ELECTRONIC VOTING SYSTEM USING BLOCKCHAIN

PROJECT REPORT

SUBMITTED BY

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Project Report Format

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1. INTRODUCTION

1.1 PROJECT OVERVIEW

The Electronic Voting System Using Blockchain project aims to address the challenges associated with traditional voting systems by leveraging blockchain technology to create a secure, transparent, and tamper-resistant electronic voting platform. This report provides an overview of the project, its objectives, methodologies, key findings, and recommendations.

1.2 PURPOSE

The purpose of the Electronic Voting System Using Blockchain project is to modernize and enhance the traditional voting process by harnessing the power of blockchain technology. This innovative system is designed to provide a secure, transparent, and tamper-resistant platform for voters to cast their ballots, ultimately increasing the integrity of elections. By leveraging blockchain, the project aims to ensure data integrity, prevent fraud, and improve the efficiency of the voting process while maintaining voter anonymity and identity verification. The ultimate goal is to revolutionize the electoral system, making it more accessible, trustworthy, and efficient for all citizens, thereby strengthening democracy.

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM

The existing problem in the Electronic Voting System Using Blockchain project lies in the transition from traditional voting systems to electronic ones, specifically the challenges associated with security, user adoption, and legal frameworks. Traditional voting systems often suffer from issues such as fraud, inefficiency, and a lack of transparency. Moving to an electronic voting system introduces concerns about the security of voter data and the potential for cyberattacks. Ensuring that users, including the elderly and those with limited technology access, can easily and confidently navigate the electronic system is another challenge. Additionally, adapting existing legal and regulatory frameworks to accommodate electronic voting without compromising security and trust is a complex issue that must be addressed for the successful implementation of the project

2.2 REFERENCES

Look for articles in peer-reviewed journals focusing on computer science, cryptography, or political science that discuss blockchain-based voting systems.Organizations like the National Institute of Standards and Technology (NIST), MIT, or the Brookings Institution might have reports or publications exploring the potentials and challenges of blockchain in voting systems.Websites such as IEEE Spectrum, TechCrunch, or Wired often cover emerging technologies and could have articles discussing blockchain's application in voting systems.

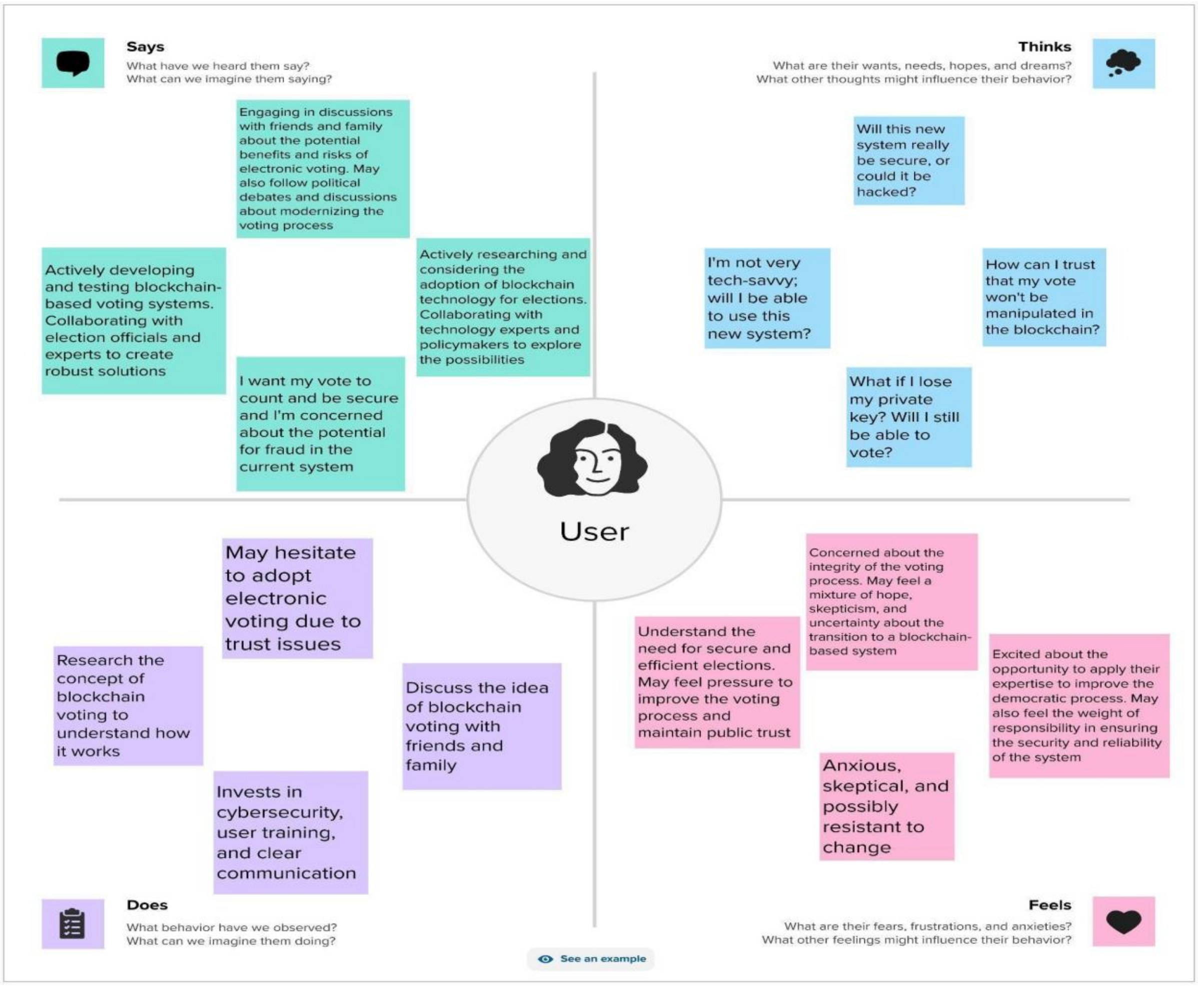
2.3 PROBLEM STATEMENT DEFINITION

The problem statement for the "Electronic Voting System Using Blockchain" project can be summarized as follows:

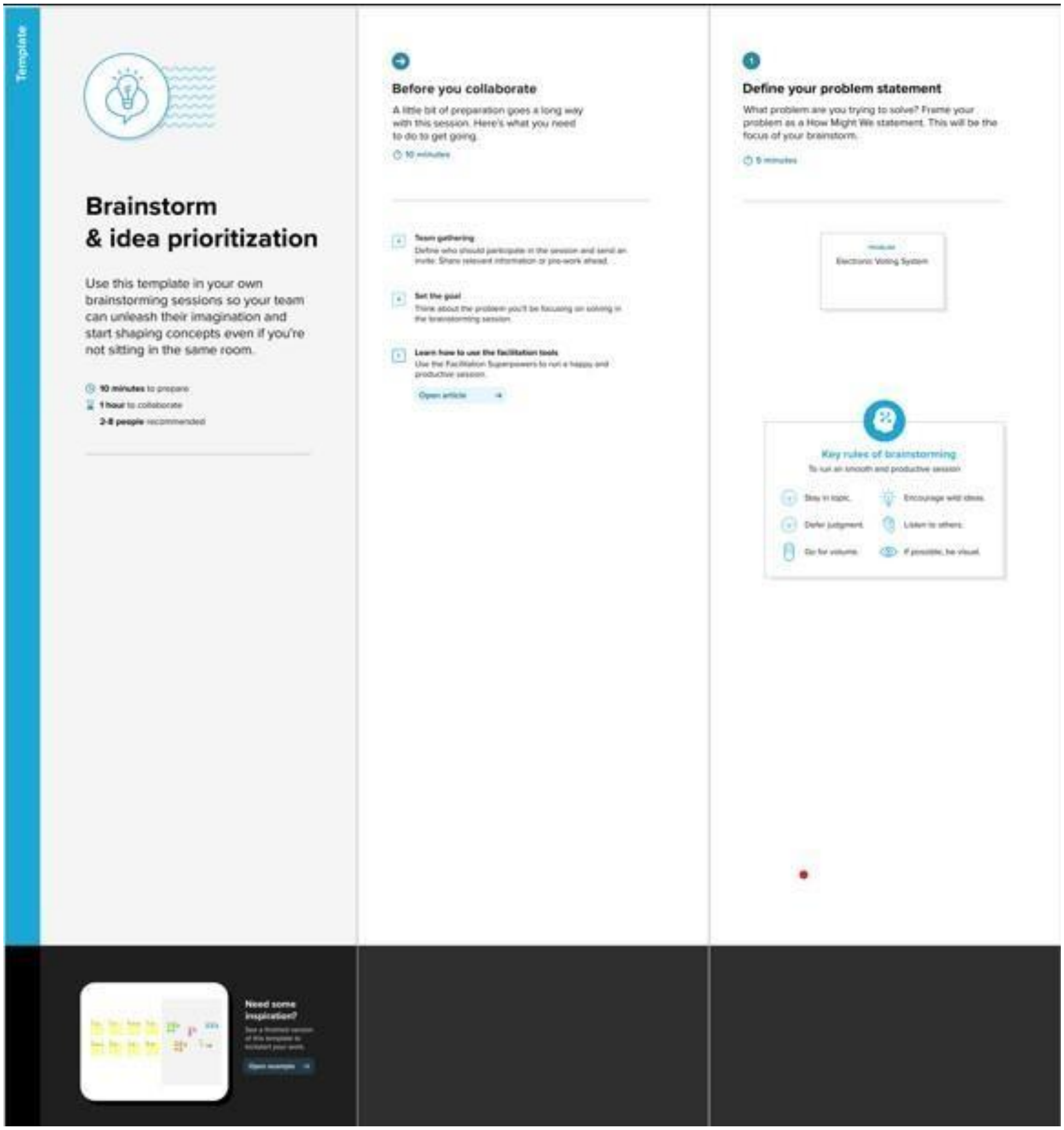
"Traditional voting systems suffer from issues like fraud, inefficiency, anda lack of transparency, necessitating a transition to electronic voting. However, the challenge lies in ensuring the security of voter data, user adoption, and adapting legal frameworks to accommodate this transition without compromising trust and integrity in the electoral process."

3. IDEATION PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



3.2 IDEATION & BRAINSTORMING



2 Brainstorm

Write down any ideas that come to mind that address your problem statement.

10 minutes

TIP

You can select a sticky note and hit the pencil [switch to sketch] icon to start drawing!

Person 1

- Develop a user-friendly mobile or web application that allows voters to securely cast their votes on the blockchain. The app could include user authentication, biometric verification, and easy-to-follow instructions
- Explore various identity verification methods, such as biometrics, digital signatures, or government-issued IDs, to ensure that only eligible voters can participate
- Consider making the system accessible to all, including people with disabilities. Ensure compatibility with screen readers, assistive technologies, and multiple languages

Person 2

- Employ robust security measures to safeguard the blockchain network against cyberattacks, including Distributed Denial of Service (DDoS) protection and encryption
- Implement zero-knowledge proofs or other privacy-preserving techniques to protect the anonymity of voters while still allowing for vote verification
- Develop a user-friendly mobile or web application that allows voters to securely cast their votes on the blockchain. The app could include user authentication, biometric verification, and easy-to-follow instructions

Person 3

- Develop an extensive voter education campaign to ensure that all citizens, regardless of their technical literacy, understand how to use the blockchain-based voting system
- Employ robust security measures to safeguard the blockchain network against cyberattacks, including Distributed Denial of Service (DDoS) protection and encryption
- Implement zero-knowledge proofs or other privacy-preserving techniques to protect the anonymity of voters while still allowing for vote verification

Person 4

- Develop a user-friendly mobile or web application that allows voters to securely cast their votes on the blockchain. The app could include user authentication, biometric verification, and easy-to-follow instructions
- Launch an extensive public awareness campaign to inform citizens about the benefits of blockchain-based voting and address any concerns or misconceptions
- Develop an extensive voter education campaign to ensure that all citizens, regardless of their technical literacy, understand how to use the blockchain-based voting system

3 Group ideas

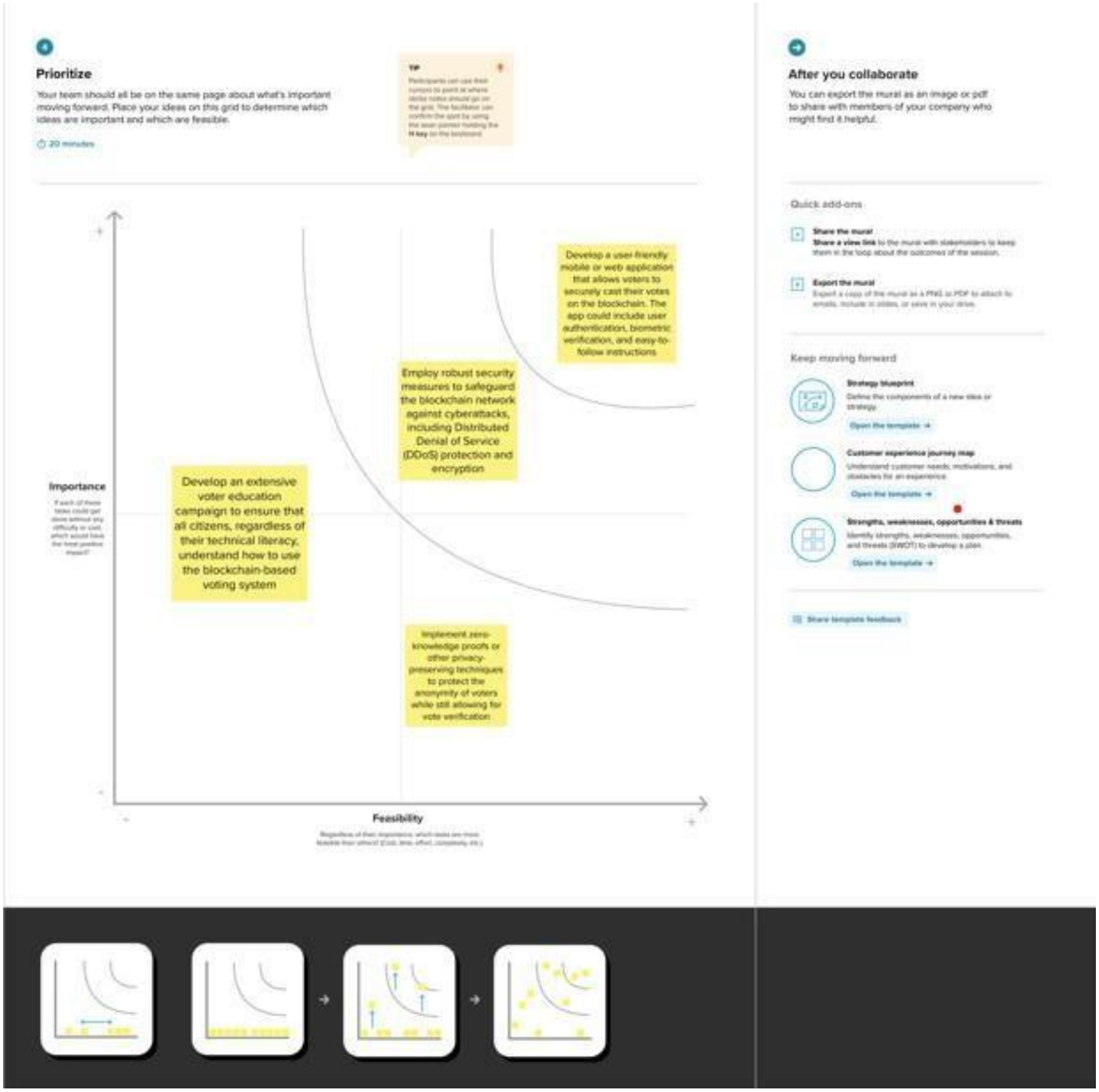
Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

20 minutes

TIP

Add customizable tags to sticky notes to make it easier to find, browse, organize, and categorize important ideas as themes within your mural.

- Develop a user-friendly mobile or web application that allows voters to securely cast their votes on the blockchain. The app could include user authentication, biometric verification, and easy-to-follow instructions
- Implement zero-knowledge proofs or other privacy-preserving techniques to protect the anonymity of voters while still allowing for vote verification
- Employ robust security measures to safeguard the blockchain network against cyberattacks, including Distributed Denial of Service (DDoS) protection and encryption
- Develop an extensive voter education campaign to ensure that all citizens, regardless of their technical literacy, understand how to use the blockchain-based voting system


Prioritize
Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.
20 minutes
TIP
Develop a user-friendly mobile or web application that allows voters to securely cast their votes on the blockchain. The app could include user authentication, biometric verification, and easy-to-follow instructions
Employ robust security measures to safeguard the blockchain network against cyberattacks, including Distributed Denial of Service (DDoS) protection and encryption
Importance
Develop an extensive voter education campaign to ensure that all citizens, regardless of their technical literacy, understand how to use the blockchain-based voting system
Implement zero-knowledge proofs or other privacy-preserving techniques to protect the anonymity of voters while still allowing for vote verification
Feasibility
After you collaborate
You can export the mural as an image or pdf to share with members of your company who might find it helpful.
Quick add-ons
Share the mural
Share a view link to the mural with stakeholders to keep them in the loop about the outcomes of the session.
Export the mural
Export a copy of the mural as a PNG or PDF to attach to emails, include in slides, or save in your drive.
Keep moving forward
Strategy blueprint
Define the components of a new idea or strategy.
Open the template →
Customer experience journey map
Understand customer needs, motivations, and obstacles for an experience
Open the template →
Strengths, weaknesses, opportunities & threats
Identify strengths, weaknesses, opportunities, and threats (SWOT) to develop a plan.
Open the template →
Share template feedback

4. REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

Voter Registration:

- The system must allow eligible voters to register and verify their identities.

Ballot Creation and Distribution:

- Authorized administrators should be able to create electronic ballots for different elections.
- Ballots should be distributed to registered voters securely.

Voting Process:

- Voters should be able to securely cast their votes using the system.
- The system must ensure voter anonymity.

Real-time Vote Counting:

- The system should count votes in real-time and display the results securely.

Blockchain Integration:

- Utilize blockchain technology to securely store and timestamp voting data.
- Ensure the immutability and transparency of the blockchain ledger.

User Authentication:

- Implement multi-factor authentication for secure user login and identity verification.

User Interface:

- Develop a user-friendly and accessible interface for all demographics.
- Provide clear instructions for voting procedures.

Audit Trail:

- Maintain an immutable audit trail for transparency and accountability.
- Record all voting activities and system changes.

Security Measures:

- Implement strong encryption to protect voter data.
- Conduct regular security audits and vulnerability assessments.
- Include fail-safes to prevent double voting and fraudulent activities.

Scalability:

- Design the system to handle a large number of voters simultaneously, especially during high-demand elections.

4.2 NON FUNCTIONAL REQUIREMENTS

Security:
- Ensure the highest level of security to protect against cyber threats, hacking, and fraud.
- Implement strong access controls and encryption for data protection.

Performance:
- The system must be highly responsive and capable of handling peak loads during elections without significant performance degradation.

Reliability:
- The system should be available and operational 24/7 to accommodate various time zones and ensure that voters can participate at their convenience.

Usability:
- Ensure that the user interface is intuitive and user-friendly for all age groups and technology literacy levels.

Compliance:
- The system must comply with relevant laws and regulations related to electronic voting and data protection.

Auditability:
- Provide features for auditing and traceability to guarantee the integrity of the election process.

Scalability:
- The system should be designed to scale horizontally to accommodate a growing number of users and elections.

Interoperability:
- Ensure that the system can work seamlessly with various hardware and software platforms.

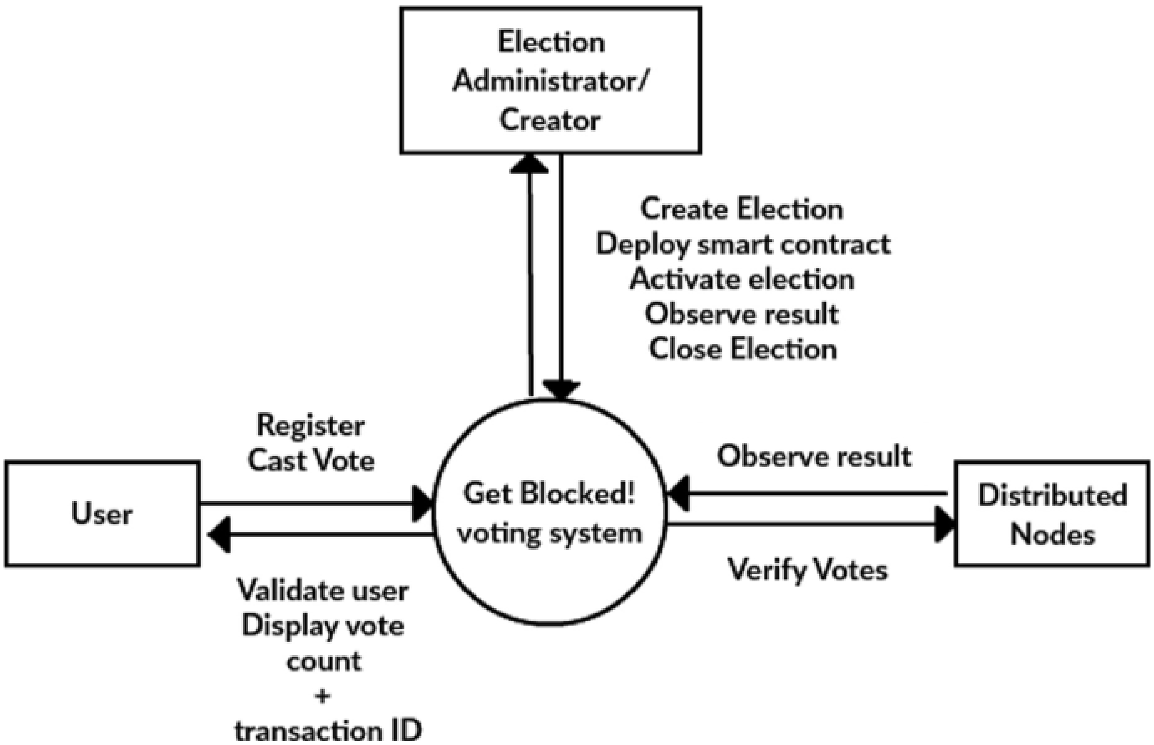
Backup and Recovery:
- Implement robust backup and disaster recovery mechanisms to ensure data integrity and system availability.

Documentation:
- Maintain thorough documentation for system administration, user guides, and training materials.

These functional and non-functional requirements will serve as a foundation for the development and evaluation of the Electronic Voting System Using Blockchain project. It's important to tailor these requirements to the specific needs and constraints of the project.

5. PROJECT DESIGN

5.1 DATAFLOW DIAGRAMS & USER STORIES



5.2 SOLUTION ARCHITECTURE

System Overview: The architecture comprises three main components: the User Interface, Backend Server, and Blockchain Network. Each component serves a specific role in ensuring the secure, transparent, and efficient functioning of the electronic voting system.

1.User Interface:

- This component is the front end that interacts directly with voters.
- It provides an intuitive and user-friendly platform for voters to access and

cast their votes.
- It includes features for voter registration, ballot selection, and the submission of votes.
- The User Interface securely communicates with the Backend Server for user authentication and vote submission.

2.Backend Server:
- The Backend Server acts as the intermediary layer between the User Interface and the Blockchain Network.
- It handles user authentication and ensures the security of the voting process.
- This component is responsible for verifying voter identities, ensuring anonymity, and securely transmitting vote data to the Blockchain Network.
- It communicates with the Voter Database for identity verification and with the Blockchain Network for vote recording.

3.Blockchain Network:
- The Blockchain Network represents the core of the solution architecture.
- It securely stores and records all voting data in a decentralized and tamper-resistant manner.
- The blockchain ledger ensures the transparency and immutability of vote records.
- It communicates with the Backend Server to receive and record vote data.

4.Additional Components:

While the above components are the primary elements of the solution architecture, there may be additional components and technologies integrated for enhanced security, scalability, and performance. These could include:

- Security Layers: Various security measures, including encryption, firewalls, and intrusion detection systems, to protect against cyber threats.
- Voter Database: Stores and manages voter registration and authentication data.
- Ballot Database: Contains electronic ballots for different elections.
- Audit Trail Module: Logs all system activities and changes for transparency and accountability.
- Scalability Features: Ensures the system can handle a growing number of voters and elections.
- Load Balancers: Distribute user requests efficiently to maintain system

responsiveness.

Blockchain Platform: Select an appropriate blockchain platform, such as Ethereum, Hyperledger Fabric, or a custom-built blockchain, based on your project's specific requirements and use case.

Communication Protocols: Use secure communication protocols to ensure data integrity and privacy, such as HTTPS for user interactions and blockchain-specific protocols for data transmission to the ledger.

Deployment and Hosting: Consider whether the solution will be hosted on cloud infrastructure, on-premises servers, or a combination of both. Ensure high availability and disaster recovery capabilities.

This architecture provides a high-level overview of the Electronic Voting System Using Blockchain, and the actual implementation will require detailed design, development, and testing to meet the project's specific objectives and requirements. It is recommended to consult with experienced system architects and blockchain experts to fine-tune the architecture and ensure its effectiveness and security.

6. PROJECT PLANNING & SCHEDULING

6.1 TECHNICAL ARCHITECTURE

6.1.1 Architectural Design:

- Define the overall system architecture, including the User Interface, Backend Server, and Blockchain Network.
- Select the specific blockchain platform and communication protocols.

6.1.2 Data Storage and Security:

- Design the data storage mechanisms, including voter and ballot databases.
- Plan security measures, including encryption, access controls, and audit trails.

6.1.3 Integration and Interoperability:

- Address how the system will integrate with external entities and existing systems, if applicable.
- Ensure interoperability with various platforms and devices.

6.2 SPRINT PLANNING AND ESTIMATION

6.2.1 Define Sprint Goals:

- Break down the project into manageable sprints or development phases.
- Define the specific goals and features to be developed in each sprint.

6.2.2 Resource Allocation:

- Allocate team members, including developers, designers, and testers, to specific sprints.
- Ensure that the necessary resources, tools, and technology are available.

6.2.3 Estimation:

- Estimate the time and effort required for each sprint's tasks.
- Use techniques like story points or hours estimation to plan the work.

6.3 SPRINT DELIVERY SCHEDULE

6.3.1 Sprint Timeline:

- Create a timeline for each sprint, including start and end dates.
- Ensure that sprint durations are reasonable and flexible.

6.3.2 Task Breakdown:

- Break down sprint goals into detailed tasks and user stories.
- Assign tasks to team members and track progress.

6.3.3 Milestones and Deliverables:

- Identify key milestones for each sprint.
- Specify the deliverables, such as a functional module or system feature.

6.3.4 Sprint Review and Retrospective:

- Plan for sprint review meetings to demonstrate completed work.
- Conduct retrospectives to identify areas for improvement in subsequent sprints.

7. CODING AND SOLUTIONS

```
// SPDX-License-Identifier: MIT

pragma solidity ^0.8.0;


contract VoteSystem{

   address public owner;


   constructor(){

      owner= msg.sender;

   }


 struct candidate {

    uint voterId;

    string name;

    uint age;

    uint voteCount;

 }


 mapping (uint => candidate) candidateMap;
```

```
struct voters {

    uint voterId;

    string name;

    uint age;

    bool votingState;

}



mapping (uint => voters) votersMap;

mapping (uint=>bool) registeredVoter;



modifier checkVoterVoted(uint _votersVoterId){

    require (votersMap[_votersVoterId].votingState == false);

    _;

}



modifier checkRegisteredVoter(uint _votersVoterId){

        require(registeredVoter[_votersVoterId]==true, "Voter is not
Registered");

        _;

}

uint[] voterIdlist;
```

```
uint[] candidateIdList;



 function enrollCandidate(uint _voterId,string memory _name,uint  _age )
public {


 require (_age >= 25);

 require (candidateMap[_voterId].voterId != _voterId);


    candidateMap[_voterId].voterId = _voterId;

    candidateMap[_voterId].name = _name;

    candidateMap[_voterId].age = _age;


    candidateIdList.push(_voterId);

 }


 function enrollVoter(uint _voterId,string memory _name,uint _age) public
returns(bool){


require (_age >= 18);

require (votersMap[_voterId].voterId != _voterId);
```

```
    votersMap[_voterId].voterId = _voterId;

    votersMap[_voterId].name = _name;

    votersMap[_voterId].age = _age;



    voterIdlist.push(_voterId);

   return registeredVoter[_voterId]=true;



 }



 function getCandidateDetails(uint _voterId) view public returns(uint,string
memory,uint,uint) {



    return
(candidateMap[_voterId].voterId,candidateMap[_voterId].name,candidate
Map[_voterId].age,candidateMap[_voterId].voteCount);

 }



 function getVoterDetails(uint _voterId) view public returns (uint,string
memory,uint,bool){



    return
(votersMap[_voterId].voterId,votersMap[_voterId].name,votersMap[_voter
```

```
Id].age,votersMap[_voterId].votingState);


 }


 function vote(uint _candidateVoterId,uint _votersVoterId) public
checkVoterVoted(_votersVoterId) checkRegisteredVoter(_votersVoterId) {

     candidateMap[_candidateVoterId].voteCount += 1;

     votersMap[_votersVoterId].votingState = true;

 }


 function getVotecountOf(uint _voterId) view public returns(uint){

        require(msg.sender== owner, "Only owner is allowed to Check
Results");

     return candidateMap[_voterId].voteCount;

 }


 function getVoterList() view public returns (uint[] memory){



    return  voterIdlist;

    }
```

```
 function getCandidateList() view public returns(uint[] memory){



 return candidateIdList;

 }

}
```

8. PERFORMANCE TESTING

8.1 PERFORMANCE METRICS

1. Transaction Throughput:

- Measure the number of transactions (votes) processed per second. This metric assesses the system's capacity to handle a high volume of votes during peak election times.

2. Response Time:

- Evaluate the system's responsiveness by measuring the time it takes for a user to complete their vote or for the system to respond to user actions.

3. System Availability:

- Calculate the percentage of time the system is operational and accessible to voters. High availability is crucial for ensuring that voters can participate at their convenience.

4. Accuracy of Vote Counting:

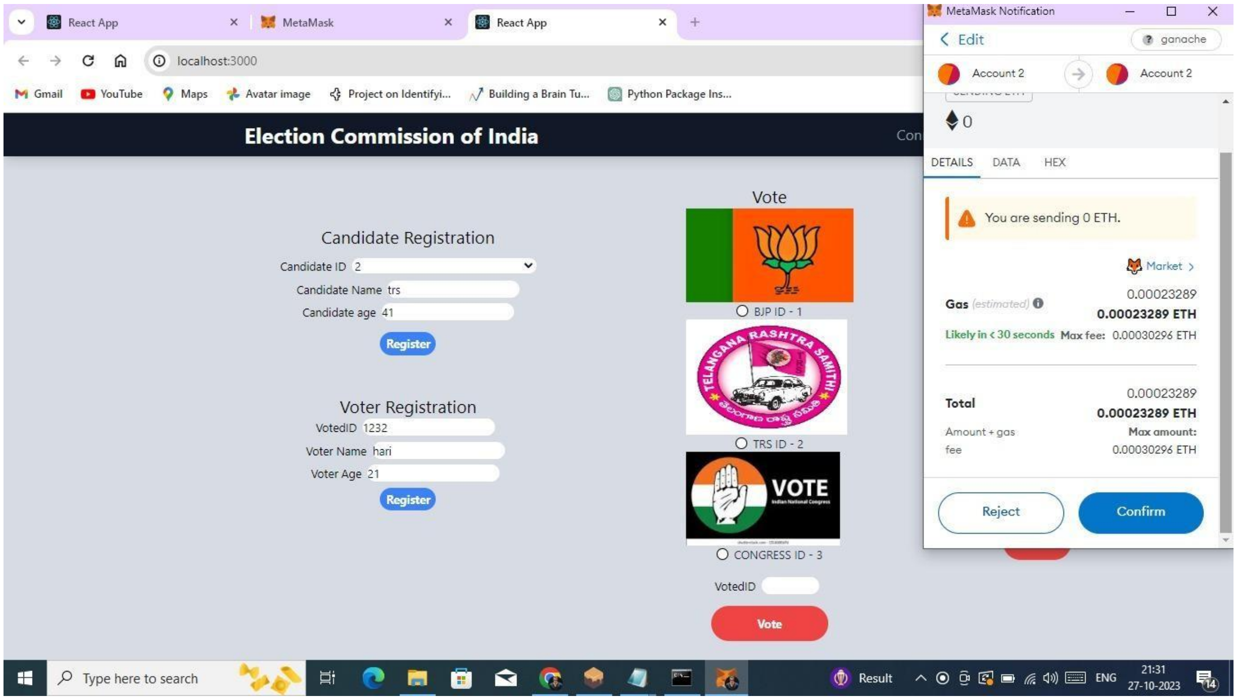
- Assess the accuracy of the vote-counting process by comparing the electronic results to manual or traditional voting system results for the same election.

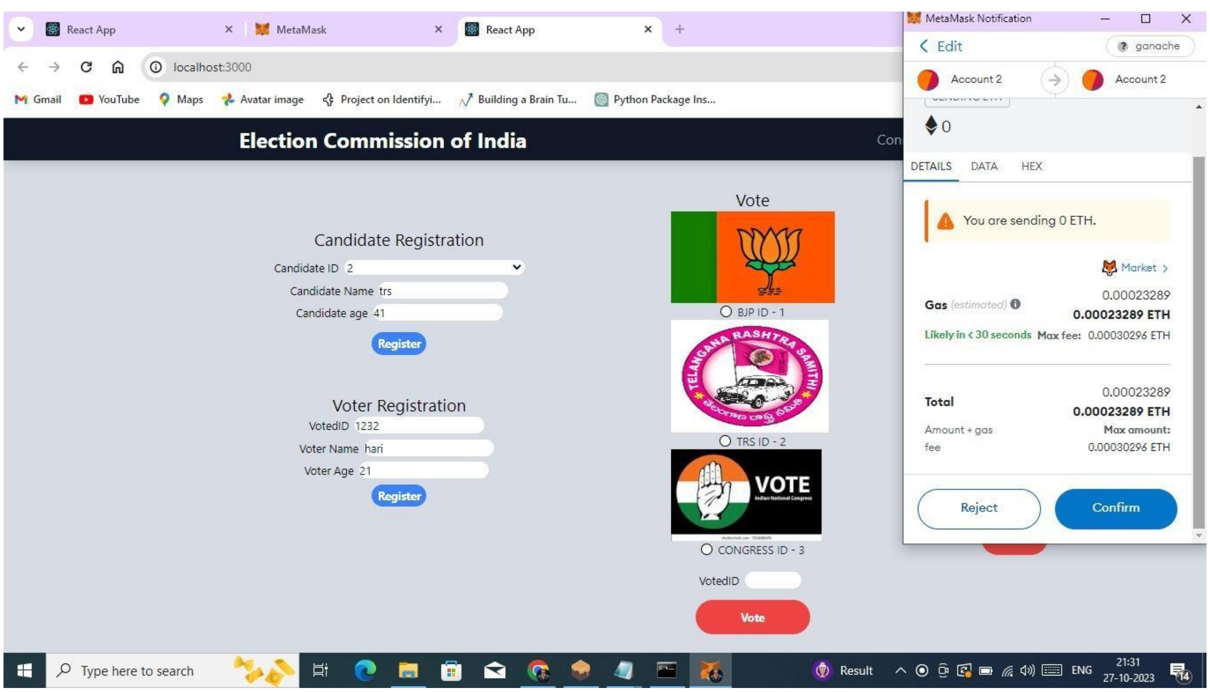
5. Security Compliance:

- Evaluate the system's compliance with security standards and regulations, ensuring that data is adequately protected and that the system guards against cyber threats.

9. RESULTS

9.1 OUTPUT SCREENSHOTS





10. ADVANTAGES AND DISADVANTAGES

ADVANTAGES	DISADVANTAGES
Security and Transparency: ● Blockchain technology ensures the security and integrity of voting data, making it extremely difficult to tamper with or manipulate results. ● Transparency is enhanced as all transactions are recorded on the blockchain, providing a publicly verifiable audit trail.	Security Concerns: ● Although blockchain is considered secure, it's not immune to cyberattacks. Hacking or vulnerabilities in the system can compromise the integrity of the election.
Reduced Fraud and Manipulation: ● The immutability of the blockchain prevents fraudulent voting and ensures that each vote is counted accurately. ● Voter anonymity is maintained, reducing the risk of coercion or vote buying.	Technical Barriers: ● Some voters, particularly the elderly and those with limited technology access, may face challenges in using electronic voting systems.
Efficiency and Accessibility: ● Electronic voting systems can expedite the voting process, reducing the time required to tally results. ● Accessibility is improved for voters who may have difficulty physically accessing polling stations.	Complex Implementation: ● Designing, developing, and deploying a secure electronic voting system is a complex and resource-intensive task.

Cost Savings: • Over time, electronic voting systems can be more cost-effective than traditional paper-based systems due to reduced printing and manpower costs.	Legal and Regulatory Challenges: • Adapting existing legal and regulatory frameworks to accommodate electronic voting systems can be a time-consuming and complex process.
Real-time Results: • Votes can be counted and results can be available in real-time, enabling faster dissemination of election outcomes.	Dependence on Technology: • Electronic voting systems are reliant on technology, and technical failures or outages can disrupt the voting process.

11. CONCLUSION

In conclusion, the development and implementation of an Electronic Voting System Using Blockchain represent a significant leap forward in modernizing the electoral process. This project holds the promise of addressing many of the longstanding challenges associated with traditional voting systems while introducing new possibilities.

The advantages of enhanced security, transparency, reduced fraud, increased efficiency, and accessibility are compelling reasons to pursue this technology. Real-time results and cost savings are additional benefits that can significantly improve the election process.

However, it is vital to acknowledge and address the potential disadvantages and challenges. Security concerns, technical barriers, regulatory complexities, and privacy issues must be carefully considered and mitigated. Resistance to change, dependence on technology, and the absence of a physical paper trail require thoughtful solutions.

The success of the Electronic Voting System Using Blockchain project hinges on the robustness of its technical architecture, meticulous planning and scheduling, adherence to performance metrics, and a commitment to continuous improvement. To overcome the challenges and capitalize on the advantages, collaboration with experts, stakeholders, and vigilant monitoring are essential.

As the world embraces digital transformation, this project exemplifies the potential for technology to enhance the democratic process and make it more accessible, secure, and transparent for all citizens. Through careful planning, attention to detail, and dedication to the democratic principles that underlie elections, we can aspire to bring about a new era of trust and efficiency in our electoral systems.

12. FUTURE SCOPE

1. Wider Adoption:

As the technology matures and becomes more widely accepted, the future scope includes the potential for broader adoption of electronic voting systems using blockchain, both at the national and international levels.

2. Enhanced Security Measures:

Future developments can focus on even stronger security measures, including advanced cryptographic techniques, multi-factor authentication, and AI-based threat detection to safeguard against cyberattacks.

3. Blockchain Innovations:

As blockchain technology advances, the use of more efficient and scalable blockchain platforms will become possible, allowing for larger-scale electronic voting systems with improved performance.

4. Privacy Enhancements:

Future versions of the system can implement advanced privacy techniques while maintaining voter anonymity, ensuring that the system complies with evolving data protection regulations.

5. User Accessibility:

Efforts can be made to enhance the user interface and user experience, making it even more accessible to all demographics, including those with limited technology access.

The future scope of an Electronic Voting System Using Blockchain is dynamic and evolving, driven by advances in technology, changing societal needs, and the desire to make the democratic process more accessible, secure, and transparent. The project has the potential to contribute significantly to the evolution of electoral systems and to promote trust and efficiency in the democratic process.

13. APPENDIX

13.1 SOURCE CODE

https://drive.google.com/file/d/1W4Mn7GL_2wEnCIr0gD9wOJxPHJjZOQ6A/view?usp=sharing

13.2 PROJECT DEMOLINK

https://drive.google.com/file/d/1hBiYup3DAzE2d57eR7KkWhFYkXRmwvQv/view

13.3 GITHUB LINK

https://github.com/Venkatesh-2024/NM-Electronic-Voting-System.git