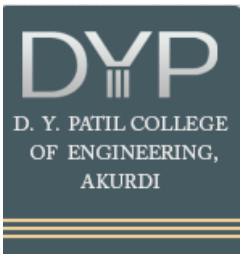
Project-II (414456)

Project Report On

E-VOTING SYSTEM USING BLOCKCHAIN

In the partial fulfillment of the requirement for Bachelor Degree in Information Technology



Submitted By

PRATHAMESH CHAVAN	**[72018410L]**
ATHARVA KEDAR	**[72018190G]**
ROSHAN KUMAR	**[72018465H]**
PARAS KAMBLE	**[72018166G]**

Guided by

Mrs. RUTUJA TIKAIT

DEPARTMENT OF INFORMATION TECHNOLOGY
D Y PATIL COLLEGE OF ENGINEERING, AKURDI, PUNE
SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
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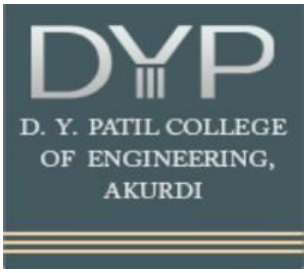

CERTIFICATE

This is to certify that the project report entitled **"E-Voting System using Blockchain"** being submitted by Group number: 20 is a record of bonafide work carried out by him/her under the supervision and guidance of **Mrs. Rutuja Tikait** in partial fulfillment of the requirement for **BE (Information Technology Engineering) – 2019** course of Savitribai Phule Pune University, Pune in the academic year 2022-2023.

Prathamesh Rajendra Chavan(72018410L)

Paras Ekant Kamble(72018166G)

Atharva Yogesh Kedar(72018190K)

Roshan Kumar(72018465H)

Date:

Place:

Mrs. Rutuja Tikait
Guide

Dr.Preeti Patil
Head of the Department

This project report has been examined by us as per the Savitribai Phule Pune University, Pune, requirements at D.Y. PATIL College of Engineering on . . . . . .

(Name & Signature)
Internal Examiner

(Name & Signature)
External Examiner

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STUDENT NAME **SIGNATURE**

Prathamesh Chavan(72018410L)

Paras Kamble(72018166G)

Atharva Kedar(72018190K)

Roshan Kumar(72018465H)

ABSTRACT

Voting is a fundamental right for every nation. An Electronic Voting (E-Voting) system is a voting system in which the election process is notated, saved, stored, and processed digitally, which makes the voting management task better than the traditional paper-based method. Blockchain is offering new opportunities to develop new types of digital services. While research on the topic is still emerging, it has mainly focused on technical and legal issues instead of taking advantage of this novel concept and creating advanced digital services.

In this project, the concept of developing an electronic voting system using blockchain technology is implemented. The blockchain is an emerging, decentralized, and distributed technology with strong cryptographic foundations that promise to improve different aspects of many industries.

Expanding e-voting into blockchain technology could be the solution to alleviate the present concerns in e-voting. Here we propose a blockchain-based voting system that will limit voting fraud and make the voting process simple, secure, and efficient. This E-voting system will also protect the integrity of your vote by preventing voters from being able to vote multiple times

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CHAPTER 1
INTRODUCTION

1.1 INTRODUCTION TO PROJECT

India possesses a democratic system and functions as a democratic nation. As now all Indian citizens become a part of the growing digital India with a digital ID which is an Aadhaar card. Voting schemes have evolved from counting hands in the early days to systems that include paper, punch cards, and electronic voting machines Contemporary democracies are founded on the principles of traditional paper ballots or electronic voting (e-voting). Over the past few years, there has been substantial criticism of electronic voting machines (EVMs) as a result of inconsistent election result reports. There have been many questions regarding the design and internal architecture of these devices and how they might be susceptible to attacks .Online voting is pushed as a potential solution to attract young citizens and nonresidents of the country. For a robust online election scheme, a number of functional and security requirements are to be met such as transparency, accuracy, suitability, data privacy, etc. We have worked on the following ideas by having two different sets of modules: the election commission and the voter(s). Election Commission creates elections and adds registered candidates along with the parties for contesting the election. By utilizing an election's REST API hosted on Ethereum's Blockchain, the voter's interface displays the necessary details for casting their vote. Subsequently, the cast vote is stored on our blockchain framework, from which the Election Commission retrieves the vote count. However, the limitation arises from deviating from the traditional approach of using smart contracts. Consequently, our coded blockchain framework cannot operate on the main network without hosting it separately, and interaction requires the use of a distinct web3 provider. Another drawback is the absence of a public API for voter ID, which hampers the authentication of voters. The most important factor of this application is to integrate the blockchain framework with both modules for seamless voting.

1.2 MOTIVATION:

The Existing System of Election is running manually. The Voter has to Visit Booths to Vote for a Candidate so there is waste of Time. Due to this many people don’t go out to cast their vote which is one of the most important and Worrying factors. In A democracy Each and every vote is important. This Traditional system can be replaced by a new online system which will limit voting fraud and make voting as well as counting more efficient and transparent.

Our main motivation in this project is to provide a secure voting environment and show that a

reliable e-voting scheme is possible using blockchain. Because, when e-voting is available for everyone who has a computer, or a mobile phone, every single administrative decision can be made by people and members; or at least people's opinions will be more public and more accessible to politicians and managers.The adoption of e-voting has the potential to pave the way for true direct democracy for humanity. This is crucial because traditional elections can be susceptible to corruption or manipulation, particularly in smaller towns or larger cities situated in corrupt countries. Additionally, conducting large-scale traditional elections can be financially burdensome in the long run, especially when there are numerous geographically dispersed vote centers and millions of voters involved. Also, the voter turnout at the voting centers is relatively low as the person might not be staying at the address his name is enrolled in the list, or he might be out for vacation or any other work. E-voting will be able to solve these problems if implemented carefully. The concept of e-voting predates blockchain technology and has primarily relied on centralized computation and storage models. An excellent example of this is Estonia, as their government was one of the pioneers in implementing a comprehensive and fully online e-voting solution. The discussions around e-voting began in Estonia in 2001 and were officially initiated by national authorities in the summer of 2003. The Estonian e-voting system is still operational, with numerous enhancements and modifications made over time. It has proven to be robust and reliable, utilizing smart digital ID cards and government-distributed personal card readers for individual authentication.

1.3 BLOCKCHAIN:

Blockchain can help to implement a system that is immutable, transparent, and efficient and cannot be hacked into. The inability to change or delete information from blocks makes the blockchain the most effective technology for voting systems. Blockchain technology is supported by a distributed network consisting of a variety of interconnected nodes. Each of these nodes has its own copy of the distributed ledger (information) that contains the total history of all transactions the network has processed. There is no centralized system that controls the network. If the majority of the nodes agree, then they accept a transaction.

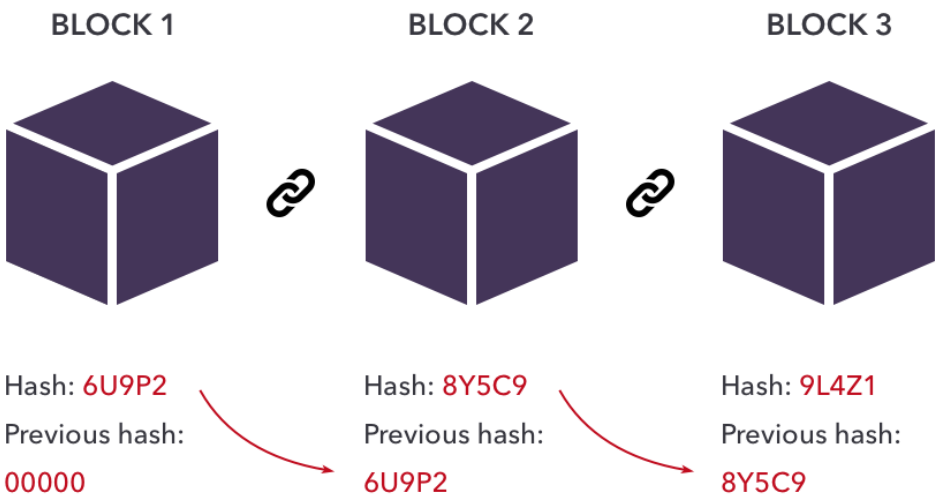

Fig: 1 Hashing Methodology Diagram

This network permits users to stay anonymous. A basic analysis of blockchain technology (including sensible contracts) suggests that it is an appropriate basis for e-voting and furthermore, it might have the potential to form e-voting a lot of acceptable and reliable. Blockchain technology offers numerous advantages in making e-voting more cost-effective, streamlined, and highly secure. It represents a relatively new paradigm that enables the creation of decentralized systems, ensuring data integrity, availability, and fault tolerance. This technology has the potential to revolutionize existing systems by establishing decentralized networks of interconnected computers that validate and record online transactions. These networks also serve as ledgers, where digital data is interconnected through blocks, forming the blockchain. Notably, the records stored on the blockchain are inherently resistant to tampering or modification, making them essentially immutable.

CHAPTER 2
LITERATURE SURVEY

Sr. No.	Title	Author	Year	Content
1	Web-based open-audit voting	Adida, B., Helios	2008	This paper proposes associated justify an adequate security model and criteria to judge comprehensibility. In addition, it highlights a web ballot theme called "Pretty Graspable Democracy" that not only meets the required security model but is also more comprehensible compared to the existing "Pretty Smart Democracy" theme, which is currently the only theme that fulfills the proposed security model.
2	A fair and robust voting system by broadcast	Dalia, K., Ben, R., Peter Y. A, and Feng, H	2012	This paper introduces a recovery round as a solution to announce the election result in case of voter abandonment, while also incorporating a commitment round to uphold fairness. Furthermore, the paper presents a computational security proof of ballot secrecy, ensuring the confidentiality of votes.

3	Star-vote: A secure, transparent, auditable, and reliable voting system	Bell, S., Benaloh, J., Byrne, M. D., Debeauvoir, D., Eakin, B.	2013	This paper describes the STAR-Vote design, that may preferably be the next-generation electoral system for Travis County and maybe elsewhere.
4	The Future of E-voting	Hitesh Tewari	2017	The paper describes the traditional voting system integrated into today's modern world. Using technologies such as blockchain, and encryption techniques.
5	EPRA International Journal of Research and Development (IJRD)	Peer Reviewed Journal	2021	Translating this process to the blockchain network to improve reliability and resolve concerns of manipulation from the client system, a system can be proposed consisting of two blockchains- the vote blockchain and voter blockchain.

CHAPTER 3
PROBLEM STATEMENT

3.1 Problem Statement/definition:

In our country, the manual voting system has been in place for many years. However, numerous challenges arise, particularly in parts of the country where people are unable to participate in voting for various reasons. For instance, individuals may be away from their registered region and consequently unable to fulfill their voting responsibilities. To address these issues, an online election voting system is required. Taking into consideration the concerns surrounding tampering of votes in Electronic Voting Machines (EVMs), this proposed online election system will be integrated with Blockchain Technology to ensure tamper-proof security.

3.2 Proposed Solution:

For our proposed plan of work we are considering two modules that are to be completed in three phases. Two modules are as follows:

1. Front-end for the application
2. Back-end implementing Blockchain.

Each of these modules will be considered as one phase and the remaining phase will cover the connection and testing of these modules.

- Phase 1: During this phase, our focus will be on developing the front-end module, which involves creating interactive user interfaces for both the admin and the user. Simultaneously, we will conduct research to explore and understand the implementation of Blockchain technology in the decentralized application. This research work will pave the way for integrating Blockchain seamlessly into our system.
- Phase 2: In this phase, we will cover the back-end module, we will implement the Blockchain using the Ethereum framework and convert the system into a decentralized application.

Phase 3: The connection of two different modules along with the testing of the platform will be completed in this phase.

CHAPTER 4
SYSTEM ANALYSIS

4.1 Identification of Need

Identification of need is a process of determining what and how an end-user would expect a product to perform after the deployment at production level. There's also nontechnical needs of an end-user or a business client which reflects the users' perception of the product and not the actual technical workaround, but they are closely related to the technical need at times Through the implementation of a needs identification system, the organization plays a crucial role in ensuring the efficient allocation of resources to various projects within the organization. This system helps identify and assess the specific requirements and demands of each project, enabling the organization to allocate assets effectively and in alignment with the project's needs.

4.2 Identifying Problems

Conducting a thorough problem analysis before initiating a project can lead to significant time and cost savings for the organization. This stage is crucial in project planning as it serves as a guiding force for all subsequent analyses and decision-making processes. If the project fails to progress beyond this stage without viable solutions that the organization can implement, it is advisable not to proceed with the project in its current form. This approach ensures that potential issues are identified early on, allowing for necessary adjustments or alternative courses of action to be explored before committing resources.

4.3 Observations

The needs of a project are determined through observations made by the organization. These observations are often subjective in nature, which is why it is important to involve someone with expertise in the specific project domain. An experienced observer can effectively identify the requirements and priorities of the project by answering key questions. When making observations, it is essential to consider both the project itself and its desired outcomes. By taking these factors into account, the observations can address and fulfill all the necessary needs of the project.

4.4 Gathering Information

Observation and gathering information are two distinct processes in project planning. Observations primarily focus on identifying the specific needs and requirements of the project. On the other hand, gathering information involves collecting data and insights about the processes necessary to execute the proposed project successfully. In both observation and information gathering, it is crucial to include input and feedback from the group or stakeholders who will ultimately benefit from the completed project. By involving these individuals or groups, their valuable perspectives and insights can be incorporated into the planning process, ensuring that the project meets their expectations and needs effectively. Their comments and input provide valuable guidance and help in shaping the project to align with the desired outcomes and desired benefits.

4.5 Objectives and Opportunities

Once the organization has conducted a thorough analysis of the project's needs and identified its objectives, the next crucial step is to allocate funds for its implementation. By accurately identifying the project's requirements, the organization can effectively allocate resources and secure the necessary financial means to support the project's execution. Furthermore, it is essential for a business to consider the potential future cash flow of the project. This involves evaluating the expected revenue generation, cost structure, and overall financial viability of the project. By assessing the project's potential to generate sufficient cash inflows to cover its expenses and generate profits, the organization can make informed decisions regarding resource allocation and financial planning. This consideration helps ensure that the project remains financially sustainable throughout its lifecycle and aligns with the organization's overall financial objectives.

CHAPTER 5
FEASIBILITY STUDY

A feasibility study serves as a condensed version of the entire system analysis and design process, providing a high-level overview. The study starts by categorizing the problem definition. Its primary objective is not to solve the problem but rather to assess whether the problem is worth addressing. This preliminary study is conducted before the actual development of the project begins, without considering the project's potential success. Instead, it focuses on creating a roadmap of possible solutions based on different paths.

The feasibility study emphasizes the evaluation of the following areas:

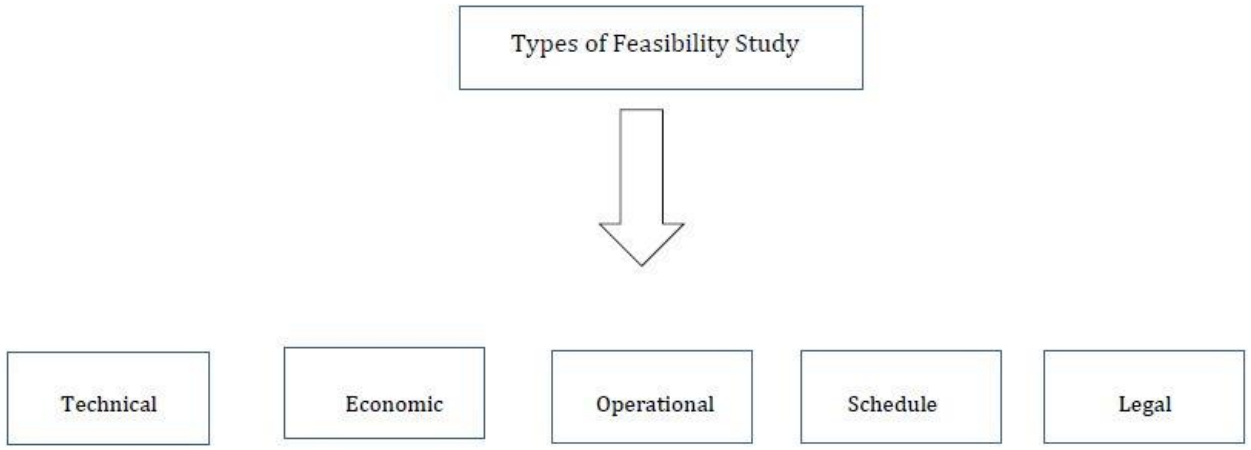

Fig: 2 Types Of feasibility Study

5.1 Technical Feasibility

Evaluating the technical feasibility of a project is indeed a challenging aspect of the feasibility study. This is mainly because, during this phase, detailed system designs may not be available, making it difficult to assess factors such as performance and costs associated with the chosen technology. Several considerations need to be taken into account when conducting a technical analysis. It is crucial to have a clear understanding of the various technologies involved in the proposed system before initiating the project. The feasibility study should aim to demonstrate that the development of the proposed system is technically feasible.

To achieve this, the following steps are typically involved:

• An outline of the requirements,

• A possible system design,

• Possible choices of software to be used or developed,

• Estimates on number of users, data, etc.

5.2 Economic Feasibility

The economic feasibility study focuses on evaluating the cost of software development in comparison to the potential income or benefits derived from the completed system. It is crucial to assess the potential for profitability once the project is successfully completed. The life cycle of an engineering project or product typically consists of several stages, including planning and design, development, and operation and maintenance. Performing an economic feasibility study helps identify the financial risks associated with the project.

Various techniques are employed in economic feasibility analysis, such as:

• Evaluate the economic feasibility of a project.

• Investigate cash flows over the lifetime of the project.

• Evaluate the likelihood of different technology scales and applications.

• Compare the economic quality of different technology application providing the same service**.**

5.3 Operational Feasibility

The operational feasibility study focuses on the degree to which the proposed development project fits in with the existing business environment and objectives with regard to development schedule, delivery date, corporate culture, and existing business processes. It is also the measure of how well the solution will work in the organization after it is deployed. As we are dealing with blockchain voting system, which indirectly targets the country's or state's election process protocol, so there will be a detailed comparison between these two to check which one dominates the other. It is also the measure how people will feel about the project as in will people be accustomed to use this in a proper way or it will be too complex to deal with.

There are two aspects of operational feasibility to be considered:

• Is the problem worth solving?

• How do the end user (voters in this case) and management (Election Commission) feel in this case?

5.4 Schedule Feasibility

Schedule feasibility in project assessment refers to determining whether the project can be implemented within a reasonable time frame. When evaluating schedule feasibility, a systems analyst must consider the interplay between time and costs. It is important to note that accelerating the project schedule may make it feasible, but it can also significantly increase expenses.

In addition to time and cost considerations, other factors related to schedule feasibility include:

• Can the company control the factors that affect schedule feasibility?
• Has management established a firm timetable for the project?
• What conditions must be satisfied during the development of the system?
• Will an accelerated schedule pose any risks? If so, are the risks acceptable?
• Will project management techniques be available to coordinate and control the project?
• Will a project manager be appointed?

It is also the likelihood that timeframes can be met and that this is adequate to meet organization's needs.

5.5 Legal Feasibility

Legal feasibility in project assessment involves determining whether the proposed system complies with legal requirements and regulations. In the case mentioned, as the project does not involve executing anything on the public domain, it can be considered legally feasible. To ensure legal feasibility, it is important to adhere to the necessary requirements and obtain the required certifications, copyrights, business insurance, tax identification numbers, and comply with health and safety measures, among others. These requirements may vary depending on the specific project and jurisdiction. When conducting a legal feasibility study, it is essential to consider ethical and social issues as well. Two key considerations are privacy and accountability. Privacy involves safeguarding personal information and ensuring that no real-world data or privacy of individuals in the country has been breached in the process. Accountability entails designing the system to be transparent and responsible, ensuring that appropriate measures are in place to address any potential legal or ethical concerns. By designing the project with a thorough understanding of legal requirements and considering ethical and social issues such as privacy and accountability, organizations can ensure that the project is legally feasible and aligned with legal standards and regulations.

CHAPTER 6
System Design

6.1 SYSTEM ARCHITECTURE

The proposed system uses blockchain techniques to classify the voting system.

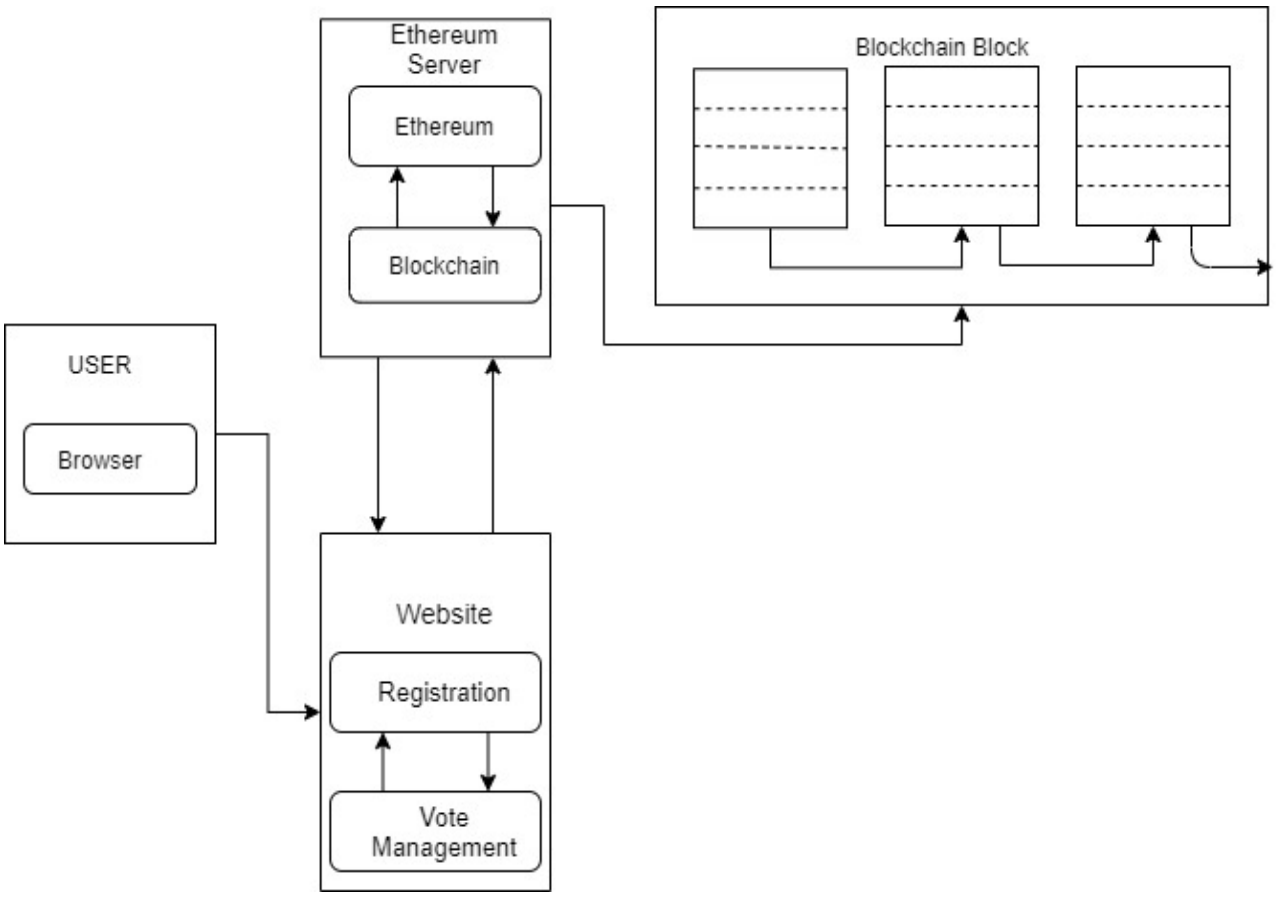

Fig: 3 System Architecture

The electronic voting system was designed to enable the overall populace to vote over the wireless medium, and the system is opened to the voter and the administrator. The primary aim of the design is to provide a secure system over a wired and wireless connection. The design architecture follows the conceptual perspective of the three-layered Organization for the advancement of Structured Information Standards (OASIS): the pre-election phase, the election phase, and the post-election phase.

6.2 SYSTEM FLOW CHART

A flowchart is a diagram that depicts a process, system, or computer algorithm. They are widely used in multiple fields to document, study, plan, improve and communicate often complex processes in clear, easy-to-understand diagrams. Flowcharts, sometimes spelled as flow charts, use rectangles, ovals, diamonds, and potentially numerous other shapes to define the type of step, along with connecting arrows to define flow and sequence. They can range from simple, hand-drawn charts to comprehensive computer-drawn diagrams depicting multiple steps and routes. If we consider all the various forms of flowcharts, they are one of the most common diagrams on the planet, used by both technical and non-technical people in numerous fields.

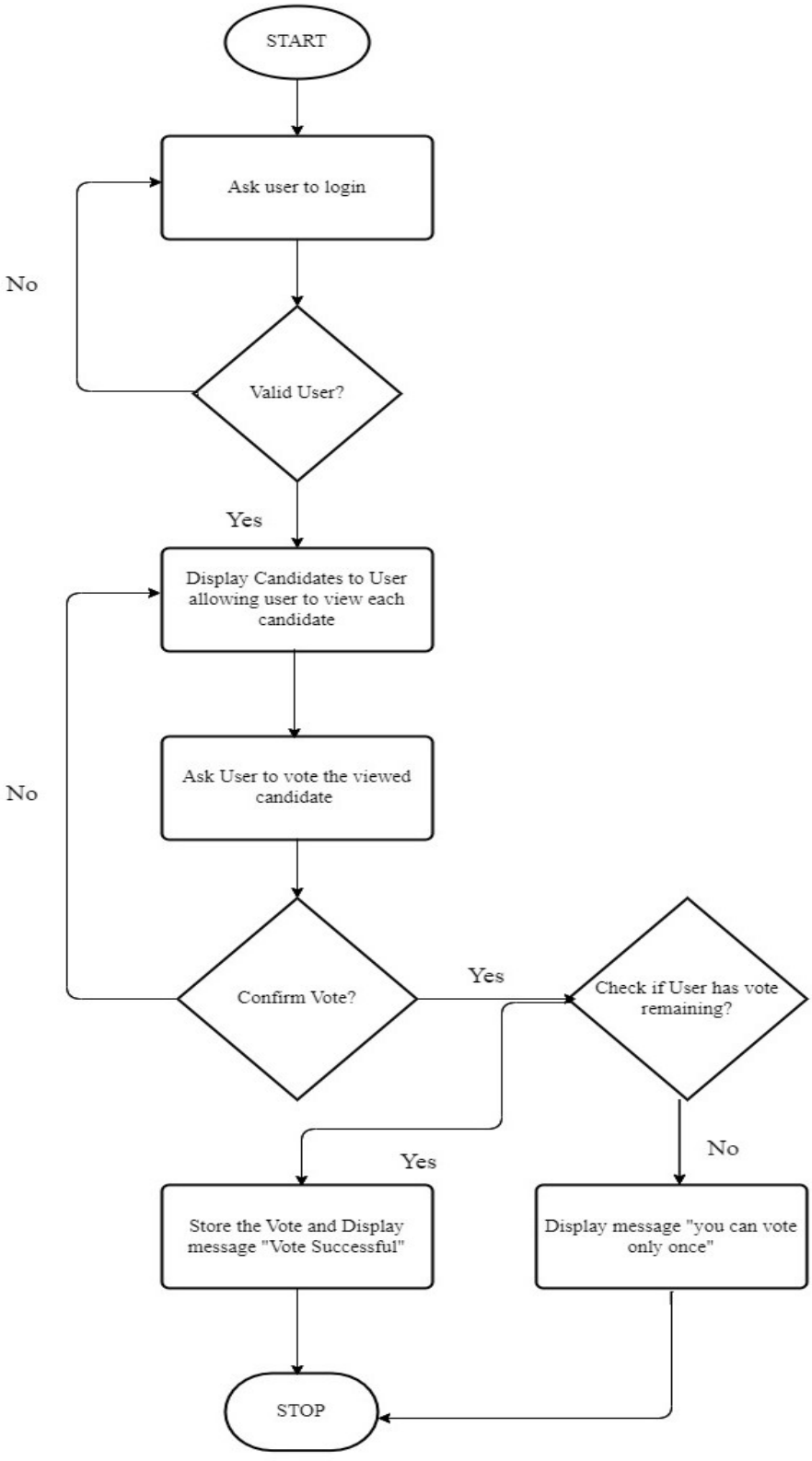

Fig: 4 Flowchart

6.3 DATA FLOW DIAGRAM

1. The DFD is also called a bubble chart. It is a simple graphical formalism that can be used to represent a system in terms of input data to the system, various processing carried out on this data, and the output data generated by this system.
2. The data flow diagram (DFD) is one of the most important modeling tools. It is used to model the system components. These components are the system process, the data used by the process, an external entity that interacts with the system and the information secure in the system.
3. DFD shows how the information moves through the system and how it is modified by a series of transformations. It is a graphical technique that depicts information flow and the transformations that are applied as data moves from input to output.
4. DFD is also known as a bubble chart. A DFD may be used to represent a system at any level of abstraction. DFD may be partitioned into levels that represent increasing information flow and functional detail.

6.3.1 DFD 0

Fig: 5 DFD 0 diagram

6.3.2 DFD 1

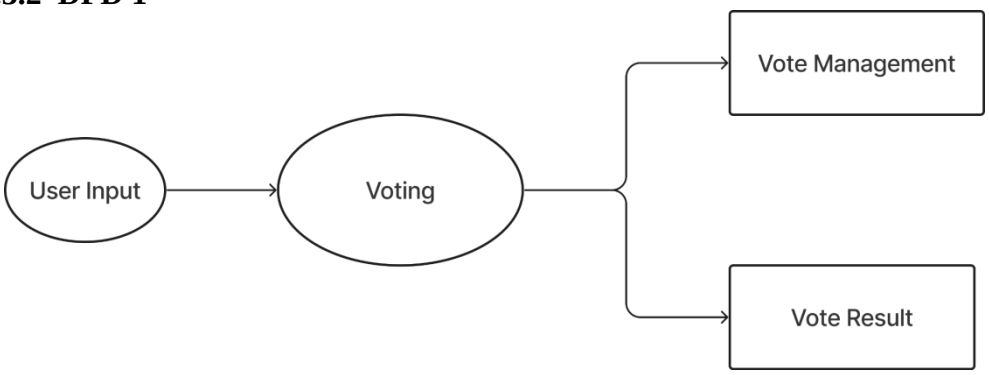

Fig: 6 DFD 1 diagram

CHAPTER 7
SOFTWARE REQUIREMENT SPECIFICATION

- Ganache: It is a personal blockchain for rapid Ethereum and Corda distributed application development.
- Truffle: A world-class development environment, testing framework, and asset pipeline for blockchains using the Ethereum Virtual Machine (EVM), aiming to make life as a developer easier.
- NodeJS: It is a JavaScript runtime built on Chrome's V8 JavaScript engine.
- The Remix Project is a rich toolset that can be used for the entire journey of contract development by users of any knowledge level, and as a learning lab for teaching and experimenting with Ethereum

Software	Type
Ganache	Ethereum Blockchain
Truffle	Development framework for ETH
Node	JavaScript Runtime
Visual Studio Code	Integrated development environment
Remix	Solidity’s IDE
Windows 10 or above	Operating System

CHAPTER 8
UML DIAGRAMS

- UML stands for Unified Modeling Language. UML is a standardized general-purpose modeling language in the field of object-oriented software engineering. The standard is managed and was created by, the Object Management Group.
- The goal is for UML to become a common language for creating models of object-oriented computer software. In its current form, UML is comprised of two major components: a Meta-model and a notation. In the future, some form of method or process may also be added to; or associated with, UML.
- The Unified Modeling Language is a standard language for specifying, Visualization, Constructing, and documenting the artifacts of software systems, as well as for business modeling and other non-software systems.
- The UML represents a collection of best engineering practices that have proven successful in the modeling of large and complex systems.
- The UML is a very important part of developing object-oriented software and the software development process. The UML uses mostly graphical notations to express the design of software projects.

8.1USE CASE DIAGRAM:

A use-case diagram in the Unified Modeling Language (UML) is a type of behavioral diagram defined by and created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases. The main purpose of a use case diagram is to show what system functions are performed for which actor. The roles of the actors in the system can be depicted.

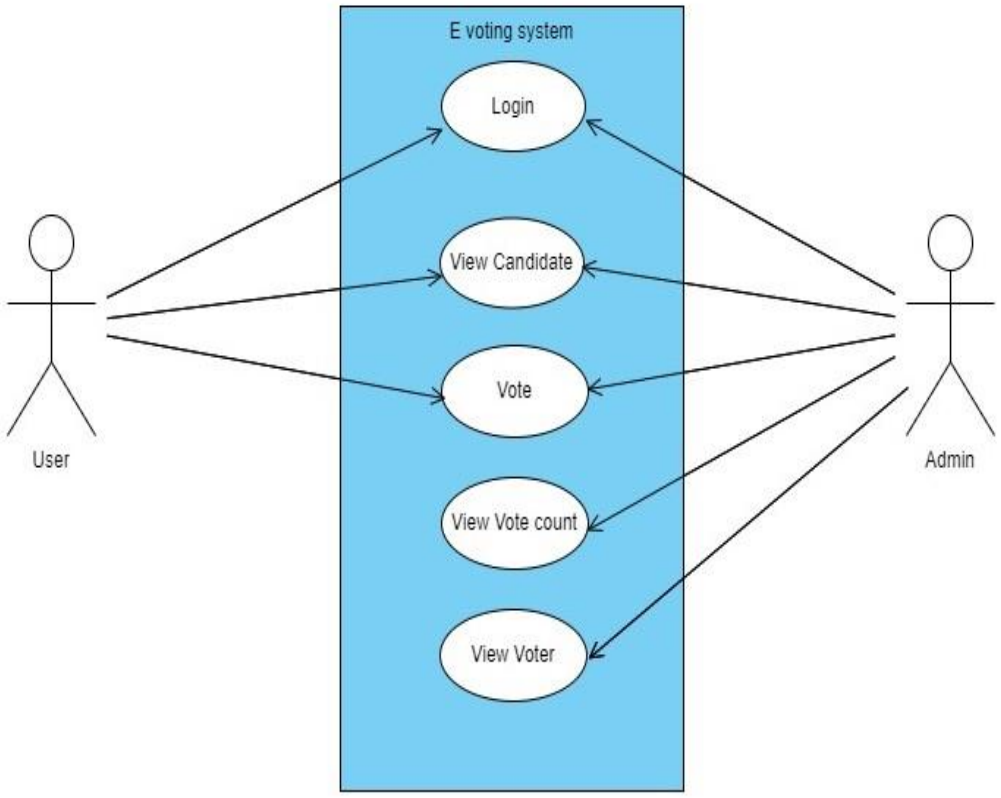

Fig: 7 Use case diagram

8.2 SEQUENCE DIAGRAM:

A sequence diagram in Unified Modeling Language (UML) is a kind of interaction diagram that shows how processes operate with one another and in what order. It is a construct of a Message Sequence Chart. Sequence diagrams are sometimes called event diagrams, event scenarios, and timing diagrams.

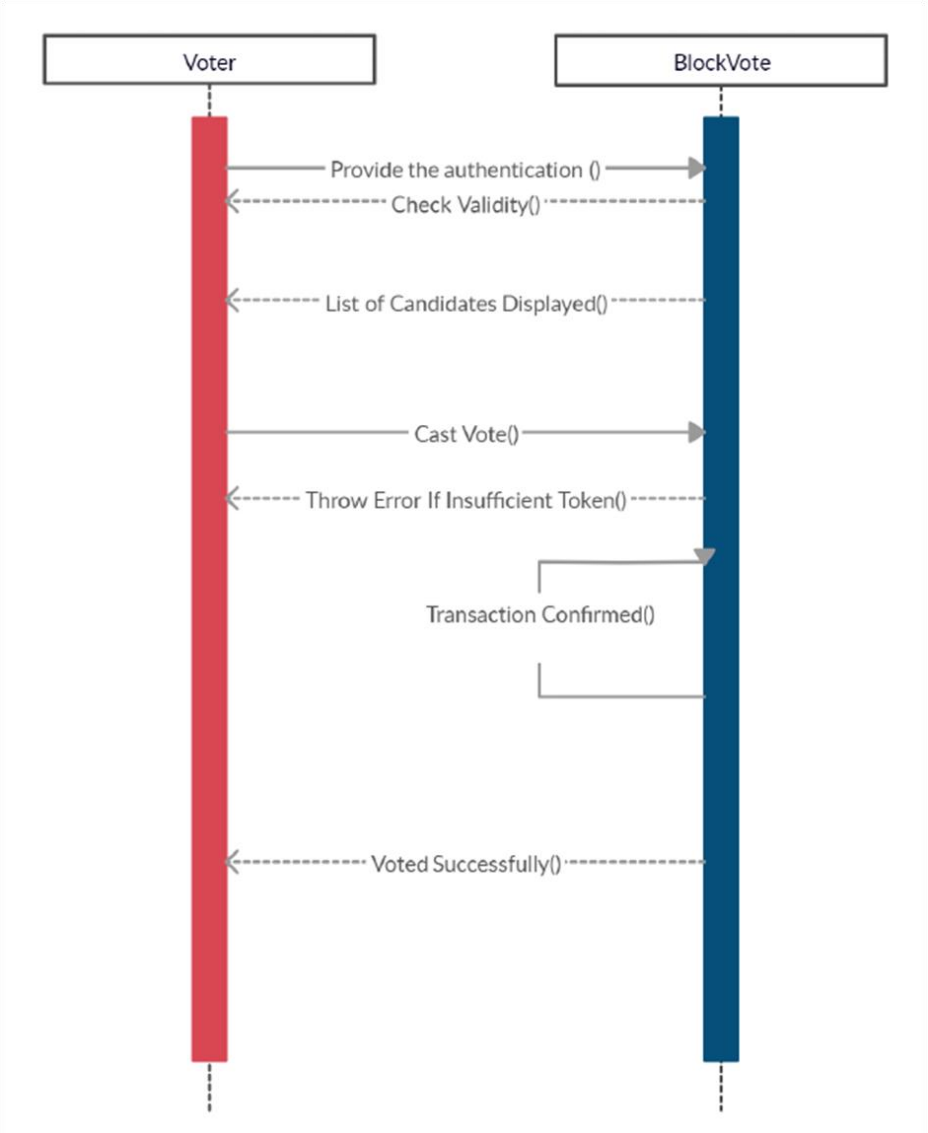

Fig: 8 Sequence diagram

8.3 ENTITY RELATIONSHIP DIAGRAM:

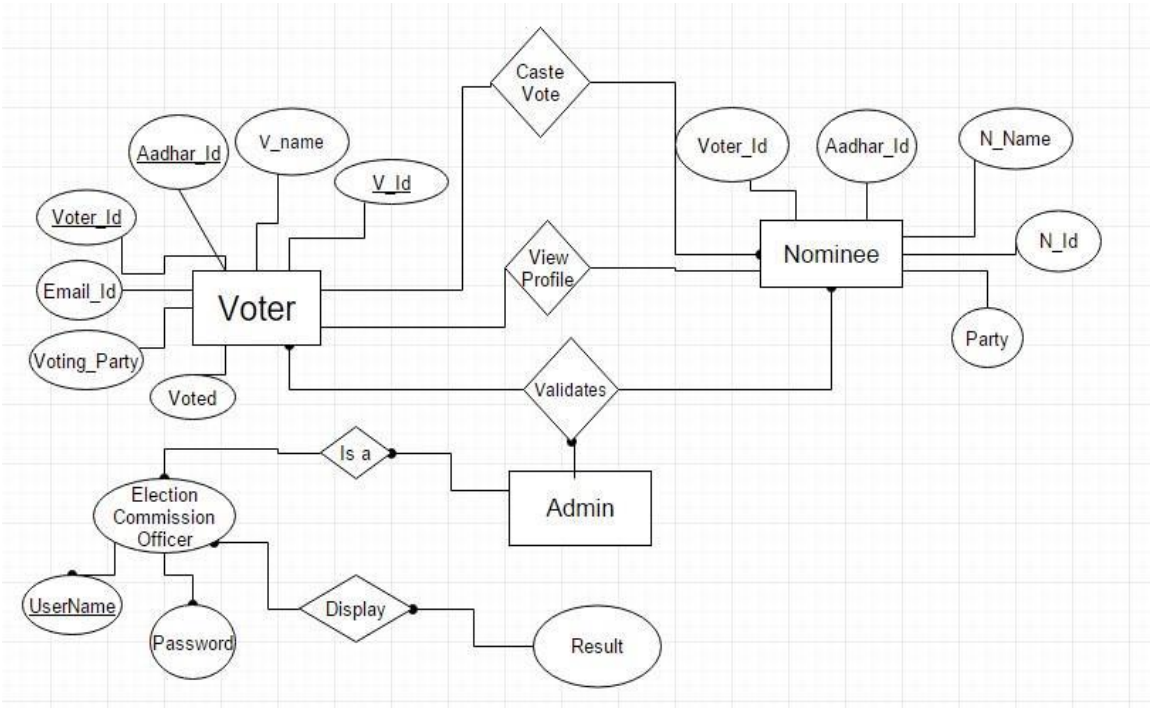

Fig: 9 ER Diagram

CHAPTER 9
IMPLEMENTATION

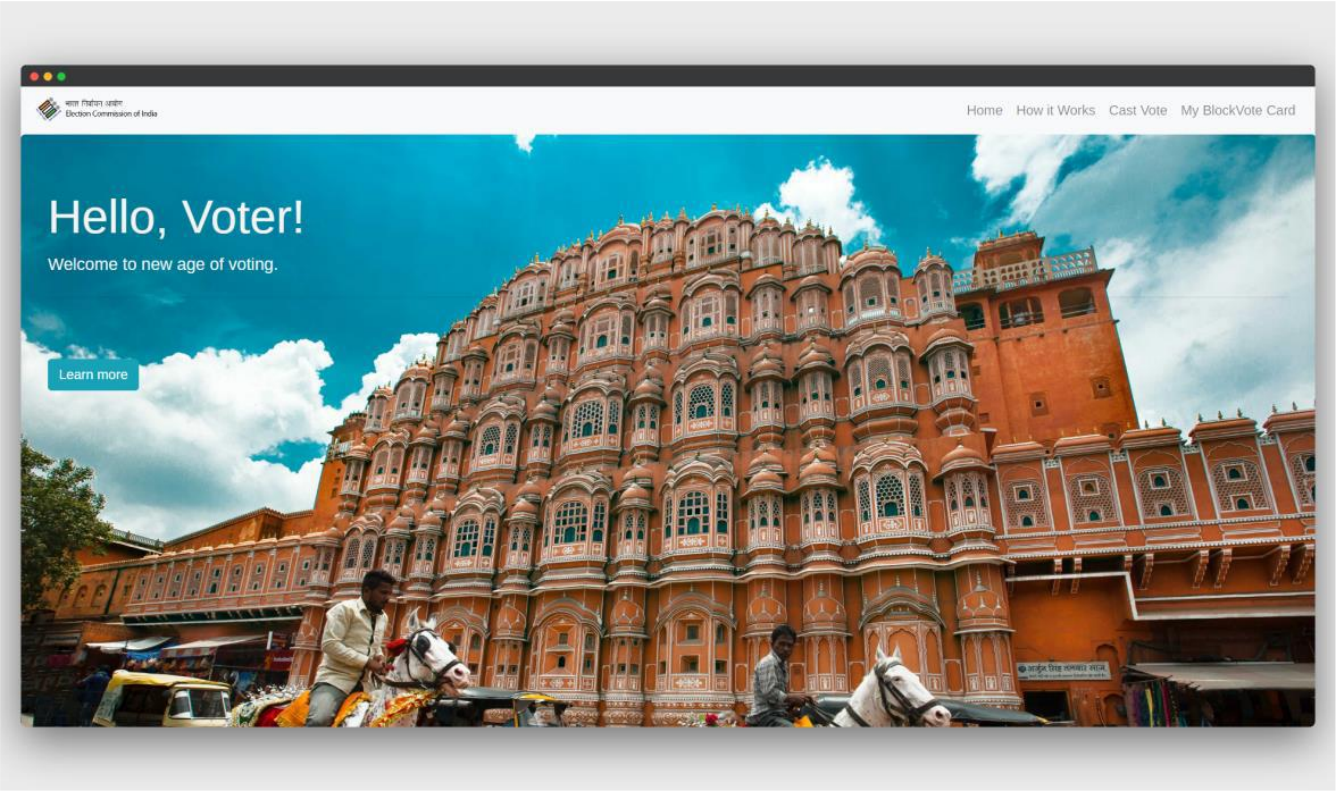

Fig: 10 HomePage

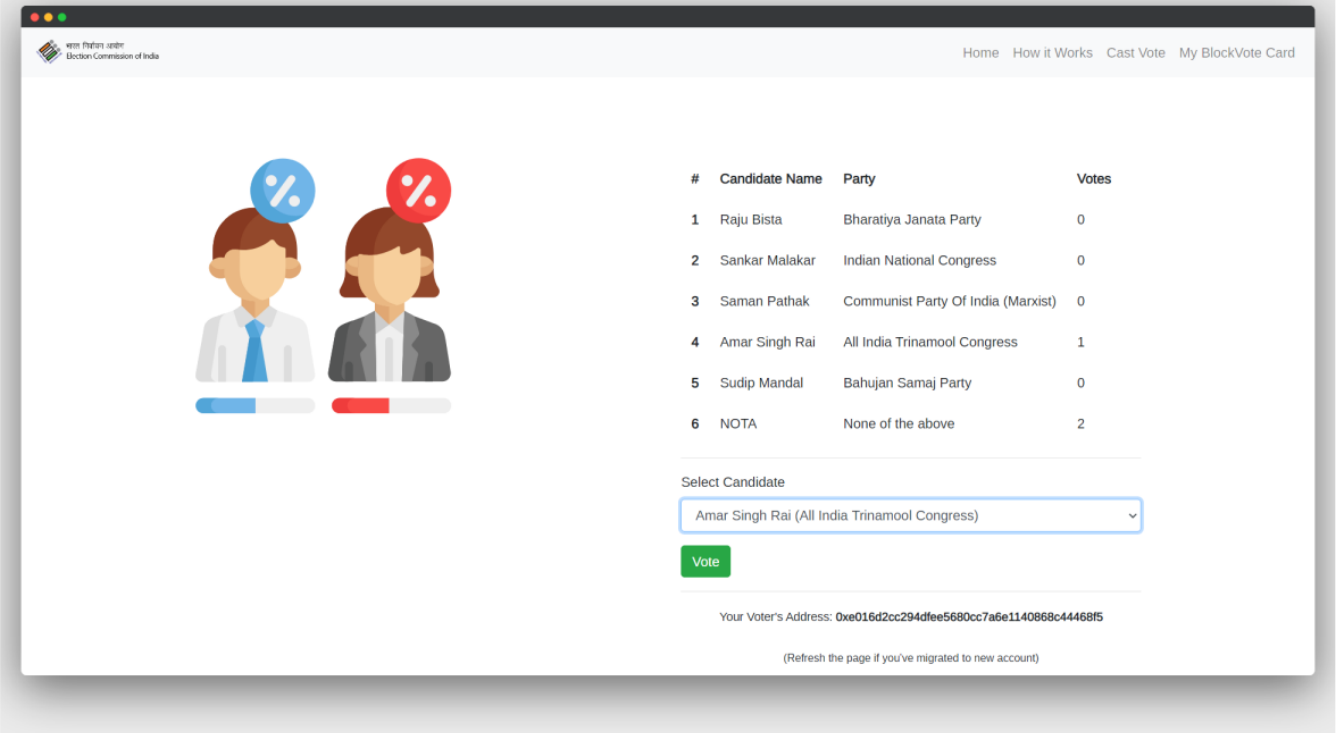

Fig: 11 Casting the Vote

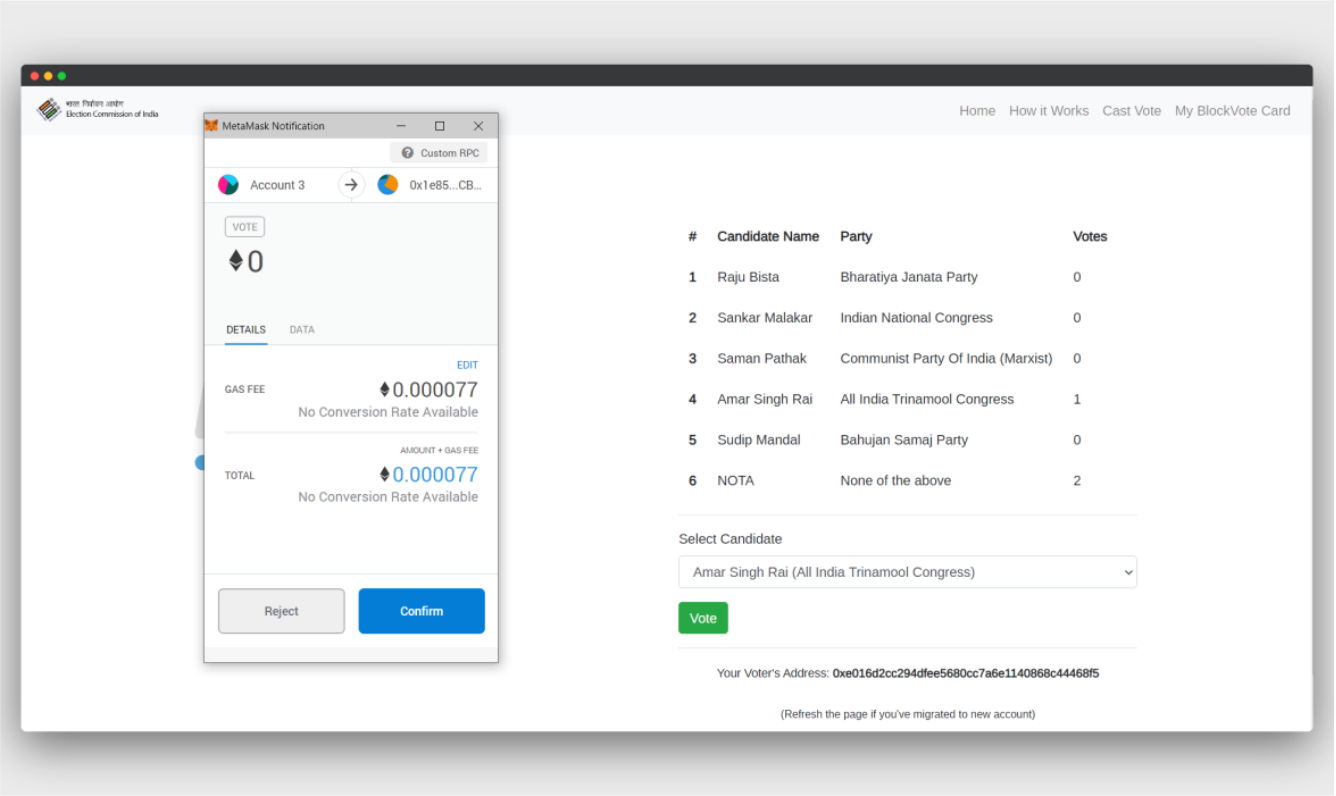

Fig: 12 Confirming the transaction to cast vote

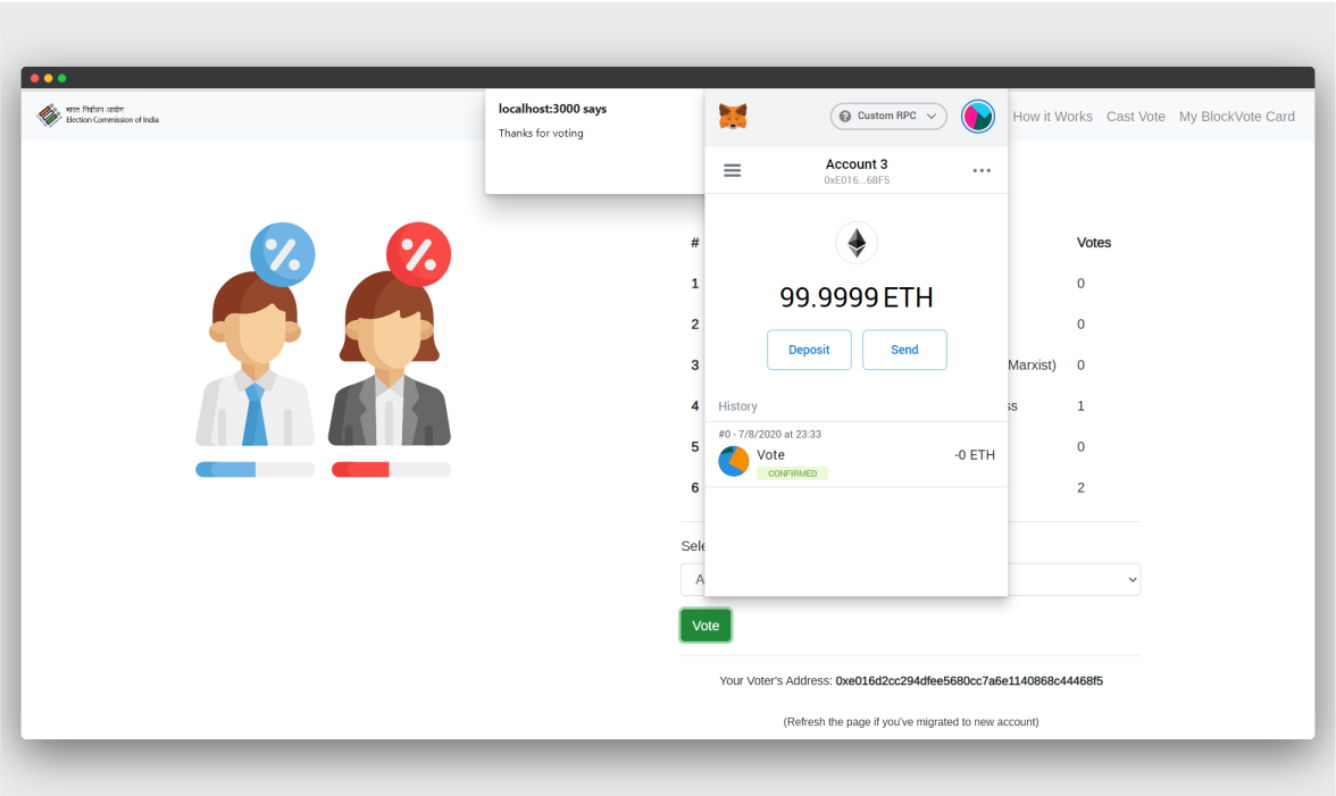

Fig: 13 Transaction confirmed by miners

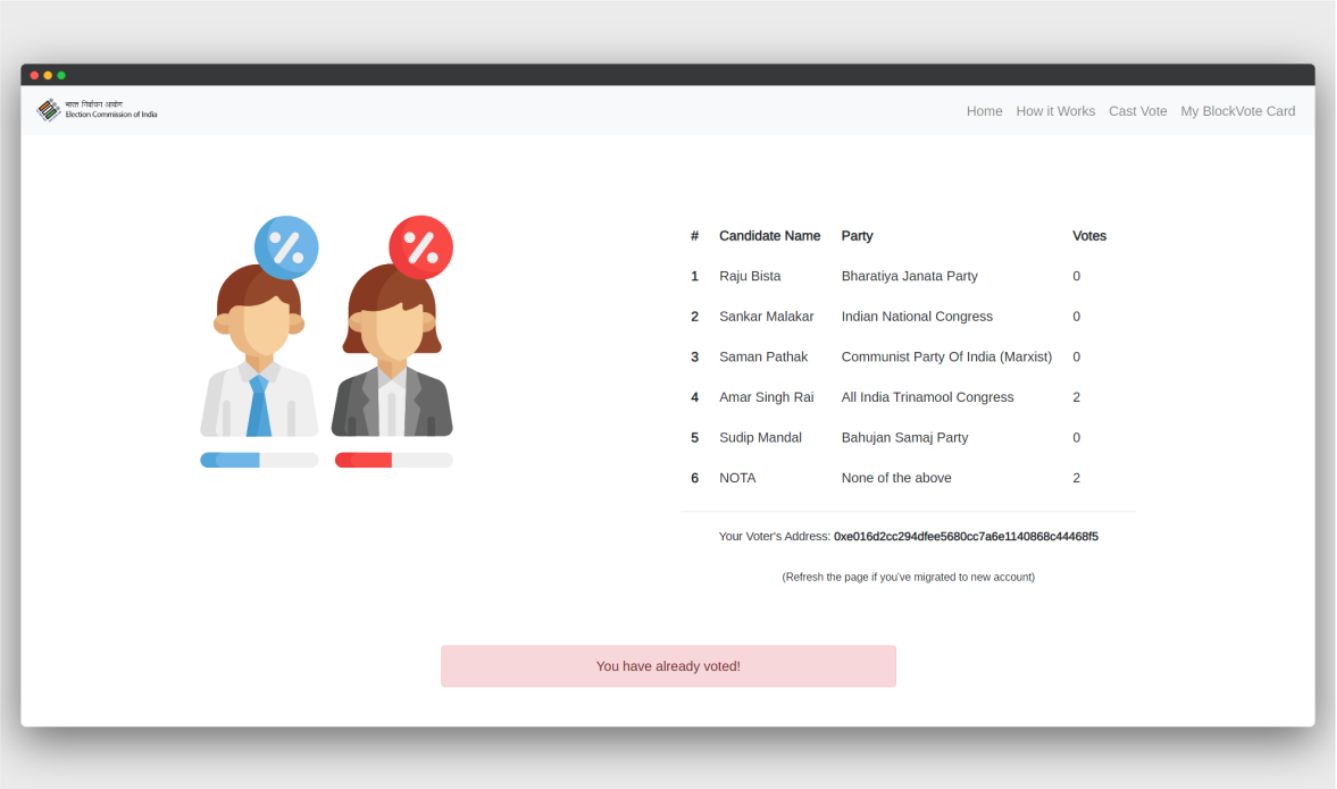

Fig: 14 Already Voted Prompt

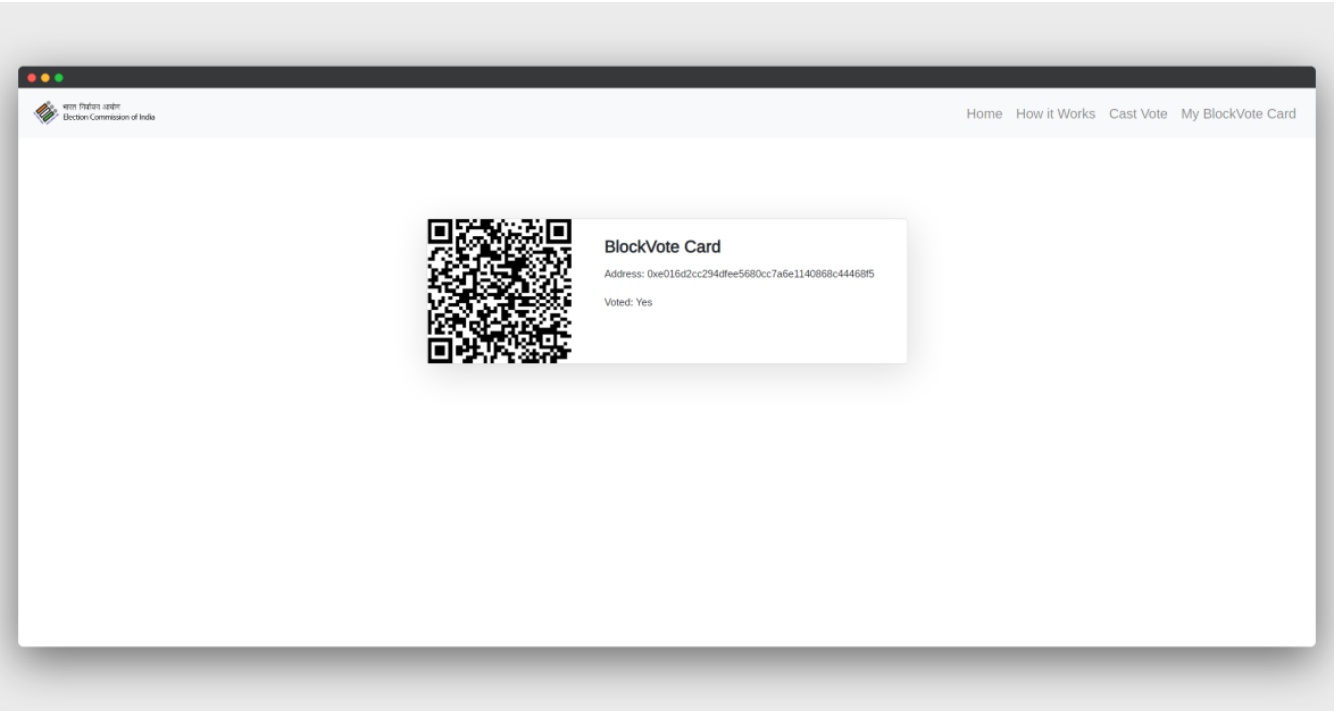

Fig: 15 Customized BlockVote Card

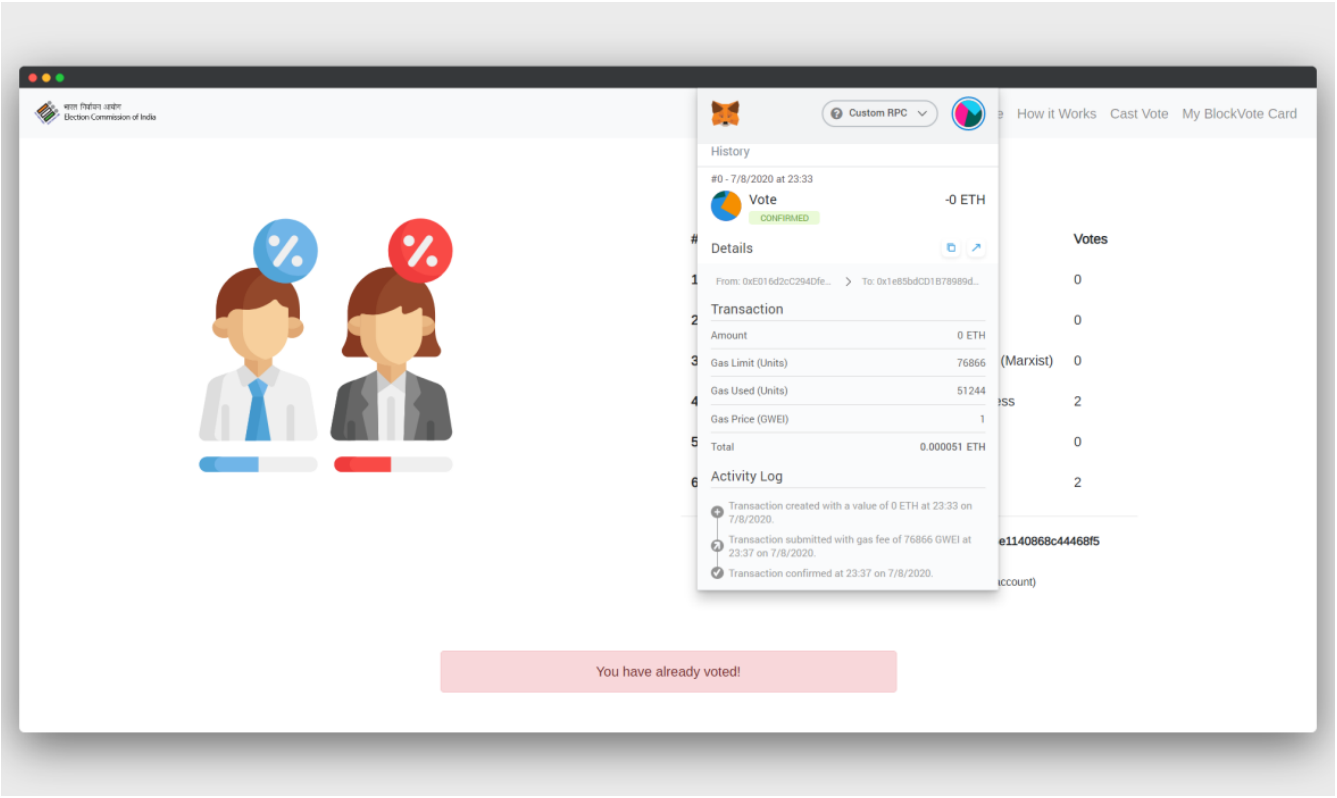

Fig: 16 Transaction Confirmed Log

CHAPTER 10
TESTING

This project uses Mocha as the testing framework to unit test and integration test all of our test cases for the application. Following strategies are used:

(i)Unit Testing:

This is the first and the most important level of testing. Itsneed begins from the moment a programmer develops a unit of code. Every unit is tested for various scenarios. Detecting and fixing bugs during early stages of the Software Lifecycle helps reduce costly fixes later on. It is much more economical to find and eliminate the bugs during early stages of application building process. Hence, Unit Testing is the most important of all the testing levels. As the software project progresses ahead it becomes more and more costly to find and fix the bugs.

Steps for Unit Testing are:-

Step 1: Creation of a Test Plan

Step 2: Creation of Test Cases and the Test Data

Step 3: Creation of scripts to run the test cases wherever applicable

Step 4: Execution of the test cases, once the code is ready

Step 5: Fixing of the bugs if present and re testing of the code

Step 6: Repetition of the test cycle until the Unit is free from all types of bugs.

(ii)Integration Testing:

Integration strategy stands for how individual modules will be combined during Integration testing. The individual modules can be combined in one go, or they can be joined one by one. A decision on how to put the pieces together is called the Integration Strategy.We have used bottom-up integration approach to integrate test our application. In Bottom Up Integration, we move from the bottom to top i.e. the components below are first written and these are integrated first. The integration happens from bottom to top. If the calling component is yet to be developed, it is replaced by a specially written component called a Driver.

TESTING DESIGNS

```
//Checking the candidate count
it("initializes with six candidates along with the parties", function() {
    return Election.deployed().then(function(instance) {
      return instance.candidatesCount();
    }).then(function(count) {
      assert.equal(count,6); //asserting the value
    });
  });
```

Fig: 17 Candidate Count Unit Test

```
//Checks for double voting by a voter

it("throws an exception for double voting", function() {
    return Election.deployed().then(function(instance) {
      electionInstance = instance;
      candidateId = 2;
      electionInstance.vote(candidateId, { from: accounts[1] });
      return electionInstance.candidates(candidateId);
    }).then(function(candidate) {
      var voteCount = candidate[3];
      assert.equal(voteCount, 1, "accepts first vote");
      // Try to vote again
      return electionInstance.vote(candidateId, { from: accounts[1] });
    }).then(assert.fail).catch(function(error) {
      assert(error.message.indexOf('revert') >= 0, "error message must contain revert");
      return electionInstance.candidates(1);
    }).then(function(candidate1) {
      var voteCount = candidate1[3];
      assert.equal(voteCount, 1, "candidate 1 did not receive any votes");
      return electionInstance.candidates(2);
    }).then(function(candidate2) {
      var voteCount = candidate2[3];
      assert.equal(voteCount, 1, "candidate 2 did not receive any votes");
    });
```

Fig: 18 Double Voting Unit Test

```
//Checks for Invalid Candidates

it("throws an exception for invalid candiates", function() {
    return Election.deployed().then(function(instance) {
      electionInstance = instance;
      return electionInstance.vote(99, { from: accounts[1] })
    }).then(assert.fail).catch(function(error) {
      assert(error.message.indexOf('revert') >= 0, "error message must contain revert");
      return electionInstance.candidates(1);
    }).then(function(candidate1) {
      var voteCount = candidate1[3];
      assert.equal(voteCount, 1, "candidate 1 did not receive any votes");
      return electionInstance.candidates(2);
    }).then(function(candidate2) {
      var voteCount = candidate2[3];
      assert.equal(voteCount, 0, "candidate 2 did not receive any votes");
    });
  });
```

Fig: 19 Invalid Candidate Unit Test

```
//Casting the vote unit testing

it("allows a voter to cast a vote", function() {
    return Election.deployed().then(function(instance) {
      electionInstance = instance;
      candidateId = 1;
      return electionInstance.vote(candidateId, { from: accounts[0] });
    }).then(function(receipt) {
      assert.equal(receipt.logs.length, 1, "an event was triggered");
      assert.equal(receipt.logs[0].event, "votedEvent", "the event type is correct");
      assert.equal(receipt.logs[0].args._candidateId.toNumber(), candidateId, "the candidate id is
correct");
      return electionInstance.voters(accounts[0]);
    }).then(function(voted) {
      assert(voted, "the voter was marked as voted");
      return electionInstance.candidates(candidateId);
    }).then(function(candidate) {
      var voteCount = candidate[3];
      assert.equal(voteCount, 1, "increments the candidate's vote count");
    })
  });
```

Fig: 20 Vote Cast Unit Test

```
//Candidate Initialization Unit Testing

it("it initializes the candidates with the correct values", function() {
    return Election.deployed().then(function(instance) {
      electionInstance = instance;
      return electionInstance.candidates(1);
    }).then(function(candidate) {
      assert.equal(candidate[0], 1, "contains the correct id");
      assert.equal(candidate[1], "Raju Bista", "contains the correct name");
      assert.equal(candidate[2], "Bharatiya Janata Party", "contains the correct party");
      assert.equal(candidate[3], 0, "contains the correct votes count");
      return electionInstance.candidates(2);
    }).then(function(candidate) {
      assert.equal(candidate[0], 2, "contains the correct id");
      assert.equal(candidate[1], "Sankar Malakar", "contains the correct name");
      assert.equal(candidate[2], "Indian National Congress", "contains the correct party");
      assert.equal(candidate[3], 0, "contains the correct votes count");
      return electionInstance.candidates(3);
    }).then(function(candidate) {
      assert.equal(candidate[0], 3, "contains the correct id");
      assert.equal(candidate[1], "Saman Pathak", "contains the correct name");
      assert.equal(candidate[2], "Communist Party Of India (Marxist)", "contains the correct party");
      assert.equal(candidate[3], 0, "contains the correct votes count");
      return electionInstance.candidates(4);
    }).then(function(candidate) {
      assert.equal(candidate[0], 4, "contains the correct id");
      assert.equal(candidate[1], "Amar Singh Rai", "contains the correct name");
      assert.equal(candidate[2], "All India Trinamool Congress", "contains the correct party");
      assert.equal(candidate[3], 0, "contains the correct votes count");
      return electionInstance.candidates(5);
    }).then(function(candidate) {
      assert.equal(candidate[0], 5, "contains the correct id");
      assert.equal(candidate[1], "Sudip Mandal", "contains the correct name");
      assert.equal(candidate[2], "Bahujan Samaj Party", "contains the correct party");
      assert.equal(candidate[3], 0, "contains the correct votes count");
      return electionInstance.candidates(6);
    }).then(function(candidate) {
      assert.equal(candidate[0], 6, "contains the correct id");
      assert.equal(candidate[1], "NOTA", "contains the correct name");
      assert.equal(candidate[2], "None of the above", "contains the correct party");
      assert.equal(candidate[3], 0, "contains the correct votes count");
    });
  });
```

Fig: 21 Candidate Initialization Unit Test

Test Report

Fig: 22 Test Report

CHAPTER 11
ADVANTAGES AND DISADVANTAGES

E-Voting advantages:

1. Accurate results and speed in vote count
2. Low cost of setup because just internet connection cost is required to vote across all the available e-voting platforms
3. Enhanced security as voting take place over secure communication channels
4. Accessibility from any corner of the world just by having an internet connection
5. Fraud prevention due to less human intervention therefore avoiding the fraud that could possibly take place at the polling stations
6. Reduced influence by family members or peers as voters can change their opinion until end of the voting day several times as only the last vote will be considered

E-Voting disadvantages:

1. In many developing countries internet access is not available to everyone, example: In rural areas low wage workers could not afford internet also many people don't know how to use and access the web
2. E-voting machines use software to register the vote and it is built by a company, general public don't know how a software works that might lead to fraudulent results being generated, vendors could also be bribed and in return, they could tweak the software to work in their favor
3. In the internet voting voter has to login by providing their personal and ID details, which will result in "Voter Anonymity" issue
4. There are situations when machine don't produce accurate results due to some errors, malfunctions,along with the possibility of hack-ing

CHAPTER 12

FUTURE SCOPE AND APPLICATIONS

12.1 FUTURE SCOPE

The future scope of e-voting systems using blockchain technology is promising and holds potential for addressing some of the key challenges associated with traditional electronic voting systems. Here are some aspects of the future scope of e-voting using blockchain:

1. **Enhanced security and transparency:** Blockchain technology can provide a decentralized and immutable ledger that enhances the security and transparency of the voting process. Each vote can be securely recorded on the blockchain, making it tamper-proof and resistant to manipulation. The transparency of the blockchain also enables independent auditing and verification of the voting results.
2. **Increased trust and voter confidence:** The use of blockchain in e-voting can help build trust and confidence among voters by providing a verifiable and transparent system. Voters can independently verify their votes and ensure they are accurately recorded, reducing concerns about fraud or tampering.
3. **Privacy and anonymity:** Blockchain-based e-voting systems can ensure privacy and anonymity for voters. By utilizing cryptographic techniques, voters' identities can remain confidential while still allowing their votes to be counted accurately. This privacy-enhancing feature is crucial for maintaining the integrity of the voting process.
4. **Elimination of centralized authorities:** Blockchain-based e-voting systems have the potential to eliminate the need for centralized authorities, such as election commissions or intermediaries, thereby reducing the possibility of manipulation or bias. The decentralized nature of blockchain technology allows for a more democratic and inclusive voting process.

12.2 APPLICATIONS

The e-voting system, or electronic voting system, offers several applications and benefits in modern elections and decision-making processes. Some of the key applications of e-voting systems are:

1. **Accessibility and convenience:** E-voting enables eligible voters to cast their votes remotely, eliminating the need to travel to physical polling stations. This enhances accessibility and convenience, particularly for individuals with disabilities, elderly voters, or those residing far from polling stations.
2. **Increased voter participation:** E-voting has the potential to increase voter turnout by overcoming barriers such as long queues, time constraints, or logistical issues associated with traditional voting methods. It allows voters to participate more easily and efficiently in the electoral process.
3. **Cost savings:** E-voting systems can lead to cost savings for electoral authorities by reducing expenses associated with physical infrastructure, printing of ballots, transportation, and the staffing of polling stations. Long-term maintenance costs may be incurred, but they can be offset by the reduction in recurring expenses.
4. **Faster results and efficiency:** E-voting systems can expedite the vote counting and result tabulation processes. With electronic tabulation, the time required to obtain election results can be significantly reduced, providing near-instantaneous outcome reporting.
5. **Improved accuracy and integrity:** E-voting systems can enhance the accuracy of vote counting, minimizing errors and eliminating the possibility of misplaced or illegible ballots. Digital systems can also include built-in checks and validations to ensure the integrity of the voting process.
6. **Security measures:** While security is a critical consideration for e-voting, proper implementation of encryption, authentication, and audit trail mechanisms can safeguard against tampering, fraud, and unauthorized access. Robust security protocols can provide a high level of assurance in the integrity of the voting system.

CONCLUSIONS

In this project, we introduced a blockchain-based electronic voting system that utilizes smart contracts to enable secure and cost-efficient elections while guaranteeing voters' privacy. Blockchain technology offers a new possibility to overcome the limitations and adoption barriers of electronic voting systems which ensures election security and integrity and lays the ground for transparency. Using an Ethereum private blockchain, it is possible to send hundreds of transactions per second onto the blockchain, utilizing every aspect of the smart contract to ease the load on the blockchain. the utilization of blockchain technology in e-voting systems offers significant advantages for the electoral process. E-voting using blockchain technology offers several key benefits for the voting process. Firstly, it enhances transparency by providing a decentralized and immutable ledger that allows for the transparent tracking and verification of votes. This means that every transaction is recorded on the blockchain, making it difficult to alter or manipulate results without detection. Secondly, it improves security through cryptographic techniques, ensuring secure transmission and storage of votes. The decentralized nature of the blockchain network makes it highly resistant to hacking or tampering attempts, enhancing the integrity of the voting process. Furthermore, blockchain technology eliminates the risk of fraud or double voting by recording each vote as a unique transaction. This prevents malicious actors from altering or duplicating votes. Additionally, e-voting using blockchain can increase accessibility by enabling remote voting, allowing citizens to vote from anywhere, thereby reducing barriers such as geographical constraints or physical disabilities.

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PUBLICATION CERTIFICATES

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JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

E-voting Using Blockchain Technology

Atharva Kedar, Paras Kamble, Roshan Kumar, Prathamesh Chavan

Department Of Information Technology,
D.Y.Patil College Of Engineering, Pune, India

Prof. Rutuja Tikait
Department Of Information Technology,
D.Y.Patil College Of Engineering, Pune, India

1) ABSTRACT:-

It is very challenging to build a secure voting system that offers fairness and privacy of current voting schemes. In this implementation paper, we evaluate an application of blockchain as a service to implement distributed electronic voting systems. Our objective is to provide a decentralized architecture to run and support a voting scheme that is open, fair, and independently verifiable. Our proposed solution implements the protocol which achieves fundamental e-voting properties as well as offer a degree of decentralization and allow for the voter to change/update their vote and the experimental result shows that our proposed solution is beneficial for the existing and upcoming voting system.

Keywords— Blockchain; Cryptocurrency; EVoting; Decentralized.

2) INTRODUCTION:-

Election has a very major role in democracy because it is the deciding factor of the future of a country but the major concern is that society doesn't trust the election system. Flawed electoral system is the issue faced by even the world's largest democracies like India, United States, and Japan. Overtime, the voting systems have evolved and the breach of

Various sectors such as innovation, social media and political decision-making organization are identified by disputes regarding voting on the web. Electronic voting is ready to change the normal voting system, which is less complicated and more
open to voters. This is legal if the web produces a voting form because democratic structures can be
displayed on any PC with a web connection. These tactics reduce the cost of many laws to some voters
by creating more ways in which they can produce a voting form. There's a chance to kill long lines at
review stations and offer better reception for people who are mentally ill, experiencing illness, serving in the military or living abroad as well as those
who are away from close rides and others who feel hard to see. upward channel. Additionally, posting a voting form on the web can cover the cost of voters' great opportunity to make the voting form at any time. Young people between the ages of 18 and 30 are special voters and the web is a process to attract those citizens who seem to be the hardest to reach.

3) LITERATURE SURVEY :-

Block chain was first introduced by Satoshi Nakamoto (a pseudonym) , who proposed a peer to-peer payment system that allows
cash transactions through the Internet without relying on trust

2) INTRODUCTION:-

Election has a very major role in democracy because it is the deciding factor of the future of a country but the major concern is that society doesn't trust the election system. Flawed electoral system is the issue faced by even the world's largest democracies like India, United States, and Japan. Overtime, the voting systems have evolved and the breach of security has evolved. The major issues that need to be addressed in the current voting system are vote rigging, EVM hacking, polling booth capture and election manipulation.

An online voting framework is a democratic framework in which any citizen can exercise his or her democratic rights anywhere in the country.

and 30 are special voters and the web is a process to attract those citizens who seem to be the hardest to reach.

3) LITERATURE SURVEY :-

Block chain was first introduced by Satoshi Nakamoto (a pseudonym) , who proposed a peer to-peer payment system that allows
cash transactions through the Internet without relying on trust or the need for a financial institution. Block chain is secure by design,
and an example of a system with a high byzantine failure tolerance.

We did a lot of research before starting our project which included a lot of research papers published under various books. During the detailed reference for the literature research, we came across some words that include:

• Truffle • Ethereum and ethers • Web3.js
• Metamask
• Ganache

A.*Web-based open-audit voting, Adida, B., Helios, 2008.*

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This paper proposes associated justify an adequate security model and criteria to judge comprehensibility. It additionally describes a web ballot theme, Pretty graspable Democracy, showing that it satisfies the adequate security model which it's a lot of graspable than Pretty smart Democracy, presently the sole theme that additionally satisfies the planned security model

B.*A fair and robust voting system by broadcast, Dalia, K., Ben, R., Peter Y. A, and Feng. H, 2012.*

This paper proposes a recovery round to enable the election result to be announced if voters abort and also added a commitment round to ensure fairness. In addition, it also provided a computational security proof of ballot secrecy.

C.*Star-vote: A secure, transparent, auditable, and reliable voting system, Bell. S., Benaloh. J., Byrne, M. D., Debeauvoir. D., Eakin, B., 2013.*

This paper describes the STAR-Vote design, that may preferably be the next-generation electoral system for Travis

is being casted from an account the account is disabled from current voting process.

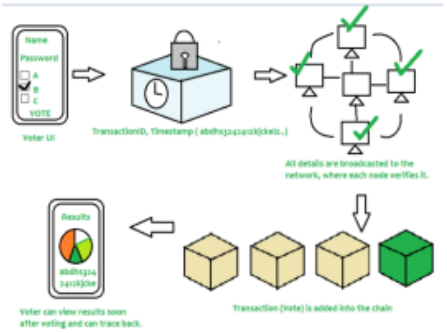

Fig 1. Proposed System Diagram

5) PROPOSED METHODOLOGY :-

A. Blockchain

This paper describes the STAR-Vote design, that may preferably be the next-generation electoral system for Travis County and maybe elsewhere.

D.*The Future of E-voting, Hitesh Tewari, 2017.*

The paper describes the traditional voting system integrated into today's modern world. Using technologies such as blockchain, and encryption techniques.

E.*EPRA International Journal of Research and Development (IJRD), Peer Reviewed Journal, 2021.*

Translating this process to the blockchain network to improve reliability and resolve concerns of manipulation from the client system, a system can be proposed consisting of two blockchains- the vote blockchain and voter blockchain.

4) PROPOSED SYSTEM:-

The block chain technology used mostly works the same as the block chain technology contained in the E-voting system and focuses on database recording. The nodes involved in Block chain that have been used by Bitcoin are independently random and not counted. However, in this e-voting system a block chain permission is used, for nodes to be made the opposite of the Bitcoin system and the Node in question is a place of general election because the place of elections must be registered before the commencement of implementation, it must be clear the amount and the identity. This method aims to maintain data integrity, which is protected from manipulations that should not happen in the election process.

A web application is being developed to measure the majority of votes which has the details about the total number of voters, the number of votes cast and the percentage of votes cast. Only one vote can be casted from one account and once a vote

A. Blockchain

Blockchain is a decentralized, digital ledger technology that allows multiple parties to have a transparent and secure record of transactions. It is often associated with crypto currencies like Bitcoin, but its applications extend far beyond that.

At its core, a blockchain is a continuously growing list of records, called blocks, that are linked and secured using cryptography. Each block contains a cryptographic hash of the previous block, a timestamp, and transaction data.

B. Ethereum

Ethereum is a decentralized, open-source blockchain-based platform that enables developers to build decentralized applications (dApps) on top of its blockchain.

It also has its own programming language, called Solidity, which is used to write smart contracts.

Smart contracts are self-executing contracts with the terms of the agreement between buyer and seller being directly written into lines of code. They run on the Ethereum blockchain and can automate the process of verifying, executing and enforcing the terms of a contract.

*C)*Truffle

Truffle is a tool that makes it easy for designers to build blockchain-based applications with respect to Ethereum. It allows designers to build and test solid contracts and create public and private organizations that use regional languages such as JavaScript. A remarkable and attractive feature about Truffle is its command line tool. We can use a variety of important commands, for example, assemble, move, repair, etc. The control center is a quick and easy way to connect with the blockchain.

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D)Metamask

Metamask is a popular cryptocurrency wallet and browser extension that allows users to manage their Ethereum and other ERC-20 tokens. It functions as a bridge between a user's web browser and the Ethereum blockchain, allowing users to interact with decentralized applications (dApps) and conduct transactions on the blockchain.

With Metamask, users can create and manage multiple Ethereum accounts, store their private keys securely on their device, and easily send and receive Ethereum and other ERC-20 tokens. The extension also includes a built-in decentralized exchange (DEX) feature, which allows users to trade tokens directly from their wallet without having to send them to an external exchange.

E)Ganache

Ganache is a personal blockchain for Ethereum development, testing, and debugging. It allows developers to simulate an Ethereum network locally on their computer, which is useful for testing smart contracts, dApps, and other blockchain-related applications in a safe and controlled environment.
Ganache provides a number of features that make it easy for developers to work with, including the ability to create and manage multiple blockchain instances, control the gas price and block time, inspect blockchain events and transactions, and perform various debugging operations.

F)Web3.Js

Web3.js is a JavaScript library that provides a set of tools and functionalities for interacting with the Ethereum blockchain. It is built on top of the Ethereum JSON-RPC API and provides a convenient way for developers to access and interact with smart contracts, manage Ethereum accounts, and send transactions on the Ethereum network.
Web3.js is used by many Ethereum-based dApps and platforms to interact with the Ethereum blockchain. It provides a number of powerful features, such as the ability to:

- Connect to a local or remote Ethereum node

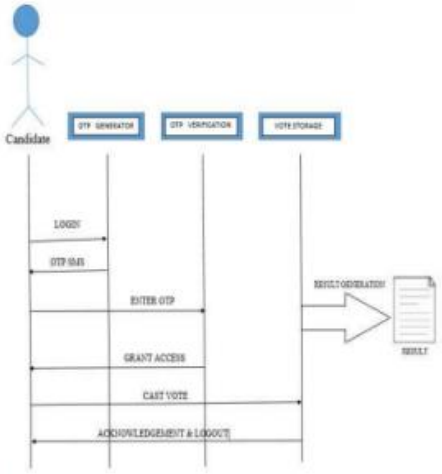

Fig 2. Sequence Diagram

6) IMPLEMENTATION :

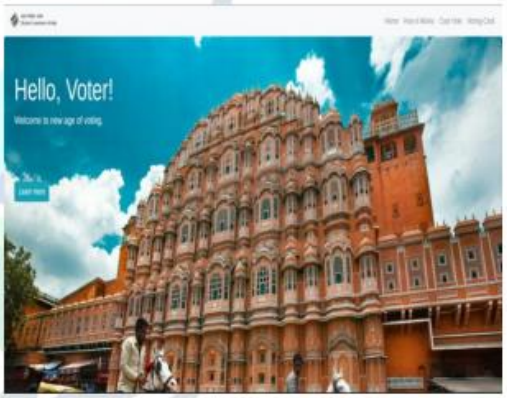

Fig 3. Home Page

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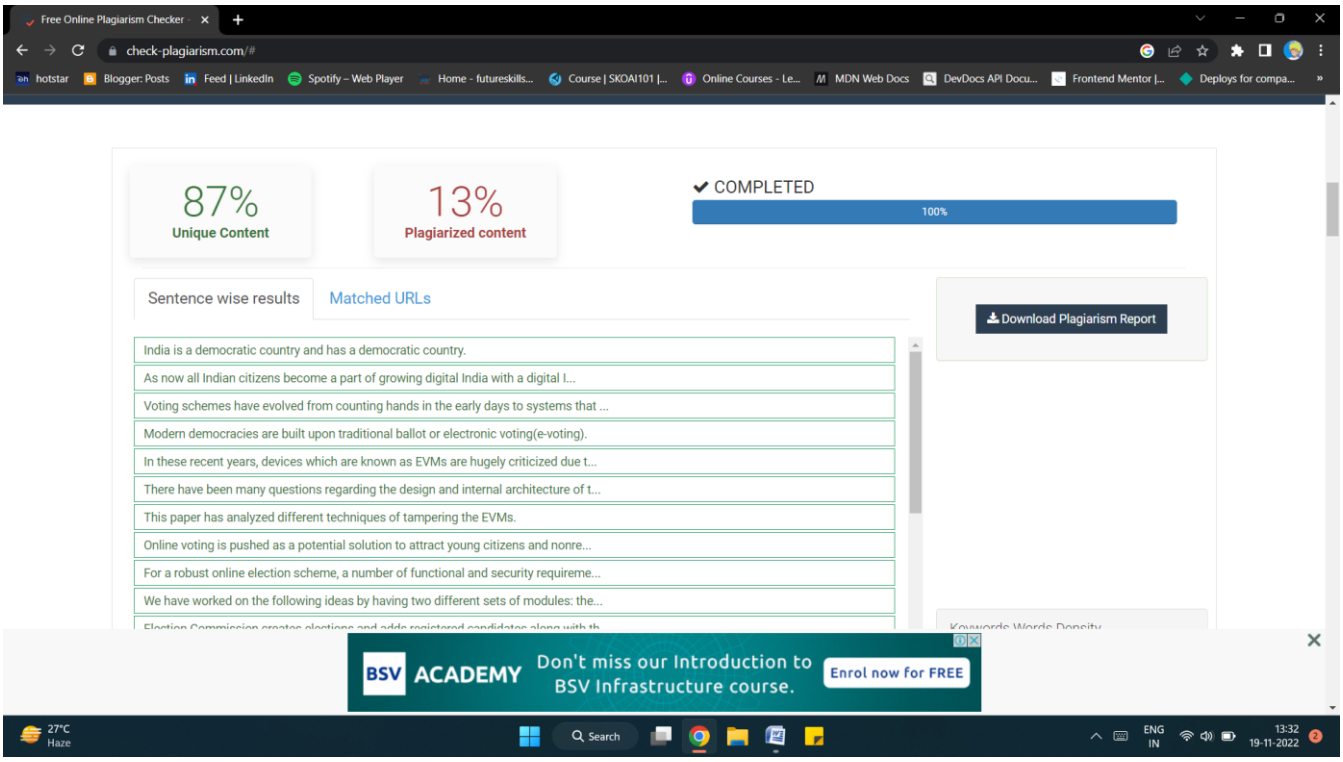

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India possesses a democratic system and functions as a democratic nation. As now all Indian citizens become a part of the growing digital India with a digital ID which is an Aadhaar card. Voting schemes have evolved from counting hands in the early days to systems that include paper, punch cards, and electronic voting machines Contemporary democracies are founded on the principles of traditional paper ballots or electronic voting (e-voting). Over the past few years, there has been substantial criticism of electronic voting machines (EVMs) as a result of inconsistent election result reports. There have been many questions regarding the design and internal architecture of these devices and how they might be susceptible to attacks .Online voting is pushed as a potential solution to attract young citizens and nonresidents of the country. For a robust online election scheme, a number of functional and security requirements are to be met such as transparency, accuracy, suitability, data privacy, etc. We have worked on the following ideas by having two different sets of modules: the election commission and the voter(s). Election Commission creates elections and adds registered candidates along with the parties for contesting the election. By utilizing an election's REST API hosted on Ethereum's Blockchain, the voter's interface displays the necessary details for casting their vote. Subsequently, the cast vote is stored on our blockchain framework, from which the Election Commission retrieves the vote count. However, the limitation arises from deviating from the traditional approach of using smart contracts. Consequently, our coded blockchain framework cannot operate on the main network without hosting it separately, and interaction requires the use of a distinct web3 provider. Another drawback is the absence of a public API for voter ID, which hampers the authentication of voters. The most important factor of this application is to integrate the blockchain framework with both modules for seamless voting.

1.2 MOTIVATION:

The Existing System of Election is running manually. The Voter has to Visit Booths to Vote for a Candidate so there is waste of Time. Due to this many people don't