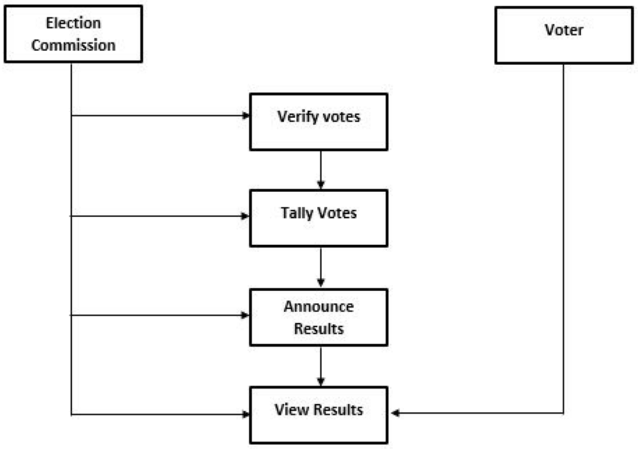


Fig 5.2: Architecture Diagram

The data collected from each constituency is used to decide the election results with the overall result derived from the sum total of these constituent components. This helps make the system modular and easily scalable for anything ranging from district elections to choosing the next prime minister

Context Diagrams

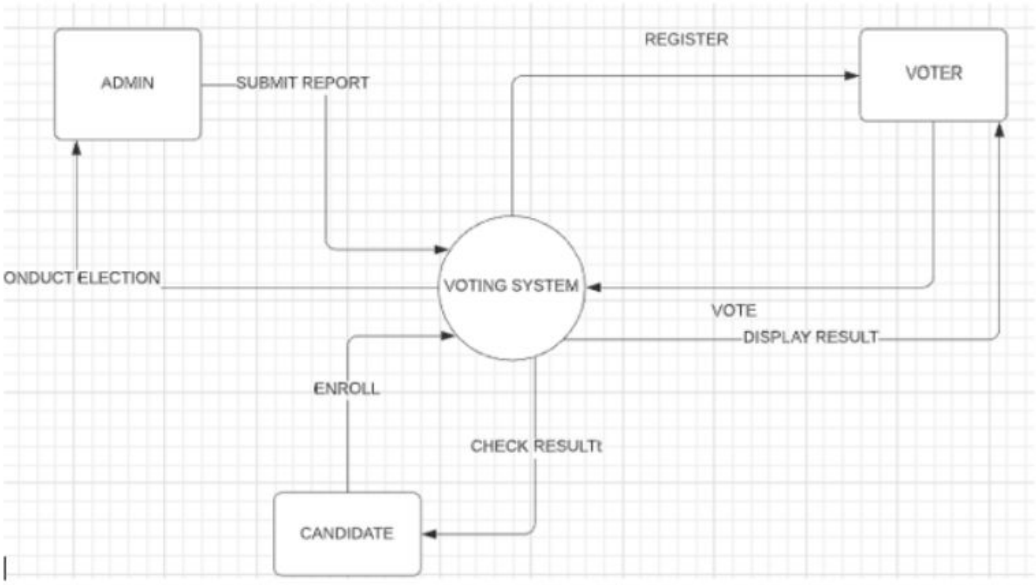


Fig 6: DFD level-0 Diagram

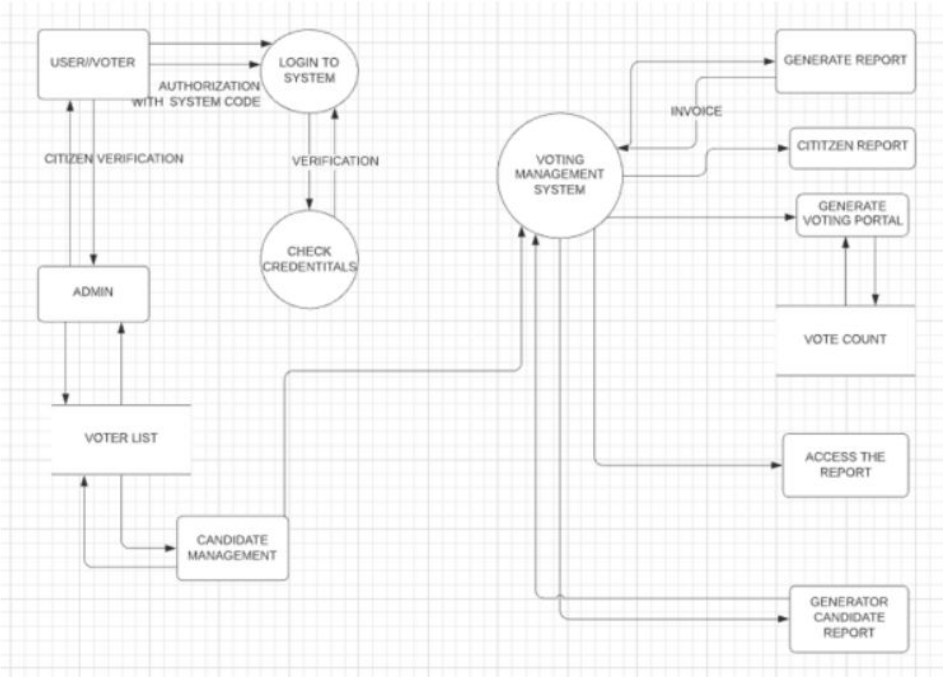
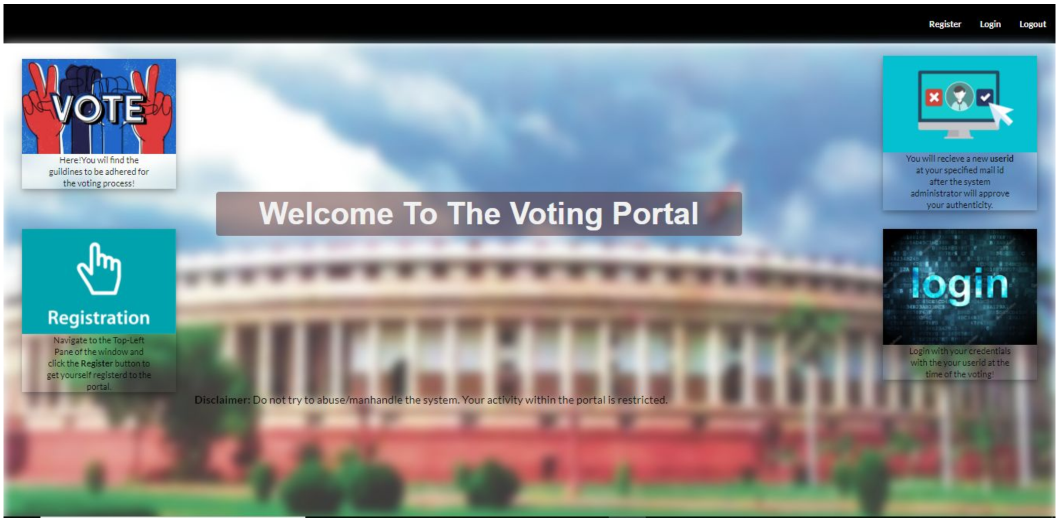


Fig 7: DFD level-1 diagram

b. UI Design

The system will work on a Web Browser like Google Chrome or Mozilla Firefox.

Home page : This Page will be the Main Page that appears in front of the Voter when they open the Voting Portal.



Welcome To The Voting Portal

Here!You wil find the guildines to be adhered for the voting process!

Navigate to the Top-Left Pane of the window and click the **Register** button to get yourself registerd to the portal.

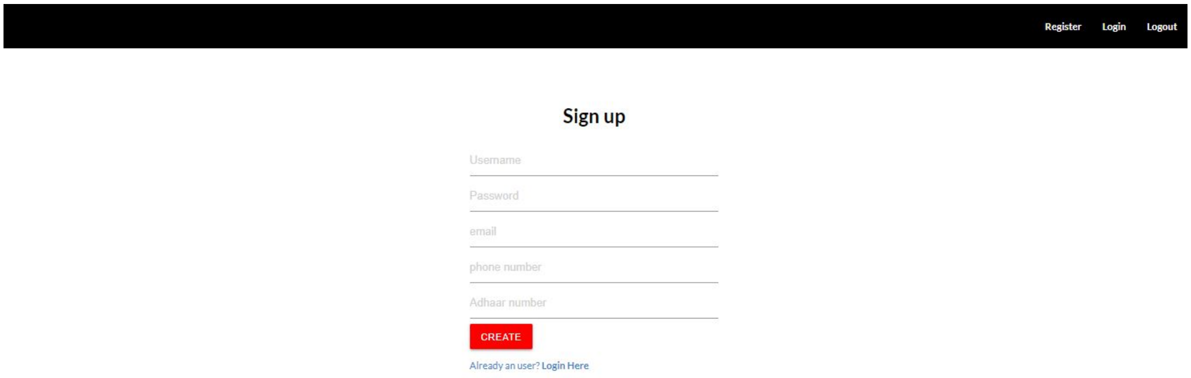
You will recieve a new **userid** at your specified mail id after the system administrator will approve your authenticity.

Login with your credentials with the your userid at the time of the voting!

Disclaimer: Do not try to abuse/manhandle the system. Your activity within the portal is restricted.

Fig 8: Home Page

Voter registration page: This Page will contain the registration form to sign up as a voter.

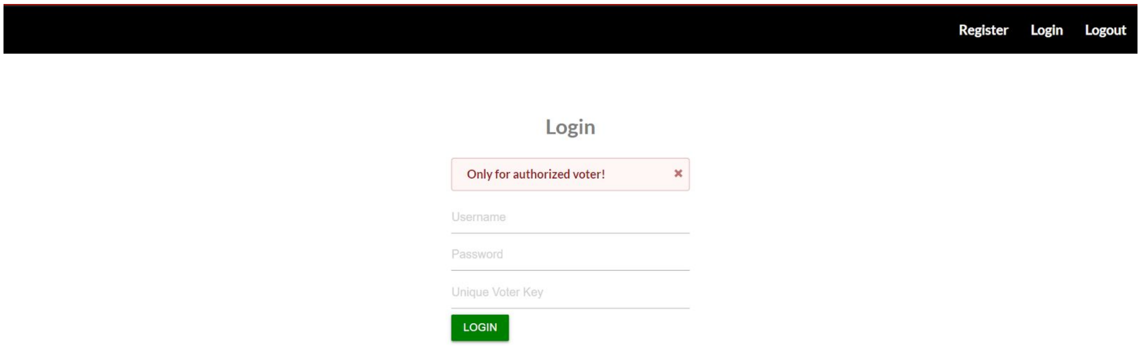


Sign up

Already an user? Login Here

Fig 9: Sign Up Page

<u>Voter login page</u>: This Module will contain a login page after the user has successfully registered as a voter and is ready to cast their vote.

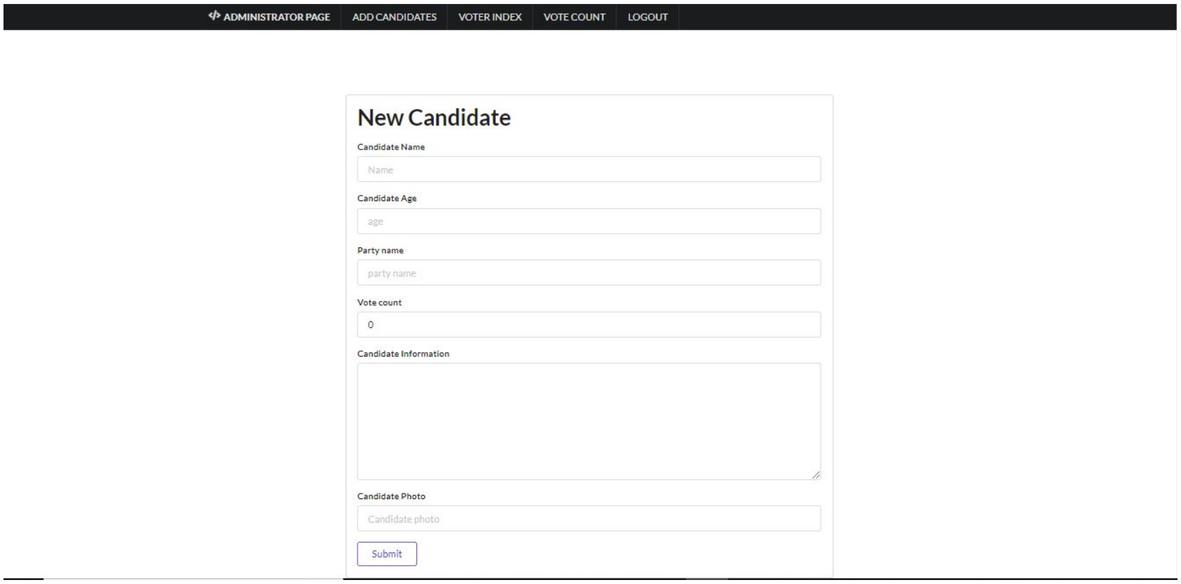


Login

Only for authorized voter! ×

Fig 10: Login Page

<u>Add candidate page</u>: This Module will contain the Nomination form for a Person to fill for their candidature.



New Candidate

Candidate Name

Candidate Age

Party name

Vote count

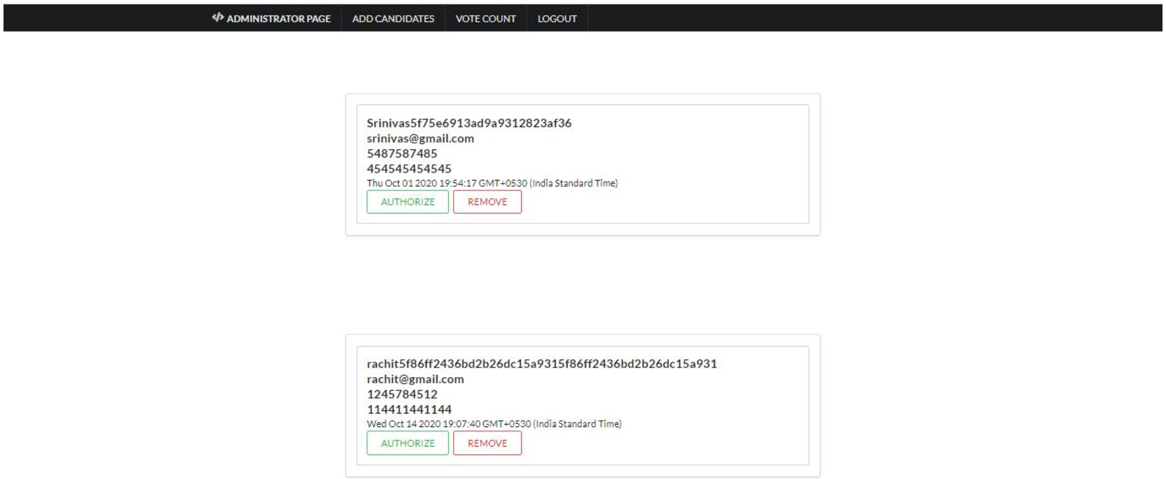
0

Candidate Information

Candidate Photo

Fig 11: Add Candidate Page

<u>Voter authorization page</u>: This Page allows for the Administrators to authorise a person as a valid voter and create their unique credentials for casting the vote.

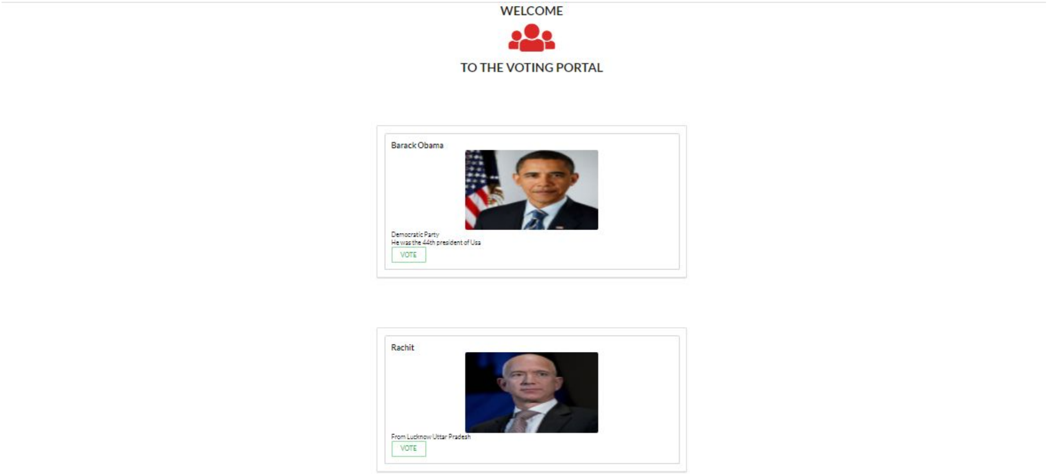


Srinivas5f75e6913ad9a9312823af36
srinivas@gmail.com
5487587485
454545454545
Thu Oct 01 2020 19:54:17 GMT+0530 (India Standard Time)

rachit5f86ff2436bd2b26dc15a9315f86ff2436bd2b26dc15a931
rachit@gmail.com
1245784512
114411441144
Wed Oct 14 2020 19:07:40 GMT+0530 (India Standard Time)

Fig 12: Authorize Voter Page

Voting Page: This Page will show the list of candidates that a voter can vote. Along with each candidate, their photo,Party Name, Age and Description will be provided.


WELCOME

TO THE VOTING PORTAL

Barack Obama

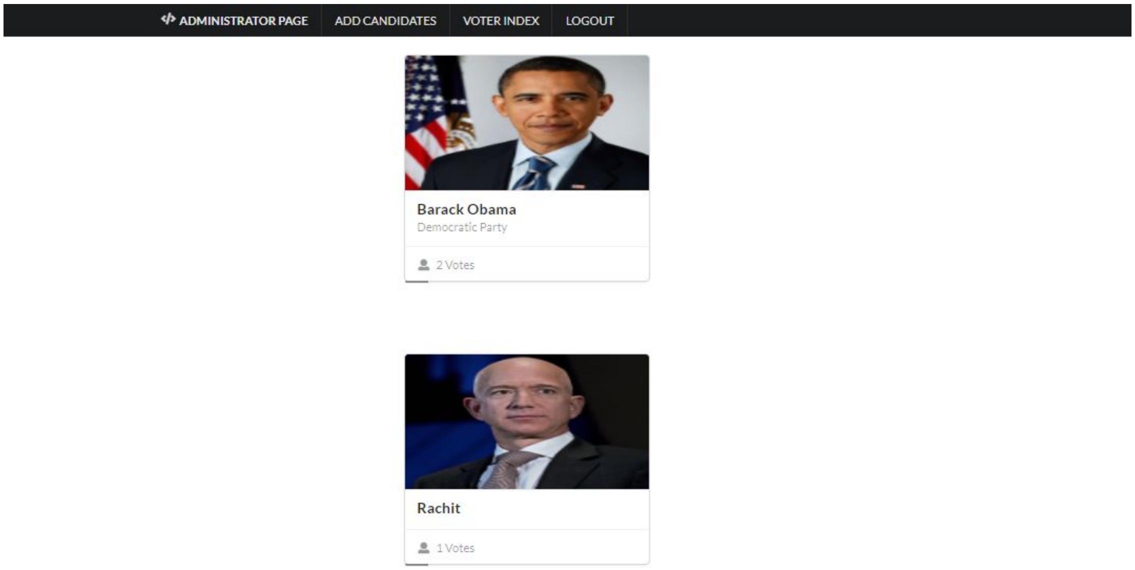
Democratic Party
He was the 44th president of Usa

Rachit

From Lucknow Uttar Pradesh

Fig 13: Select Candidate Page

Vote Count Page: This page will contain the status of Votes casted to each candidate. Here the admins will be able to see how many votes each candidate has received.



Barack Obama
Democratic Party

2 Votes

Rachit

1 Votes

Fig 14: Candidate Vote Tally Page

ii. Detailed Design

a. Activity Diagram

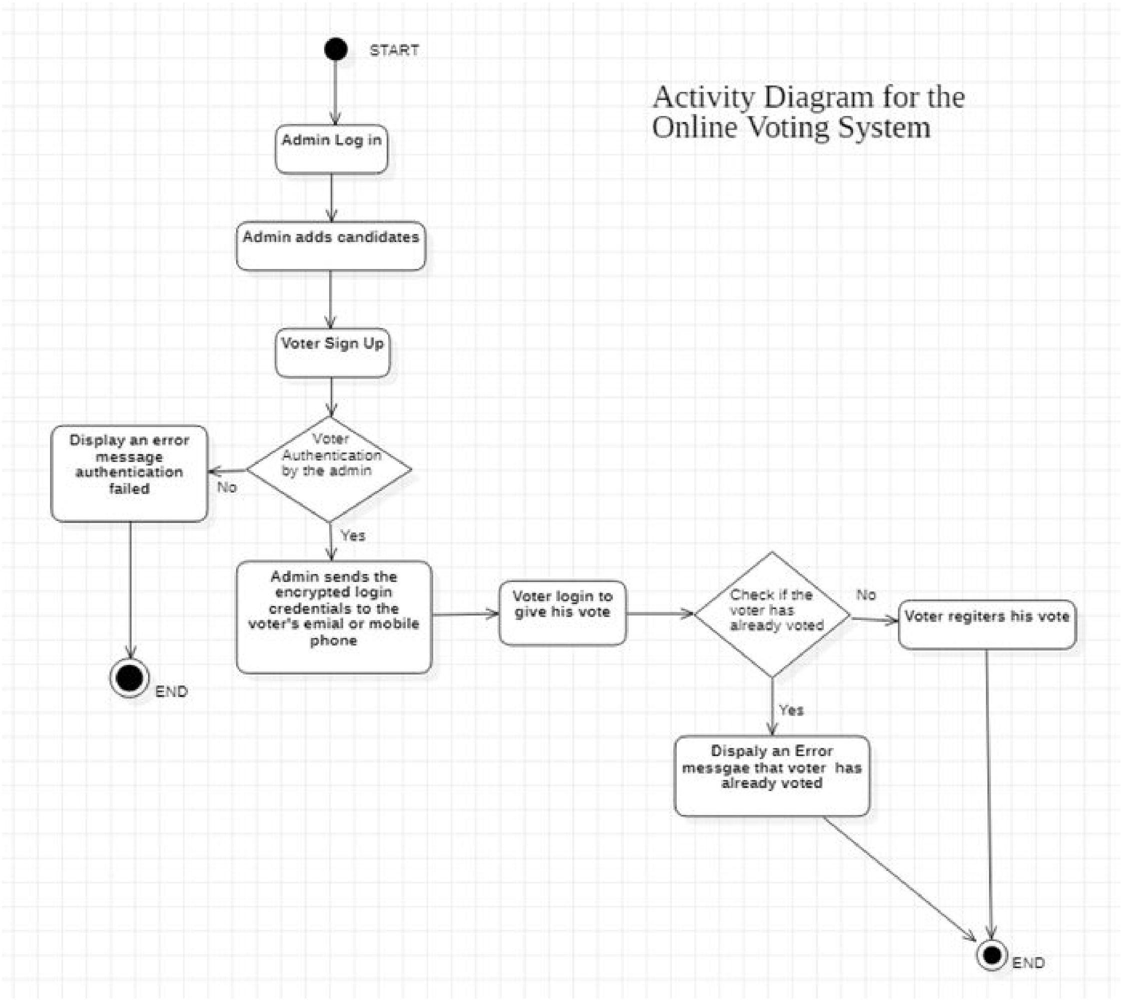

START
Activity Diagram for the
Online Voting System
Admin Log in
Admin adds candidates
Voter Sign Up
Voter Authentication by the admin
No
Display an error message authentication failed
END
Yes
Admin sends the encrypted login credentials to the voter's emial or mobile phone
Voter login to give his vote
Check if the voter has already voted
No
Voter regiters his vote
Yes
Dispaly an Error messgae that voter has already voted
END

Fig 15: Activity Diagram

b. State Diagram

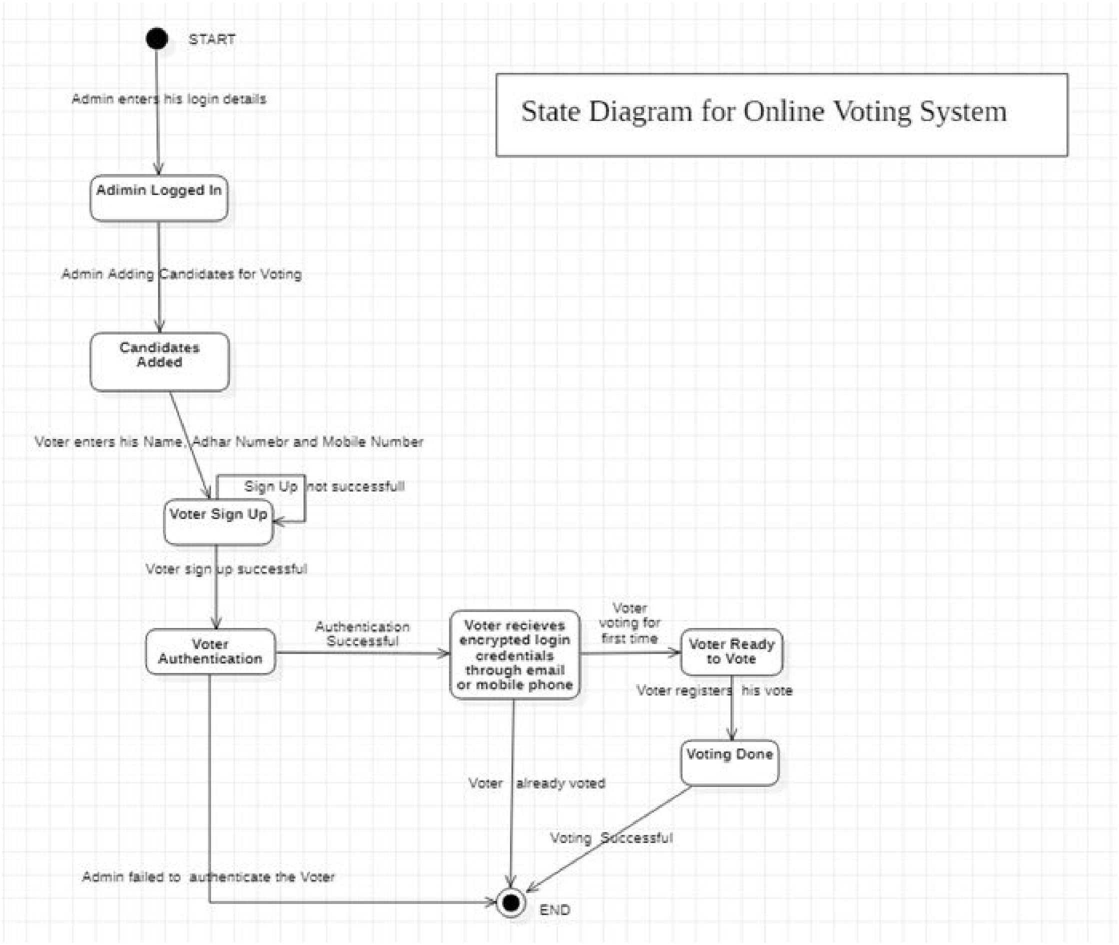

START
Admin enters his login details
Adimin Logged In
Admin Adding Candidates for Voting
Candidates Added
Voter enters his Name, Adhar Numebr and Mobile Number
Sign Up not successfull
Voter Sign Up
Voter sign up successful
Voter Authentication
Authentication Successful
Voter recieves encrypted login credentials through email or mobile phone
Voter voting for first time
Voter Ready to Vote
Voter registers his vote
Voting Done
Voter already voted
Voting Successful
Admin failed to authenticate the Voter
END
State Diagram for Online Voting System

Fig 16: State Diagram

c. Use case Diagram

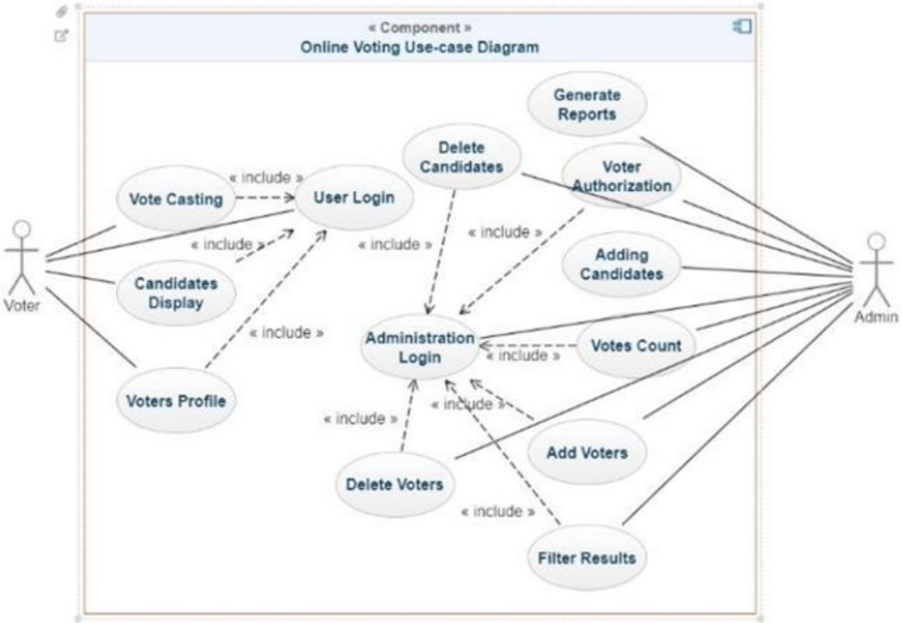


Fig 17: Use Case Diagram

d. Sequence Diagram

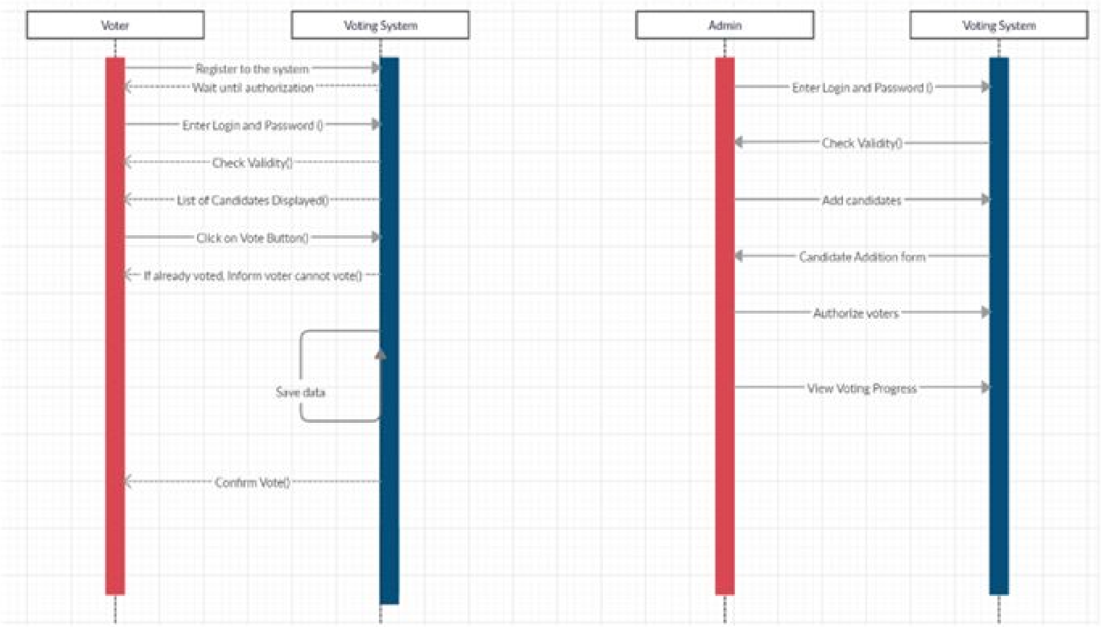


Fig 18: Sequence Diagram

e. Class Diagram

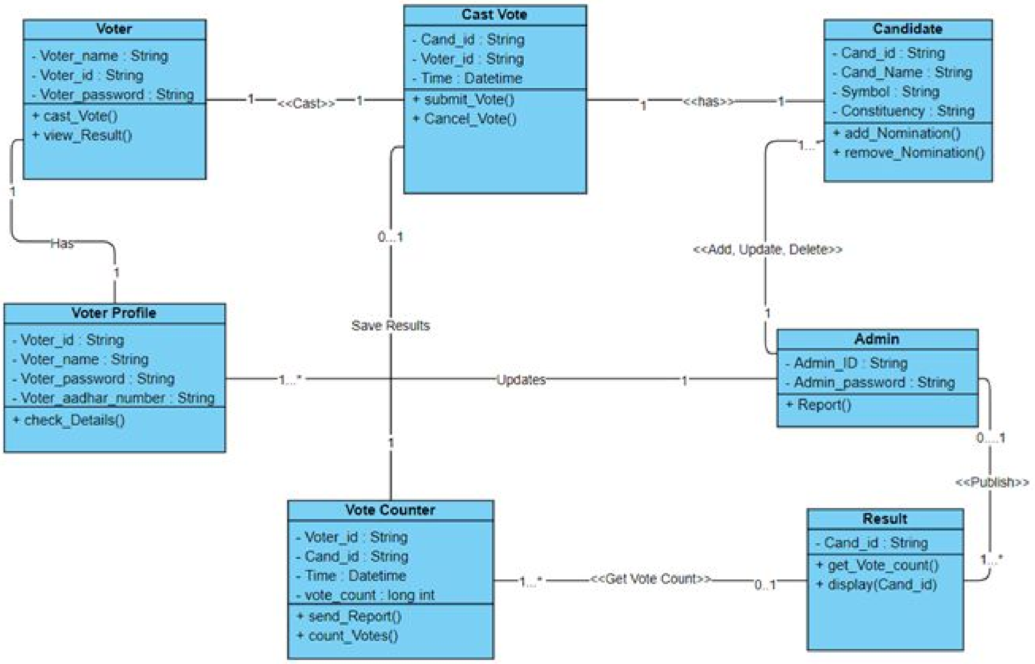


Fig 19: Class Diagram

f. ER - Diagram

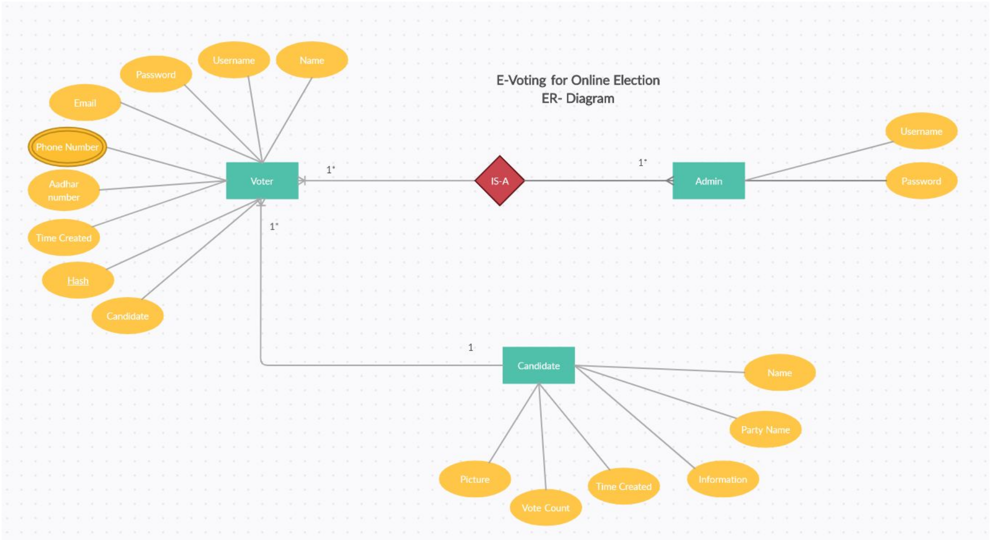
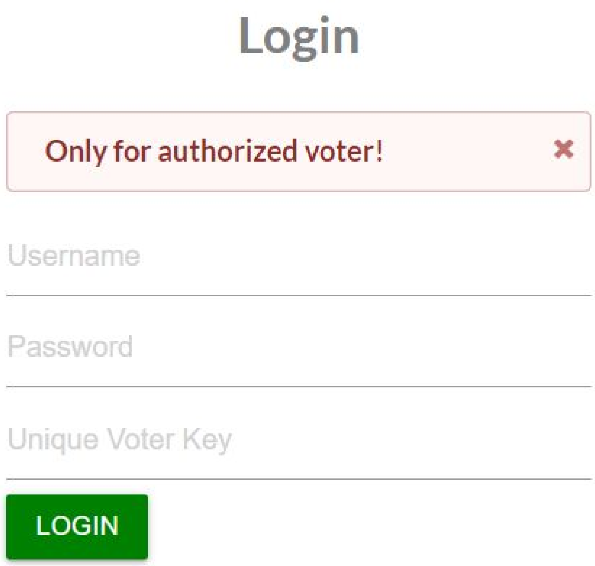


Fig 20: ER Diagram

Implementation



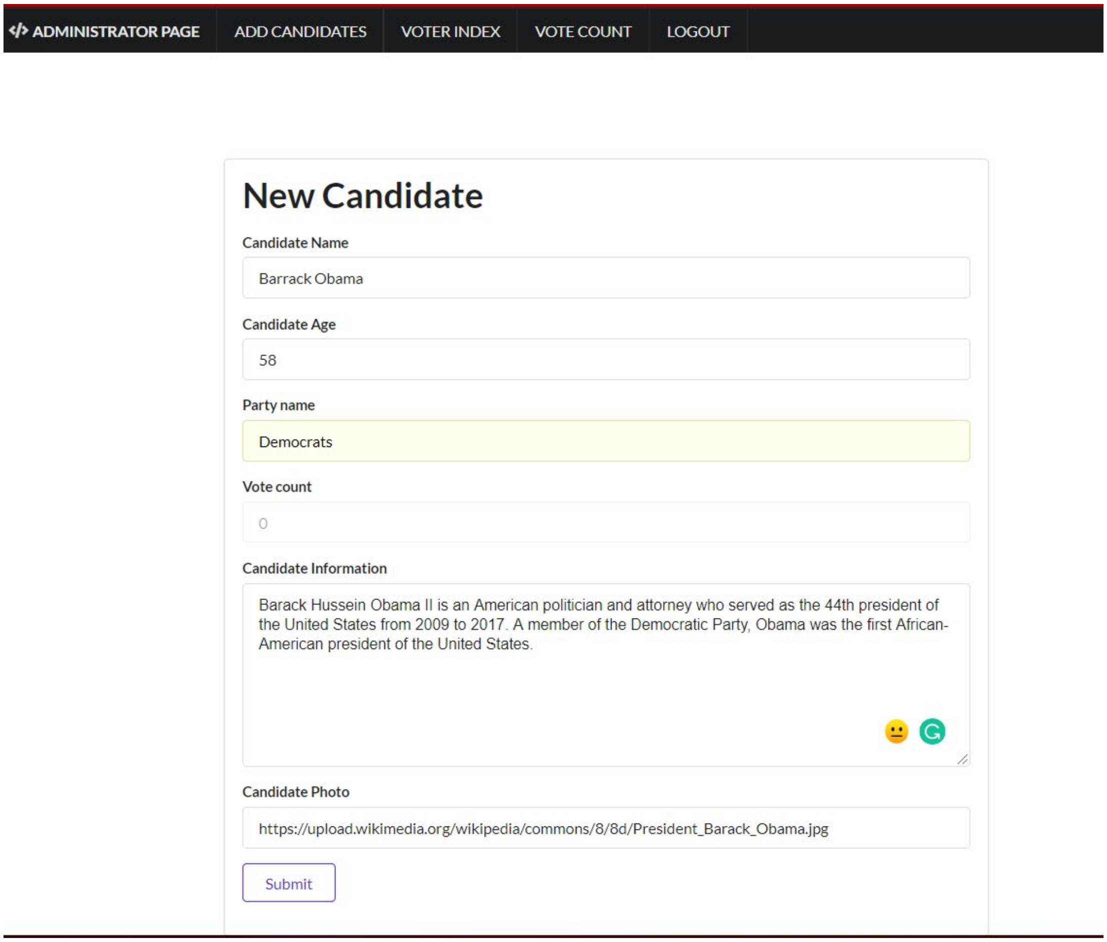
Login

Only for authorized voter! ✖

Fig 21: Login Page

Initially, admin will login through his specified username and password as depicted in figure-1 which will render him through to the administrator page which follows privileged actions.

After logging in the admin will have to add candidates details through a form provided in the administrator page.



New Candidate

Candidate Name: Barrack Obama

Candidate Age: 58

Party name: Democrats

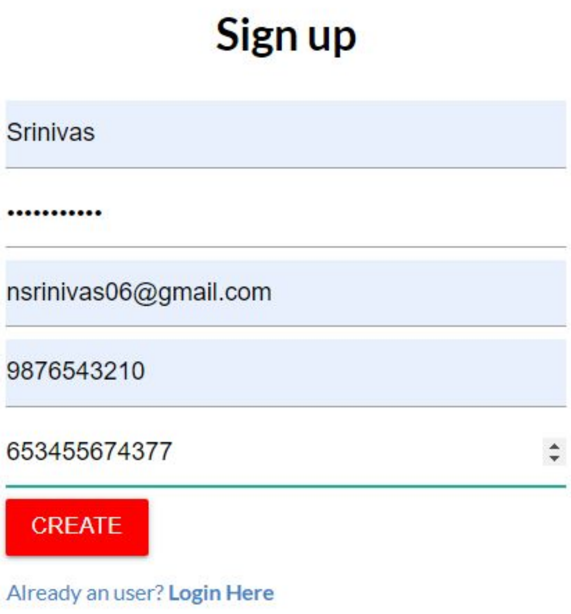
Vote count: 0

Candidate Information: Barack Hussein Obama II is an American politician and attorney who served as the 44th president of the United States from 2009 to 2017. A member of the Democratic Party, Obama was the first African-American president of the United States.

Candidate Photo: https://upload.wikimedia.org/wikipedia/commons/8/8d/President_Barack_Obama.jpg

Fig 22: Adding New Candidates

The candidate details will be saved in the database through which the voter will be able to view the details in the vote page and cast their vote after the registration/authorization process. A vote count attribute is defined for every candidate which is fixed to 0 initially.



Sign up

Srinivas

•••••••••••

nsrinivas06@gmail.com

9876543210

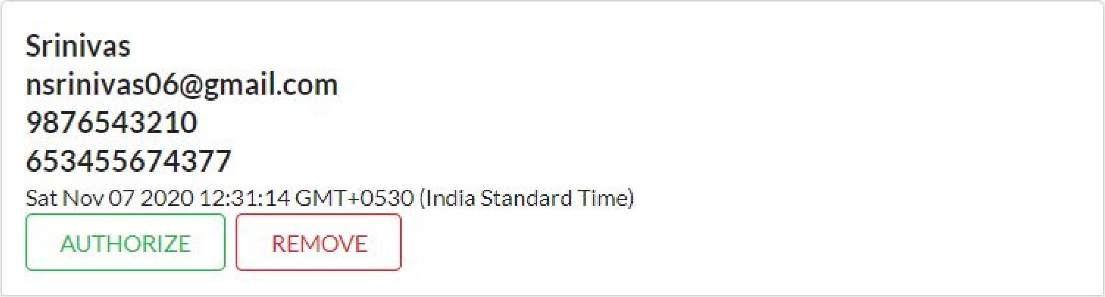
653455674377

Already an user? Login Here

Fig 23: Sign Up/Register page

After the admin has added the details of the candidate the user can now register which after registration will be qualified as a registered voter. (Voting is only allowed for authorized users from admin which will be verified manually by the admin with authenticity of the user via the aadhaar number).

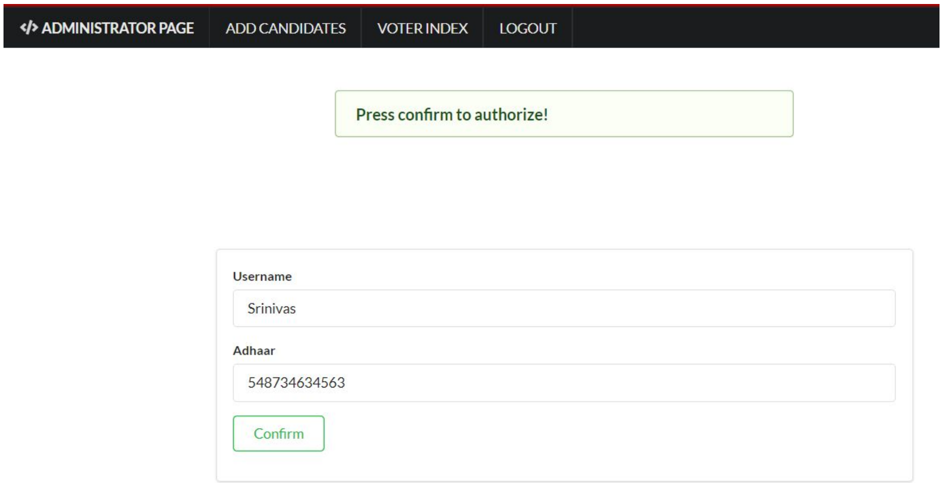
After the user has registered, admin now has the option to authorize or remove the user based on the aadhaar number on the records and the user creation timing.



Srinivas
nsrinivas06@gmail.com
9876543210
653455674377
Sat Nov 07 2020 12:31:14 GMT+0530 (India Standard Time)

Fig 24: Administrator Authorization of voter

The details of the voter in the form of aadhaar number will already be registered in the administrator system. Admin can verify from the available documents of the citizens/voters and authorize the same.



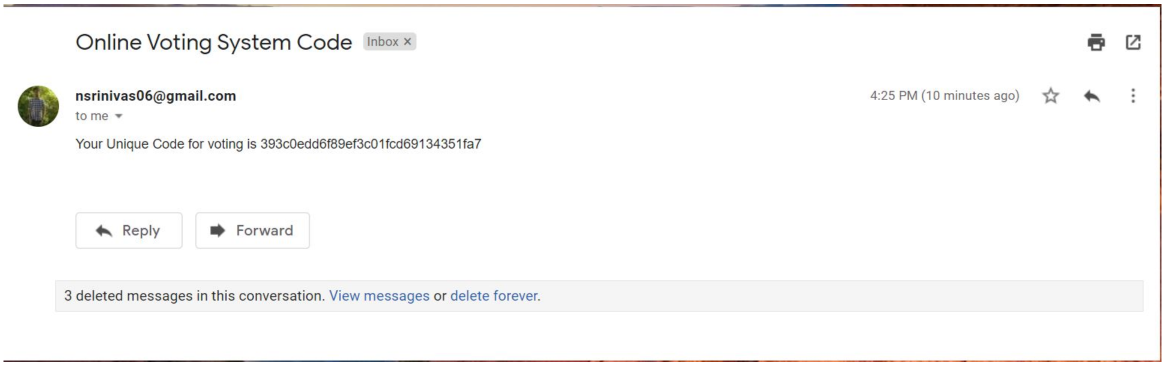
Press confirm to authorize!

Username
Srinivas
Adhaar
548734634563

Fig 25: Confirming Authorization

The authorization process will be confirmed with an encrypted username which is unique for every user that will be sent to the user via email or sms. The user will now be categorized as an authorized user.

As shown above, the user authorization with an encrypted username, the username is applied in the login of the user on the date of the voting from where the user can only login through the provided username.



Online Voting System Code

nsrinivas06@gmail.com
to me

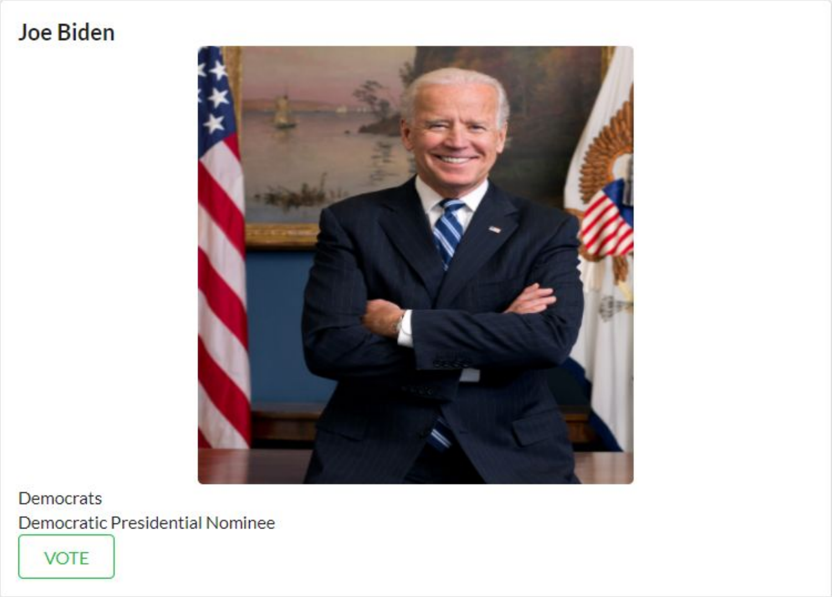
Your Unique Code for voting is 393c0edd6f89ef3c01fcd69134351fa7

3 deleted messages in this conversation. View messages or delete forever.

Fig 26: Email of Unique Code

After the user logs in he/she will be directed to the voting page where the candidate details are available with a voting button.

Pressing the voting button against the desired candidate will follow up with a confirmation page.



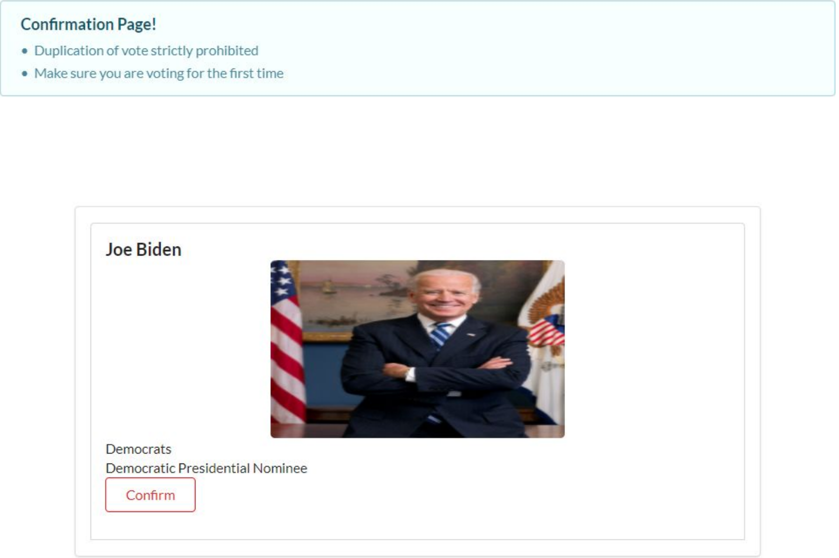
Joe Biden

Democrats

Democratic Presidential Nominee

Fig 27: Choosing candidate from ballot

A confirmation page will be generated to ensure the vote passes on to the desired candidate.



Confirmation Page!

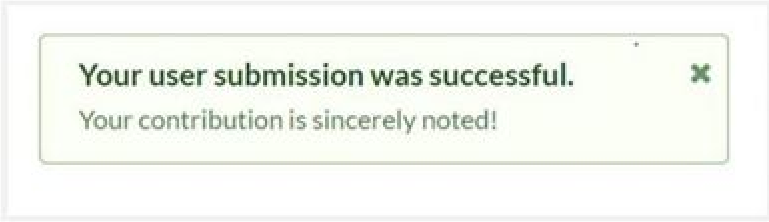
- Duplication of vote strictly prohibited
- Make sure you are voting for the first time

Joe Biden

Democrats

Democratic Presidential Nominee

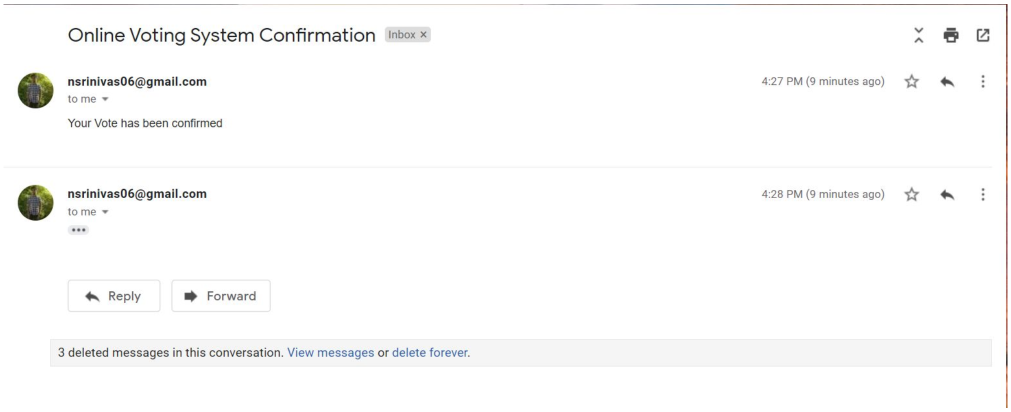
Fig 28: Confirmation of choice before vote



Your user submission was successful.

Your contribution is sincerely noted!

Fig 29: Confirmation after vote



Online Voting System Confirmation

nsrinivas06@gmail.com
to me

4:27 PM (9 minutes ago)

Your Vote has been confirmed

nsrinivas06@gmail.com
to me

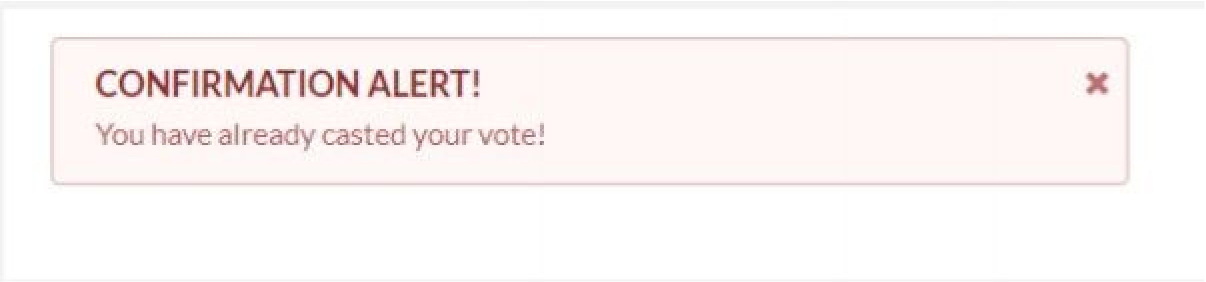
4:28 PM (9 minutes ago)

3 deleted messages in this conversation. View messages or delete forever.

Fig 30: Email confirming the vote

After the voter confirms his choice, they will be redirected to a success page showing the confirmation and commitment of the choice in the user database.

The admin can view the results of the polling in his page.



CONFIRMATION ALERT!

You have already casted your vote!

Fig 31: Attempting to cast multiple votes

If the voter again tries to cast a vote he/she will be directed to a warning page instead of a success page which will indicate that the casted vote is duplicated and will not be saved in the database.

Testing

i. Sign Up / Register Module

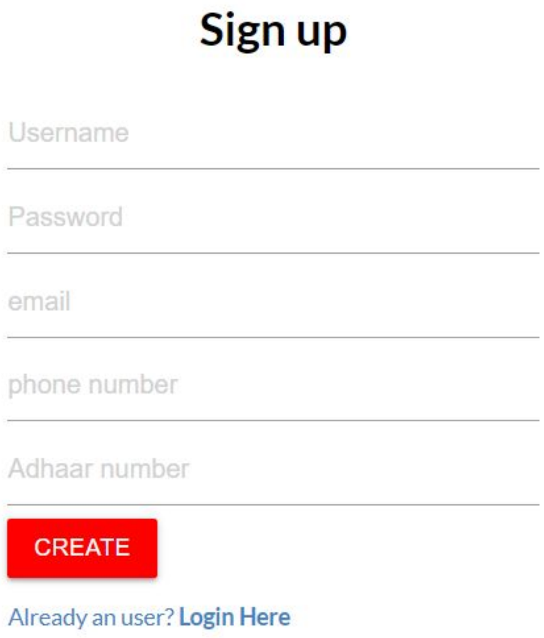


Fig 32: Sign Up Interface

Valid Equivalence Classes:

- C1: Username contains only alphabets
- C2: Password consists of at least 1 digit, 1 capital letter and a length >=8
- C3: Email Id length is between 1 – 254 characters
- C4: Email Id does not start with a numeric/special character C5: Phone Number must consist of only digits with a total length of 10
- C6: Phone number must not start with a 0

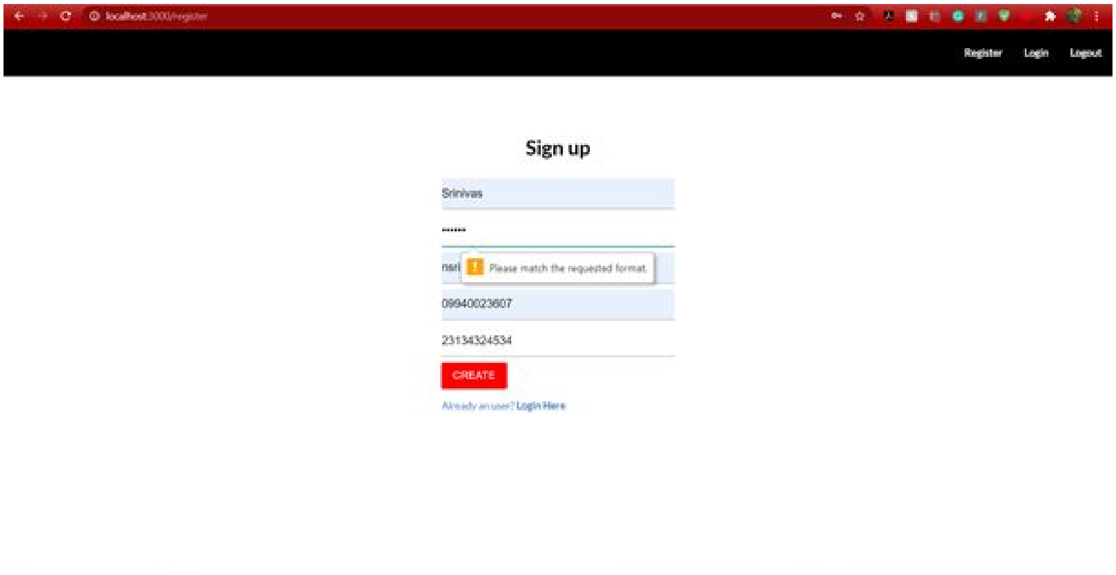
- C7: Aadhar number must consist of only digits with a total length of 12
- C8: Aadhar Number must not start with a 0

Invalid Equivalence Classes:

- C9: Username doesn’t contain only alphabets
- C10: Password doesn’t contain a special character
- C11: Password doesn’t contain a digit
- C12: Password length is less than 8
- C13: Email Id does starts with a numeric/special character
- C14: Phone Number starts with 0
- C15: Phone Number is not 10 digits
- C16: Aadhar Number starts with 0
- C17: Aadhar Number is not 12 digits

ID	Class	Username	Password	Email	Phone no	Aadhar No	Expected Result	Actual Result
1	C1 – C8	Srinivas	Thisispas3$	someone@gmail.com	9988776622	123456789123	Login Success	Login Success
2	C9	srinivas5	Thisispas3$	someone@gmail.com	9988776622	123456789123	Login Failed: Invalid Username or Password	Login Failed: Invalid Username or Password
3	C10	Rachit	Thisisincorrectpass3	someone@gmail.com	9988776622	123456789123	Login Failed: Invalid Username or Password	Login Failed: Invalid Username or Password
4	C11	Rachit	Thisisincorrectpass$	someone@gmail.com	9988776622	123456789123	Login Failed: Invalid Username or Password	Login Failed: Invalid Username or Password
5	C12	Rahul	Pass3$	someone@gmail.com	9988776622	123456789123	Login Failed: Invalid Username or Password	Login Failed: Invalid Username or Password
6	C13	Rahul	Thisispas3$	$someone@gmail.com	9988776622	123456789123	Login Failed: Invalid Email	Login Failed: Invalid Email

7	C14	Srinivas	Thisispas3$	someone@gmail.com	0988776622	123456789123	Login Failed: Phone number	Login Failed: Phone number
8	C15	Srinivas	Thisispas3$	someone@gmail.com	99887	123456789123	Login Failed: Invalid Phone Number	Login Failed: Invalid Phone Number
9	C16	Rachit	Thisispas3$	someone@gmail.com	9988776622	023456789123	Login Failed: Invalid Aadhar Number	Login Failed: Invalid Aadhar Number
10	C17	srinivas5f760e3c184f2e44a46f68b4	Thisispas3$	someone@gmail.com	9988776622	1234	Login Failed: Invalid Aadhar Number	Login Failed: Invalid Aadhar Number



Sign up

Srinivas

••••••

nsri

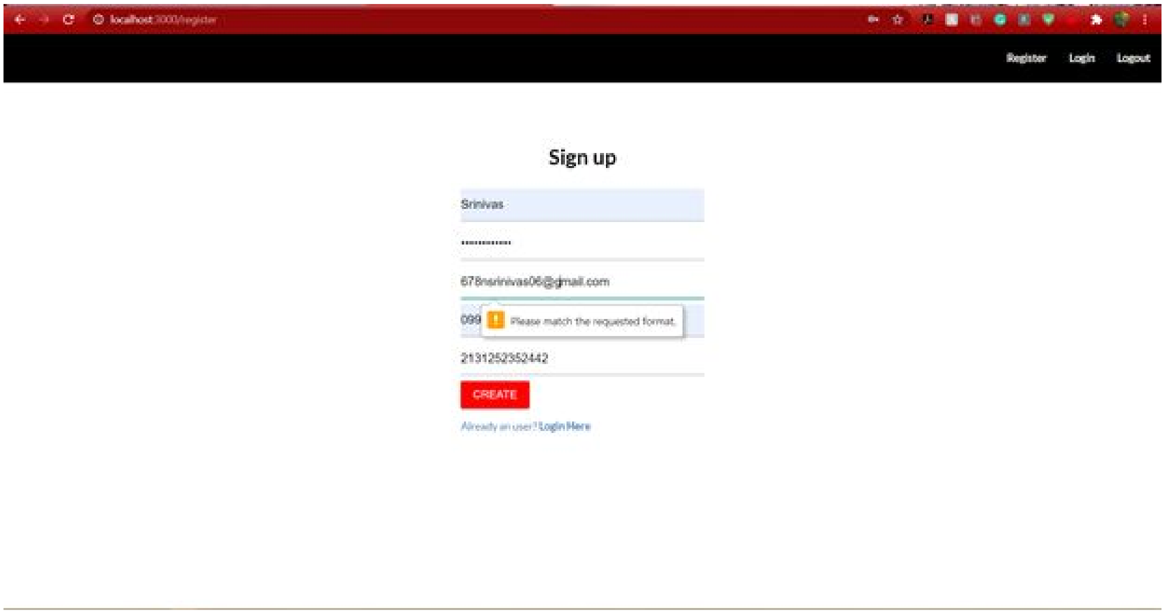
Please match the requested format.

09940023607

23134324534

Already an user? Login Here

Fig 33: Password Checking



Sign up

Srinivas

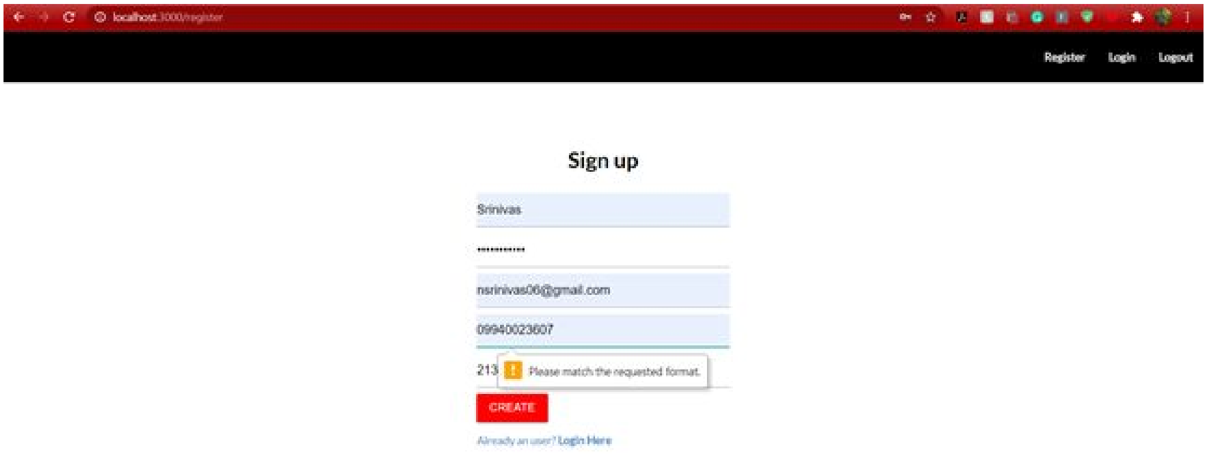
678nsrinivas06@gmail.com

099

Please match the requested format.

2131252352442

Fig 34: Email Checking



Sign up

Srinivas

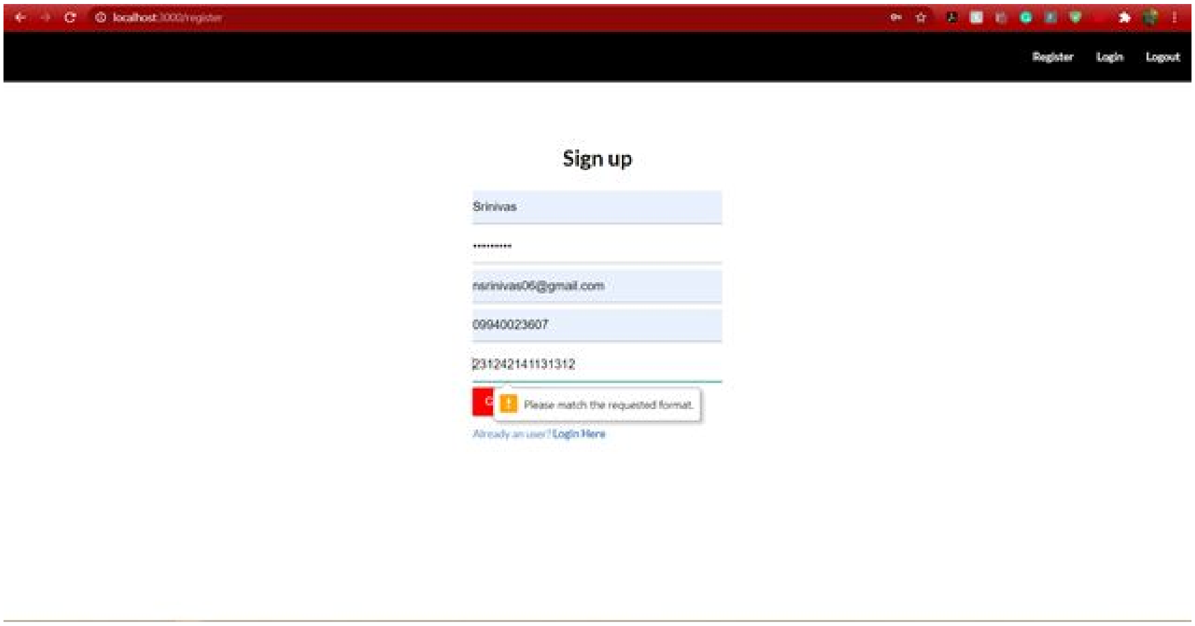
nsrinivas06@gmail.com

09940023607

213

Please match the requested format.

Fig 35: Phone Number Checking



Sign up

Srinivas

••••••••••

nsrinivas06@gmail.com

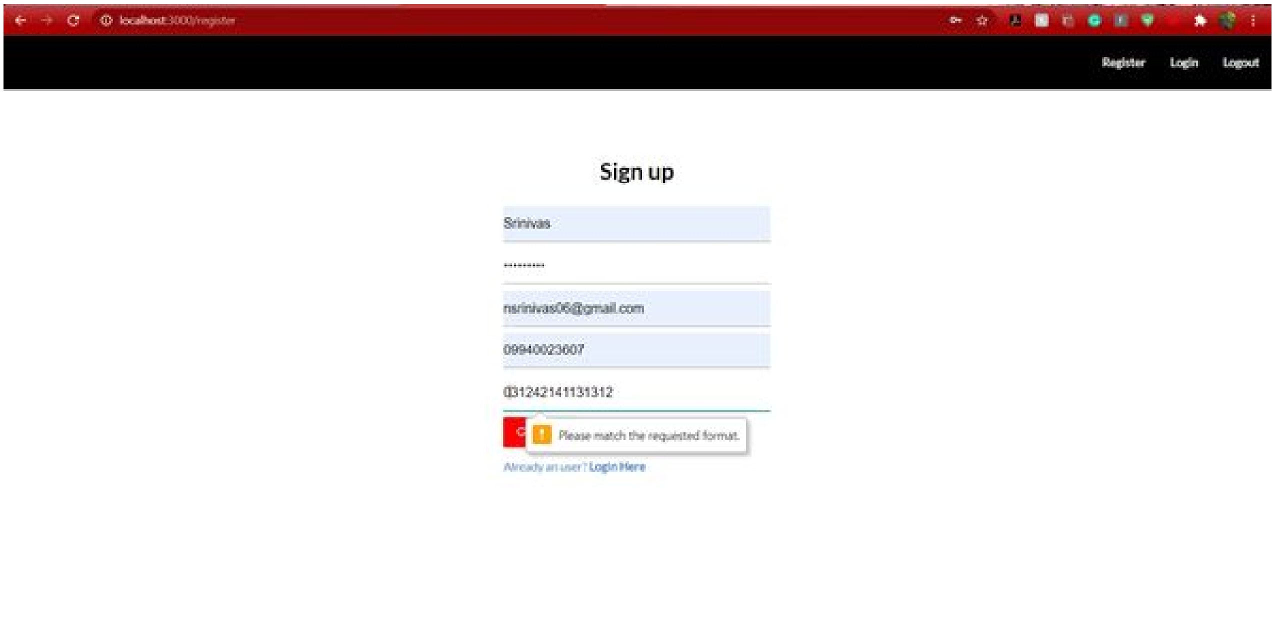
09940023607

231242141131312

Please match the requested format.

Already an user? Login Here

Fig 36.1: Aadhar Number Checking



Sign up

Srinivas

••••••••••

nsrinivas06@gmail.com

09940023607

031242141131312

Please match the requested format.

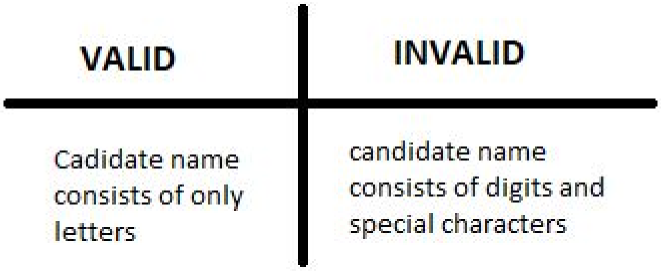
Already an user? Login Here

Fig 36.2: Aadhar Number Checking

ii. Add Candidate Module

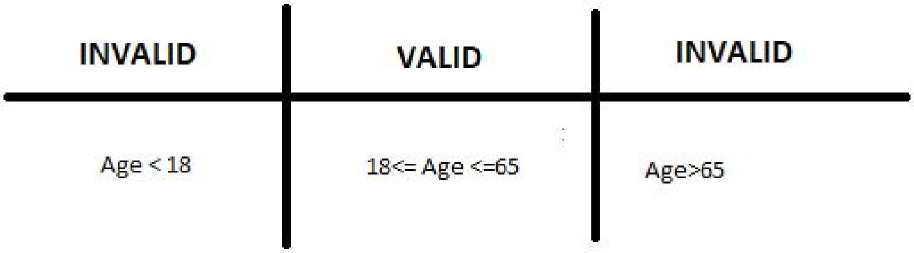
Classes:

- C1: Candidate name consists of only letters
- C2: candidate name consists of digits and special characters
- C3: age between 18 and 65
- C4: age between below 18
- C5: age above 65
- C6: age is not a digit
- C7: Party name consists of only letters
- C8: Party name consists of digits and special characters
- C9: initial votes equal to zero
- C10: initial votes not zero
- C11: candidate information consists of alphanumeric characters.
- C12: candidate information doesn’t consist of alphanumeric characters.
- C13: candidate image must be in jpeg or png format
- C14: candidate image is not in jpeg or png format



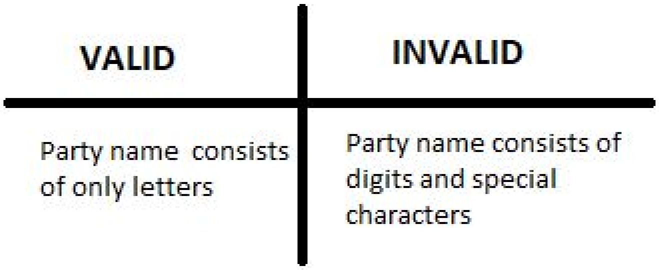
VALID	INVALID
Cadidate name consists of only letters	candidate name consists of digits and special characters

Fig 37: Equivalence Partitioning for Candidate name



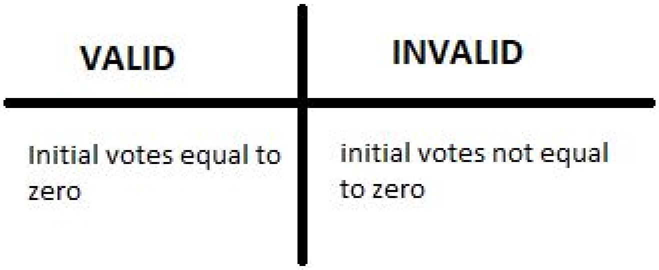
INVALID	VALID	INVALID
Age < 18	18<= Age <=65	Age>65

Fig 38: Equivalence Partitioning for Candidate age



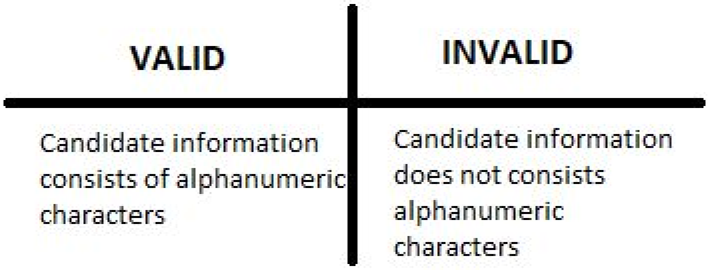
VALID	INVALID
Party name consists of only letters	Party name consists of digits and special characters

Fig 39: Equivalence Partitioning for Party name



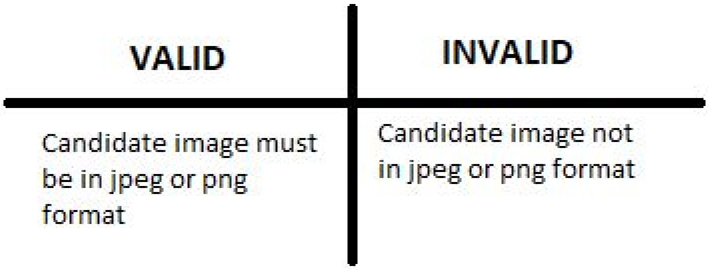
VALID	INVALID
Initial votes equal to zero	initial votes not equal to zero

Fig 40: Equivalence Partitioning for Initial Votes



VALID	INVALID
Candidate information consists of alphanumeric characters	Candidate information does not consists alphanumeric characters

Fig 41: Equivalence Partitioning for Candidate information

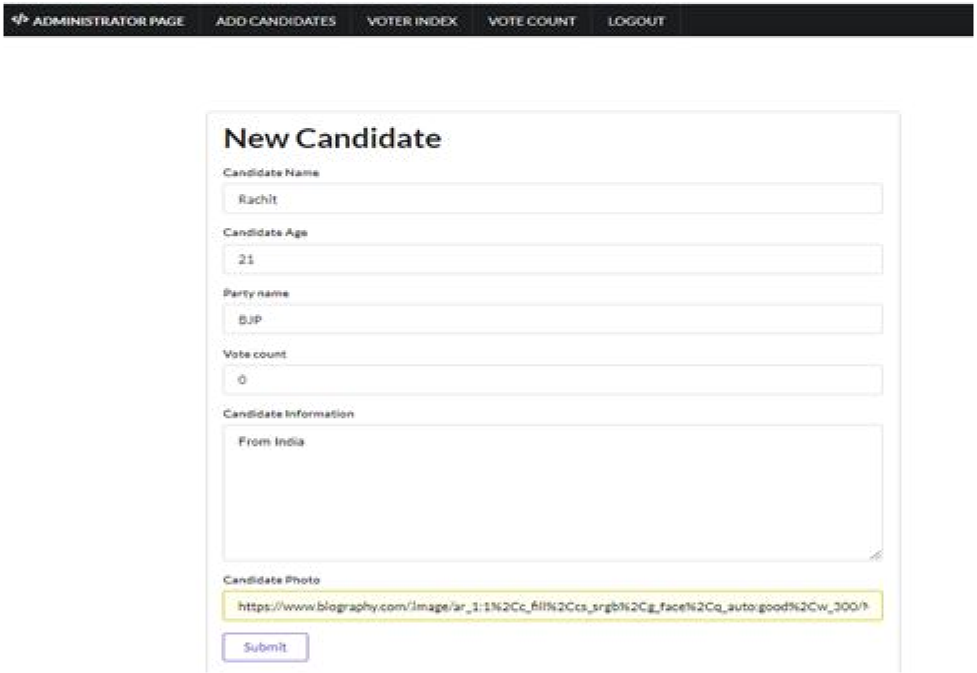


VALID	INVALID
Candidate image must be in jpeg or png format	Candidate image not in jpeg or png format

Fig 42: Equivalence Partitioning for Candidate Image

ID	Candidate Name	Candidate Age	Party Name	Initial Vote	Candidate Information	Candidate image	Expected Output
1	C1	C3	C7	C9	C11	C13	VALID
2	C2	C3	C7	C9	C11	C13	INVALID Candidate Name
3	C1	C4	C7	C9	C11	C13	INVALID Candidate Age
4	C1	C5	C7	C9	C11	C13	INVALID Candidate Age
5	C1	C3	C8	C9	C11	C13	INVALID Party Name
6	C1	C3	C7	C10	C11	C13	INVALID Initial Votes
7	C1	C3	C7	C9	C12	C13	INVALID Candidate info
8	C1	C3	C7	C9	C11	C14	INVALID Image format

Test ID	Candidate Name	Candidate Age	Party Name	Initial Votes	Candidate Information	Candidate image	Expected Output	Actual /observed result
1	Rachit	21	BJP	0	From India	img.png	VALID	VALID Candidate details : Candidate added
2	1234#$	21	BJP	0	From India	img.png	INVALID Candidate Name	Candidate Name is invalid
3	Rachit	6	BJP	0	From India	img.png	INVALID Candidate Age	Candidate Age is invalid
4	Rachit	98	BJP	0	From India	img.png	INVALID Candidate Age	Candidate Age is invalid
5	Rachit	21	$#$#	0	From India	img.png	INVALID Party Name	Party Name is invalid
6	Rachit	21	BJP	20	From India	img.png	INVALID Initial Votes	Initial Votes is invalid
7	Rachit	21	BJP	0	$#$#	img.png	INVALID Initial Candidate Info	Candidate info is invalid
8	Rachit	21	BJP	0	From India	img.doc	INVALID Image format	Image format is invalid



New Candidate

Candidate Name: Rachit

Candidate Age: 21

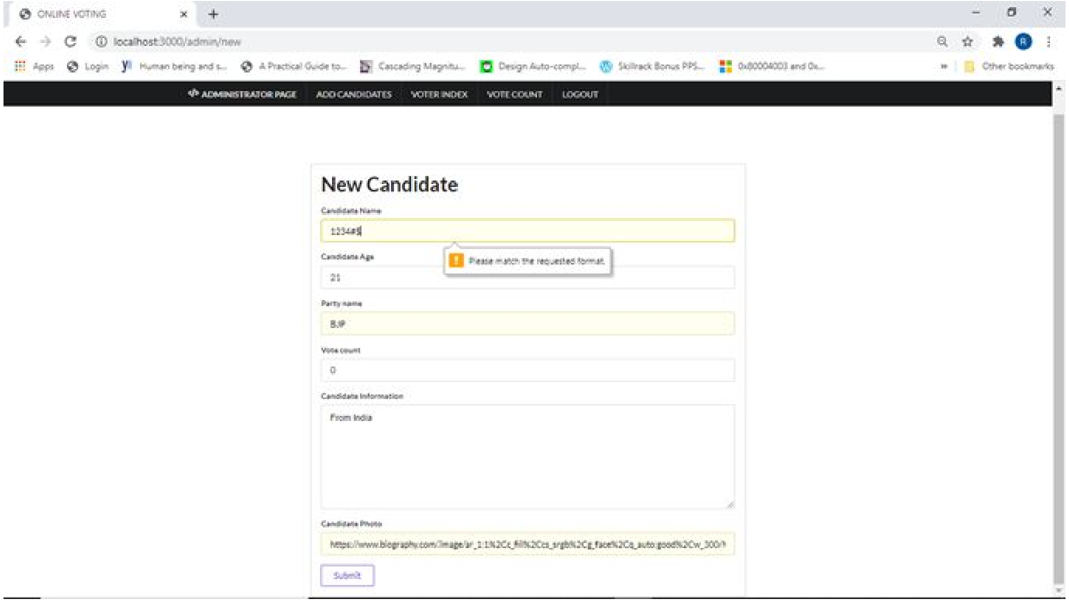
Party name: BJP

Vote count: 0

Candidate Information: From India

Candidate Photo: https://www.biography.com/.image/ar_1:1%2Cc_fill%2Ccs_srgb%2Cg_face%2Cq_auto:good%2Cw_300/h

Fig 43: Test case 1



New Candidate

Candidate Name: 1234#$

Please match the requested format.

Candidate Age: 21

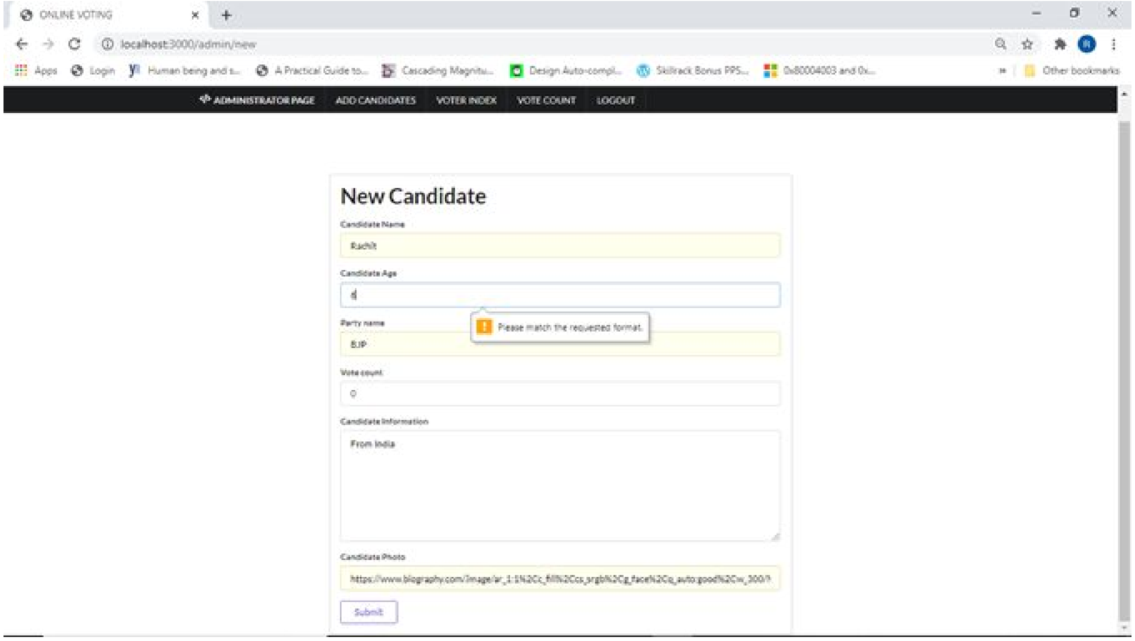
Party name: BJP

Vote count: 0

Candidate Information: From India

Candidate Photo: https://www.biography.com/.image/ar_1:1%2Cc_fill%2Ccs_srgb%2Cg_face%2Cq_auto:good%2Cw_300/h

Fig 44: Test case 2 (Invalid Candidate Name)



New Candidate

Candidate Name: Ruchit

Candidate Age: 8

Please match the requested format.

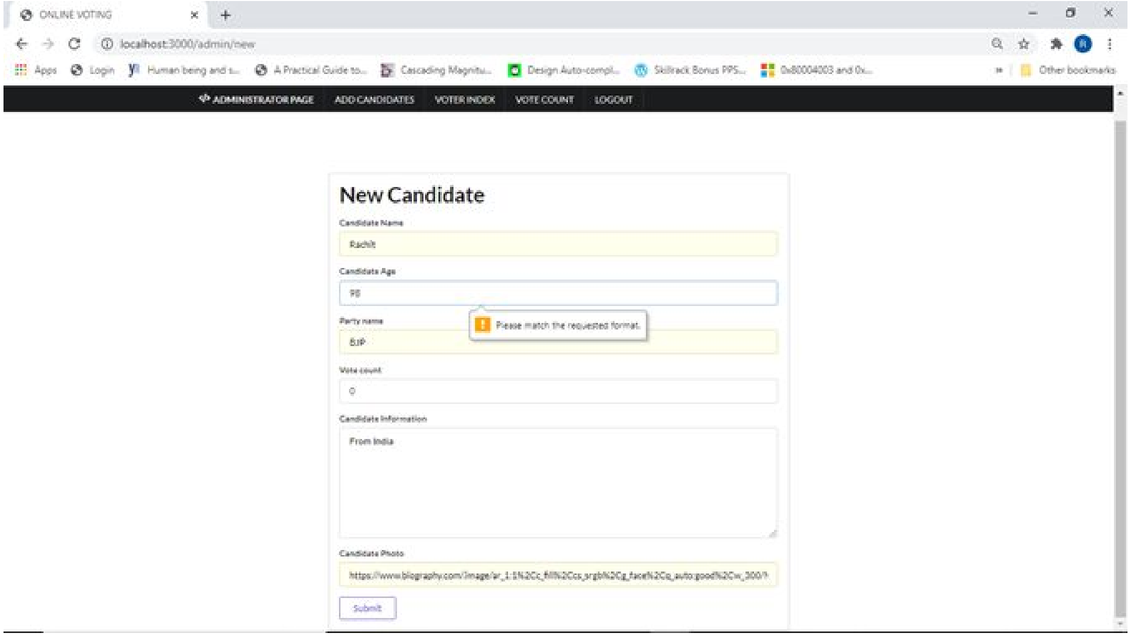
Party name: BJP

Vote count: 0

Candidate Information: From India

Candidate Photo: https://www.biography.com/image/ar_1:1%2Cc_fill%2Ccs_srgb%2Cg_face%2Cq_auto:good%2Cw_300/

Fig 45: Test case 3 (Invalid Age)



New Candidate

Candidate Name: Ruchit

Candidate Age: 98

Please match the requested format.

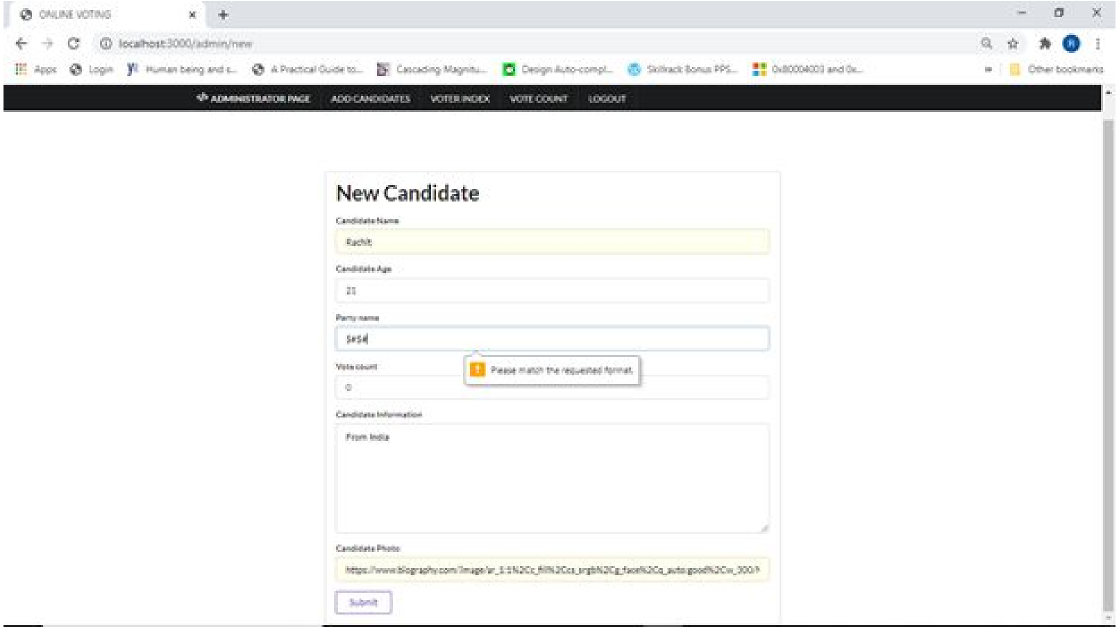
Party name: BJP

Vote count: 0

Candidate Information: From India

Candidate Photo: https://www.biography.com/image/ar_1:1%2Cc_fill%2Ccs_srgb%2Cg_face%2Cq_auto:good%2Cw_300/

Fig 46: Test case 4 (Invalid Age)



New Candidate

Candidate Name: Rachit

Candidate Age: 21

Party name: $#$#

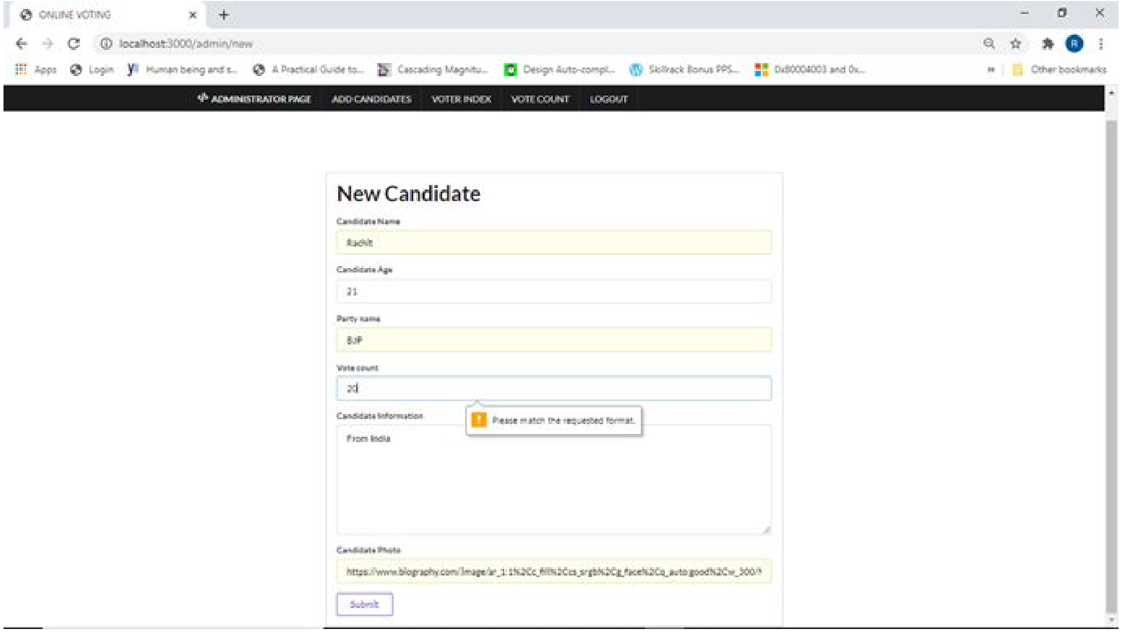
Please match the requested format.

Vote count: 0

Candidate Information: From India

Candidate Photo: https://www.biography.com/.image/ar_1:1%2Cc_fill%2Ccs_srgb%2Cg_face%2Cq_auto:good%2Cw_300/

Fig 47: Test case 5 (Invalid Party Name)



New Candidate

Candidate Name: Rachit

Candidate Age: 21

Party name: BJP

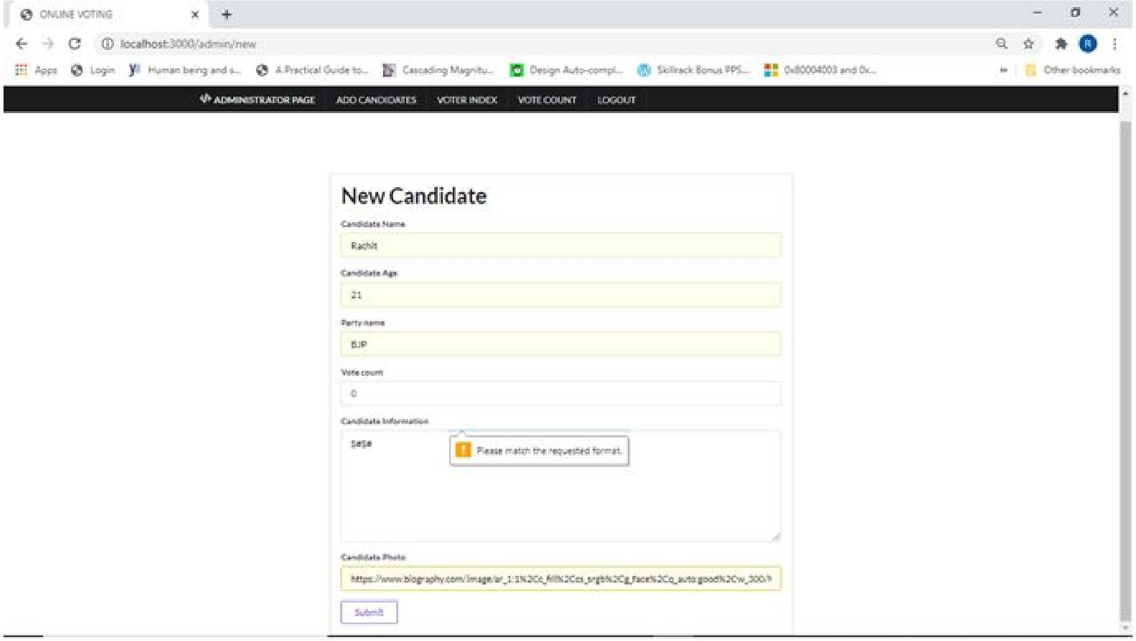
Vote count: 20

Please match the requested format.

Candidate Information: From India

Candidate Photo: https://www.biography.com/.image/ar_1:1%2Cc_fill%2Ccs_srgb%2Cg_face%2Cq_auto:good%2Cw_300/

Fig 48: Test case 6 (Invalid Initial Vote)



New Candidate

Candidate Name: Rachit

Candidate Age: 21

Party name: BJP

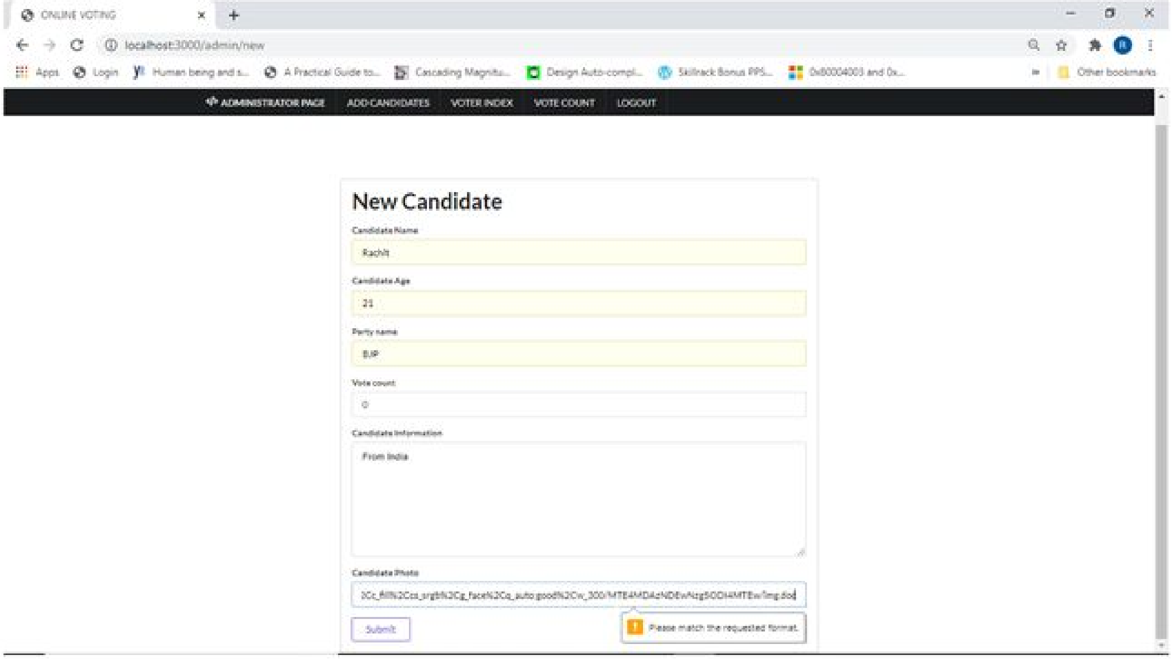
Vote count: 0

Candidate Information: $#$#

Please match the requested format.

Candidate Photo: https://www.biography.com/image/ar_1:1%2Cc_fill%2Ccs_srgb%2Cg_face%2Cq_auto:good%2Cw_300/?

Fig 49: Test case 7 (Invalid Candidate info)



New Candidate

Candidate Name: Rachit

Candidate Age: 21

Party name: BJP

Vote count: 0

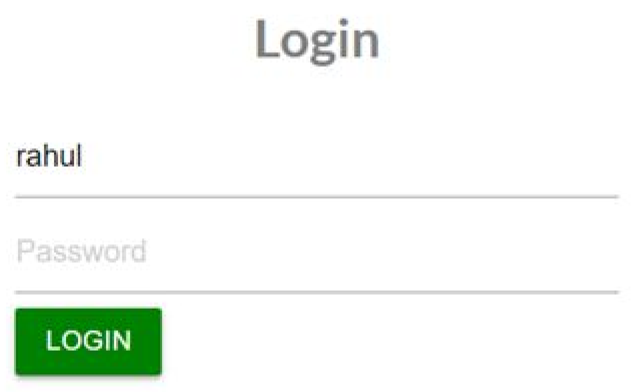
Candidate Information: From India

Candidate Photo: 2Cc_fill%2Ccs_srgb%2Cg_face%2Cq_auto:good%2Cw_300/MTE4MDAzNDEwNzg5ODI4MTEw/img.doc

Please match the requested format.

Fig 50: Test case 8 (Invalid Image Format)

iii. Login Module:



rahul

Fig 51: Login Interface

Valid equivalence classes:

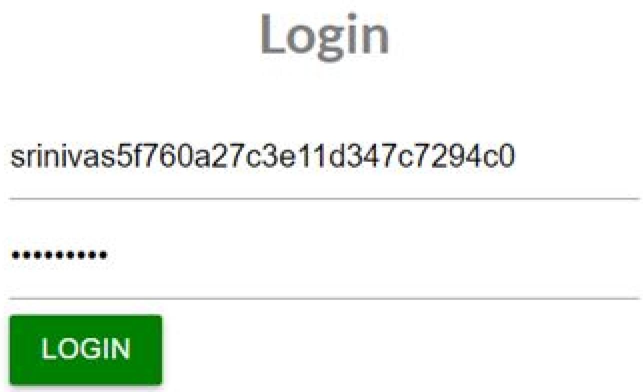
- C1 : Username is encrypted
- C2: Username is authorised
- C3 : Password format as at least 1 digit,1 capital and length>=8.

Invalid equivalence classes:

- C4 : Username is not encrypted
- C5 : Username is not authorised
- C6 : Password format is wrong.

Test Case ID	**Class**	**Input**	**Expected Result**	**Actual/ Observed Result**	**Remarks**
1	C1,C2,C3	Username : *rahuldagar5f760a27c3e11d347c7294c0*	Login Success, Redirect to Voting Page If the user is authorised	Login Success. Voting page Opens	This Class Inputs work fine, if all other class inputs are correct
2	C2	Username: *rachit5f760e3c184f2e44a46f68b4*	Login Success, Redirect to Voting Page If the username is encrypted	Login Success. Voting Page Accessed	Results are OK.
3	C3	Password: *Abc12345*	Login Success if C1,C2 are satisfied.	Login Success	OK
4	C4	Username: *rahuldagar*	Error Message : Authorised User Only, Username not encrypted.	Error : Only Authorised Voter.	Need improvement to display cause of error.
5	C5	Username: *srinivas5f760e3c184f2e44a46f68b4*	Error Message: Authorised Voter Only	Error : Authorised Voter Only	Result is OK

6	C6 - No Capitals	Password: abc12345	Error Message: Please Match the requested format	Error Message: Please Match the requested format	Need to Show the expected format on screen
7	C6- Length(Pass)<8	Password: *Abc123*	Error Message: Please Match the requested format	Error Message: Please Match the requested format	Need to specify if length is the reason for error.
8	C6- Only number	Password: 12434	Error Message: Please Match the Requested Format	Error Message: Please Match the Requested Format	Specify the Password format on login screen

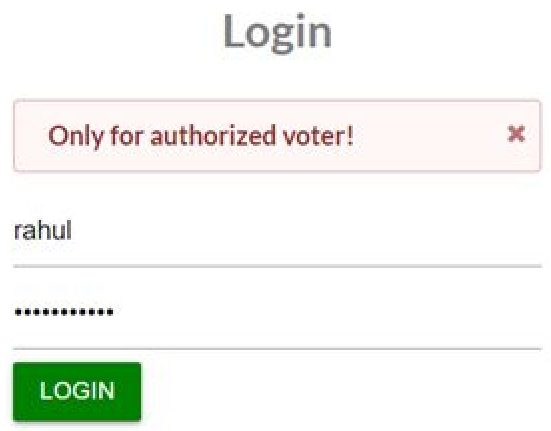


Login

srinivas5f760a27c3e11d347c7294c0

••••••••••

Fig 52: Test Case 1-3 (Valid Input)



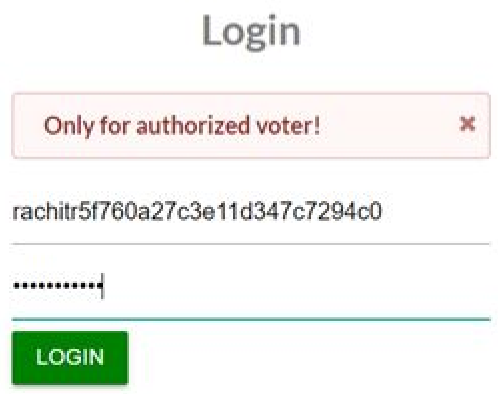
Login

Only for authorized voter! ×

rahul

••••••••••••

Fig 53: Test Case 4 (Invalid Username)



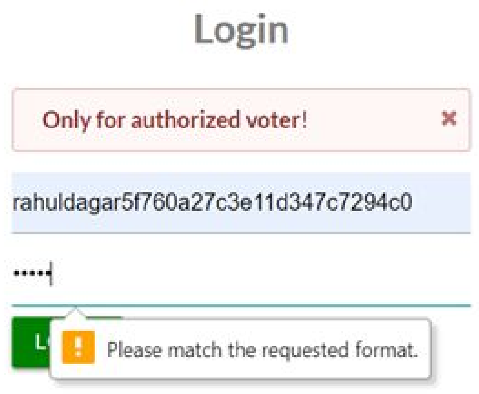
Login

Only for authorized voter! ×

rachitr5f760a27c3e11d347c7294c0

•••••••••••

Fig 54: Test Case 5 (Unauthorized User)



Login

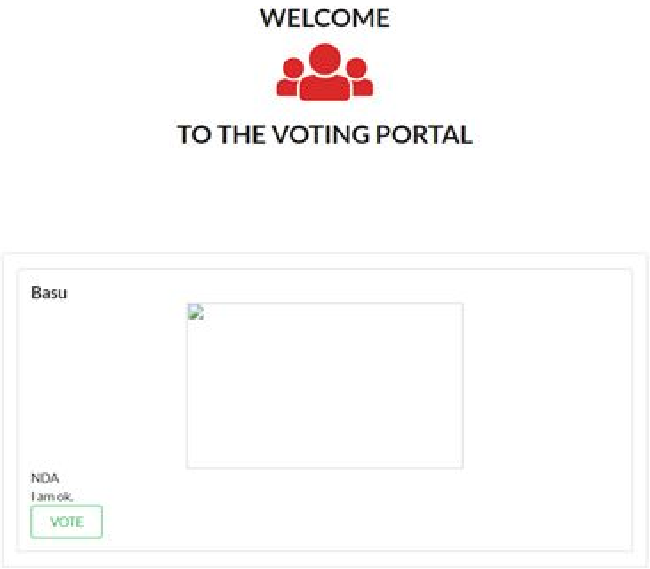
Only for authorized voter! ×

rahuldagar5f760a27c3e11d347c7294c0

•••••

Please match the requested format.

Fig 55: Test Case 6 (Invalid Password)



WELCOME

TO THE VOTING PORTAL

Basu

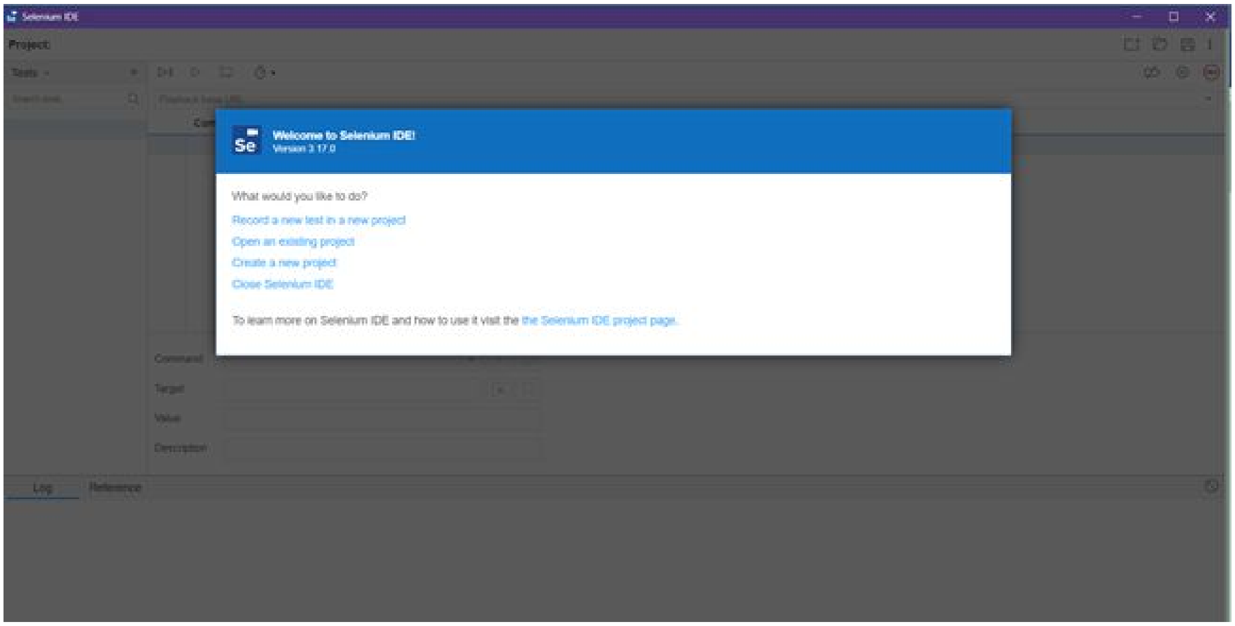
NDA
I am ok

Fig 56: Successful Entry

Automatic Testing (Selenium IDE)

For automatic testing of our project, we use the Selenium IDE which is open source and free to use.

Selenium is a portable framework for testing web applications. It provides a playback tool for authoring functional tests without the need to learn a test scripting language. The IDE records multiple locators for each element it interacts with. If one locator fails during playback, the others will be tried until one is successful.



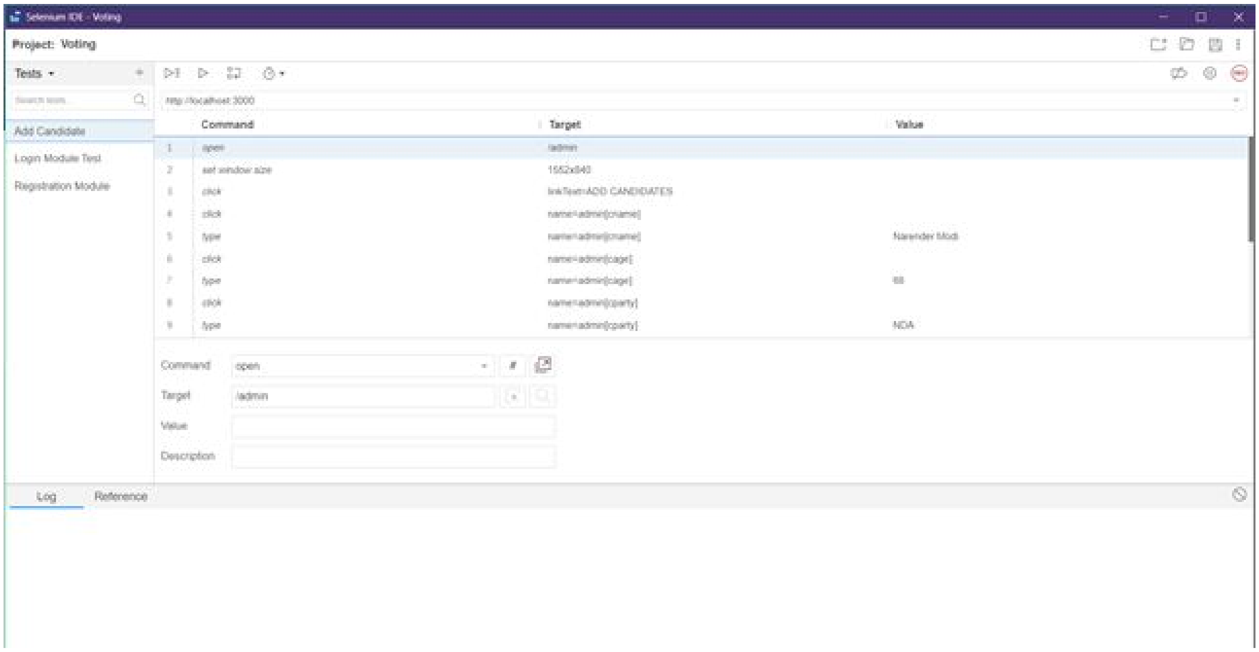
Welcome to Selenium IDE!
Version 3.17.0

What would you like to do?

Record a new test in a new project
Open an existing project
Create a new project
Close Selenium IDE

To learn more on Selenium IDE and how to use it visit the the Selenium IDE project page.

Fig 57: Selenium IDE setup



Project: Voting

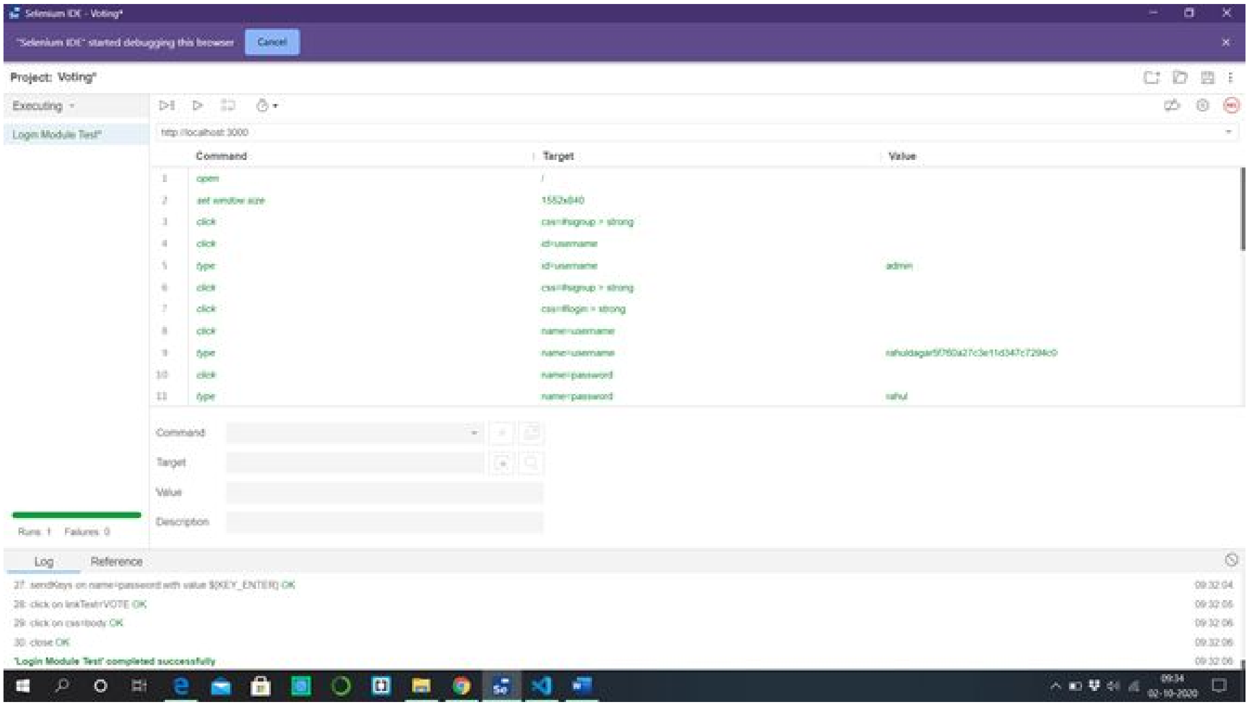
Add Candidate
Login Module Test
Registration Module

http://localhost:3000

	Command	Target	Value
1	open	/admin	
2	set window size	1552x840	
3	click	linkText=ADD CANDIDATES	
4	click	name=admin[cname]	
5	type	name=admin[cname]	Narender Modi
6	click	name=admin[cage]	
7	type	name=admin[cage]	68
8	click	name=admin[cparty]	
9	type	name=admin[cparty]	NDA

Command: open
Target: /admin
Value:
Description:

Fig 58: Test cases for the Login Module

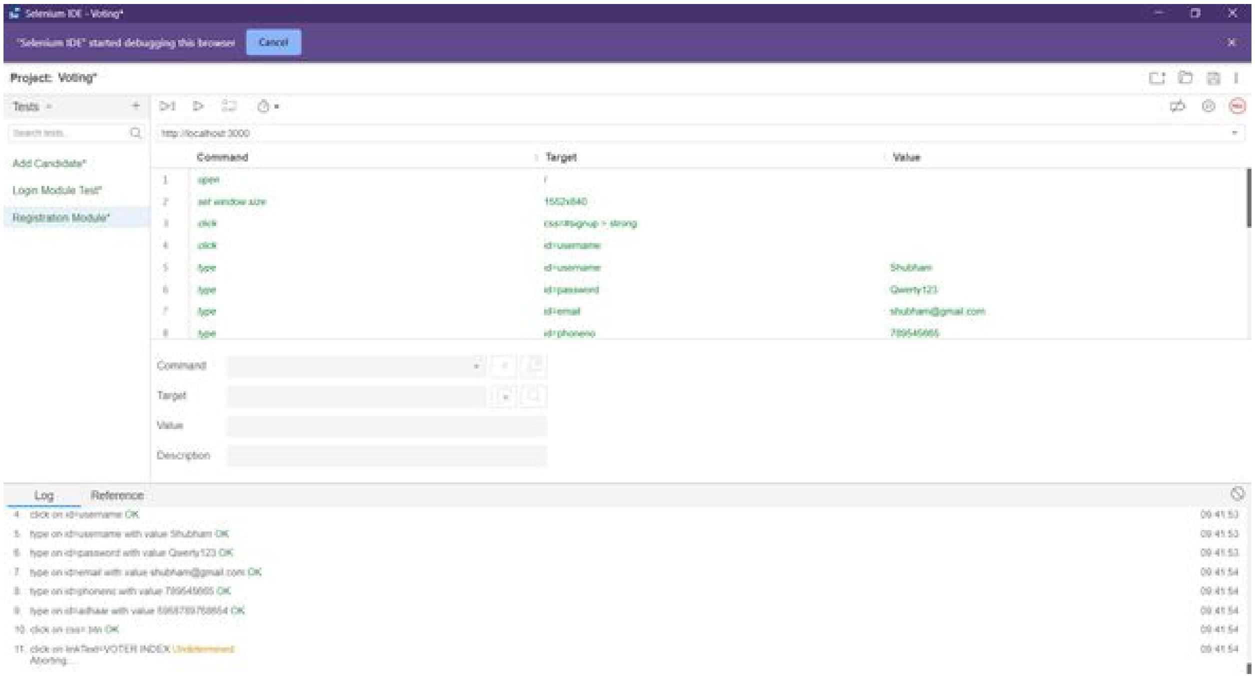


	Command	Target	Value
1	open	/	
2	set window size	1552x840	
3	click	css=#signup > strong	
4	click	id=username	
5	type	id=username	admin
6	click	css=#signup > strong	
7	click	css=#login > strong	
8	click	name=username	
9	type	name=username	rahuldagar5f760a27c3e11d347c7294c0
10	click	name=password	
11	type	name=password	rahul

Command	
Target	
Value	
Description	

```
27: sendKeys on name=password with value ${KEY_ENTER} OK          09:32:04
28: click on linkText=VOTE OK                                      09:32:05
29: click on css=body OK                                           09:32:06
30: close OK                                                       09:32:06
'Login Module Test' completed successfully                         09:32:06
```

Fig 59: Test cases for the Add Candidate Module



	Command	Target	Value
1	open	/	
2	set window size	1552x840	
3	click	css=#signup > strong	
4	click	id=username	
5	type	id=username	Shubham
6	type	id=password	Qwerty123
7	type	id=email	shubham@gmail.com
8	type	id=phoneno	789545665

Command	
Target	
Value	
Description	

```
4.  click on id=username OK                                           09:41:53
5.  type on id=username with value Shubham OK                         09:41:53
6.  type on id=password with value Qwerty123 OK                       09:41:53
7.  type on id=email with value shubham@gmail.com OK                  09:41:54
8.  type on id=phoneno with value 789545665 OK                        09:41:54
9.  type on id=adhaar with value 59587897768654 OK                    09:41:54
10. click on css=.btn OK                                              09:41:54
11. click on linkText=VOTER INDEX Undetermined                        09:41:54
    Aborting...
```

Fig 60: Test cases for the Register / Sign Up Module

Conclusion

Through this implementation, we have created a system which allows users to skip the tedious process of standing in long lines or travel long distances to reach common voting centers. Citizens can now vote from the ease of their home and thus can increase the voter turnout. This becomes increasingly relevant during the COVID-19 pandemic as large public gatherings can be avoided thus preventing the transmission of the disease. Compared to the existing alternative where voters have to fill mail ballots and send them in, our system does not depend on manual counting. It also offers increased security and transparency with the help of blockchain technology. All these features make our system easy to use, secure and transparent.

Limitation

The System is still incapable of declaring automatic results. While it is very accurate in calculating the number of votes given to each candidate, there does not exist any system to automatically declare the results of the election once the voting is complete.

The system might lack robustness. The fact that the system is made as a serial program with no scope of parallel programming, it is very uncertain that how the system will react to the the overwhelming number of votes being polled concurrently in an actual elections.The system is not tested on a very large scale, and has not been implemented in actual elections, so it is a bit difficult to predict how it is going to react in such situations.

The system lacks a self authorisation system for voters, manual authorisation is required to be done by the system administrator for each single voter. When the system is being implemented on a large scale, the huge number of voters makes it difficult for the administrator to authorise them one by one.

While the system depends on an Email/ SMS system to send the encrypted username or encrypted unique id to each voter via email or SMS, the system at current stage does not come with an inbuilt Email or SMS system , so a manual system is needed to communicate the unique voting IDs to the voters.

Future Scope

The Following future expansions are expected to be carried out in the system:

- Automatic Mailing system to deliver the Unique voting credentials to the emails of the registered voters automatically.
- Automatic SMS/Texting System to deliver the Unique voting credentials to the Phones of the registered voters automatically via text messages.
- Expansion of databases to be able to support the huge citizen and candidate database , during the real elections.
- Distributed and Parallel Processing to be introduced into the system, so that the system can take the advantage of multicore processing and the data among all the running instances of the software to be synchronised into a single database for ease of calculating the votes.
- Addition of an automatic result declaration and display system that allows the Election Commision to declare results without any human interference or calculations like tallying up votes from different constituencies. And results could be directly displayed on the software portal itself.

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