DAYANANDA SAGAR UNIVERSITY

KUDLU GATE, BANGALORE – 560114

Bachelor of Technology
in
COMPUTER SCIENCE AND ENGINEERING

Mini Project Report

(E-VOTING SYSTEM USING BLOCKCHAIN)

SATHVIK S - ENG21CS0365
SHASHIDHAR L - ENG21CS0378
HARSHYARA B – ENG21CS0085

Under the supervision of

GAURAV KUMAR
ASSISTANT PROFESSOR
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING,
SCHOOL OF ENGINEERING
DAYANANDA SAGAR UNIVERSITY

(2023-2024)

DAYANANDA SAGAR UNIVERSITY

School of Engineering
Department of Computer Science& Engineering

Kudlu Gate, Bangalore –560068
Karnataka, India

CERTIFICATE

This is to certify that the Mini Project titled **"E-VOTING SYSTEM USING BLOCKCHAIN"** is carried out by **SATHVIK S (ENG21CS365), SHASHIDHAR L (ENG21CS0378), HARSHYARA B (ENG21CS0085) bonfire** students of Bachelor of Technology in Computer Science and Engineering at the School of Engineering, Dayananda Sagar University, Bangalore in partial fulfilment for the award of degree in Bachelor of Technology in Computer Science and Engineering, during the year **2023-2024**.

Gaurav Kumar	**Dr. Girisha G S**	**Dr. Uday Kumar Reddy K R**
Assistant Professor Dept. of CSE, School of Engineering Dayananda Sagar University	Chairman, CSE School of Engineering Dayananda Sagar University	Dean School of Engineering Dayananda Sagar University
Date:	Date:	Date:

Name of the Examiner **Signature of Examiner**

1.
2.

DECLARATION

We, **SATHVIK S (ENG21CS365), SHASHIDHAR L (ENG21CS0378), HARSHYARA B (ENG21CS0085)** are students of the sixth semester B.Tech in **Computer Science and Engineering**, at School of Engineering, **Dayananda Sagar University**, hereby declare that the Mini Project titled **"E-VOTING SYSTEM USING BLOCKCHAIN"** has been carried out by us and submitted in partial fulfillment for the award of degree in **Bachelor of Technology in Computer Science and Engineering** during the academic year **2023-2024**.

Student **Signature**

Name1: SATHVIK S
USN: ENG21CS0365

Name2: SHASHIDHAR L
USN: ENG21CS0378

Name3: HARSHYARA B
USN: ENG21CS0085

Place : Bangalore
Date :

ACKNOWLEDGEMENT

It is a great pleasure for us to acknowledge the assistance and support of many individuals who have been responsible for the successful completion of this Special Topic 2.

First, we take this opportunity to express our sincere gratitude to School of Engineering & Technology, Dayananda Sagar University for providing us with a great opportunity to pursue our Bachelor's degree in this institution.

We would like to thank **Dr. Uday Kumar Reddy K R, Dean**, **School of Engineering & Technology**, **Dayananda Sagar University** for his constant encouragement and expert advice. It is a matter of immense pleasure to express our sincere thanks to **Dr. Girisha G S, Chairman**, **Department of Computer Science, and Engineering**, **Dayananda Sagar University,** for providing the right academic guidance that made our task possible.

We would like to thank our guide **Gaurav Kumar**, **Assistant Professor**, **Dept. of Computer Science and Engineering**, **Dayananda Sagar University**, for sparing his valuable time to extend help in every step of our Mini Project, which paved the way for smooth progress and the fruitful culmination of the project.

TABLE OF CONTENTS

Page

NOMENCLATURE USED

BC	Blockchain
SM	Smart Contracts
T	Transaction
E	Ethereum
VR	Voter Registration

ABSTRACT

The integrity of electoral processes is fundamental to democratic governance. However, traditional voting systems often face challenges such as fraud, tampering, and lack of transparency. To address these issues, this paper proposes a novel Electronic Voting (E-Voting) system leveraging Blockchain technology. Blockchain, a distributed ledger technology, offers inherent features like immutability, transparency, and decentralization, making it an ideal candidate for securing voting processes. In our proposed system, each vote is recorded as a transaction on the blockchain network. These transactions are cryptographically secured, ensuring tamper-proof storage of voting data.

The E-Voting process begins with user authentication to verify voter eligibility. Once authenticated, voters cast their votes through a user-friendly interface. Each vote is encrypted and added to a block on the blockchain network. The decentralized nature of blockchain ensures that no single entity can manipulate the voting data, thereby enhancing trust and transparency in the electoral process. Furthermore, smart contracts are utilized to automate certain aspects of the voting process, such as voter registration, ballot counting, and result verification. These smart contracts execute predefined rules transparently and autonomously, reducing the need for intermediaries and minimizing the potential for human error or bias.

Additionally, our system incorporates robust security measures to protect against cyber threats and ensure the confidentiality and integrity of voter data. Multi-factor authentication, cryptographic techniques, and regular security audits are employed to safeguard the E-Voting platform from unauthorized access and malicious attacks. In conclusion, the proposed Blockchain-based E-Voting system offers a secure, transparent, and efficient alternative to traditional voting mechanisms. By leveraging the inherent properties of blockchain technology, electoral integrity can be enhanced, fostering trust and confidence in democratic processes. Further research and real-world implementation are warranted to validate the effectiveness and scalability of this innovative approach.

CHAPTER 1: INTRODUCTION

In the realm of modern democracy, the convergence of electronic voting (e-voting) and blockchain technology is ushering in a new era of transparency, security, and accessibility. E-voting, a departure from traditional paper-based methods, utilizes digital platforms to facilitate the casting and counting of votes. The integration of blockchain technology, with its decentralized and tamper-resistant ledger, adds a layer of innovation to the electoral process. Blockchain ensures that each vote is recorded securely and transparently, reducing the risk of fraud or manipulation. This novel approach not only addresses the shortcomings of traditional voting systems but also introduces features such as real-time auditability, cryptographic security, and increased accessibility. As we navigate the complexities of implementing these systems, the promise of a more inclusive, trustworthy, and efficient democratic process fueled by e-voting and blockchain technology becomes increasingly apparent.

SCOPE

The scope of e-voting systems based on blockchain technology is vast and transformative. These systems offer the potential to revolutionize traditional voting methods by providing transparency, security, and accessibility. Blockchain ensures the integrity of the electoral process through tamper-resistant records, fostering trust in the democratic system. The scope also extends to increased inclusivity, as remote voting options and user-friendly interfaces enhance accessibility for a broader range of voters. While challenges like identity verification and scalability exist, the evolving landscape of e-voting on the blockchain holds the promise of a more efficient, trustworthy, and democratic electoral future.

CHAPTER 2: PROBLEM DEFINITION

Background: Traditional electronic voting systems have faced various challenges, including concerns about security, transparency, and trust. Instances of tampering, hacking, and doubts about the integrity of election results have raised significant questions about the effectiveness of existing e-voting systems. To address these issues and enhance the overall credibility of electronic voting, there is a need to explore innovative solutions that leverage emerging technologies. Blockchain technology, known for its decentralized and tamper-resistant nature, holds the potential to revolutionize the e-voting landscape.

1. Security Concerns:

- Current e-voting systems are susceptible to security breaches and unauthorized access, leading to potential manipulation of votes.
- Lack of a secure and transparent mechanism to verify and validate the authenticity of each vote cast.

2. Trust and Transparency:

- Public distrust in the fairness and transparency of election processes due to a lack of a verifiable and auditable trail of votes.
- Challenges in ensuring that every vote is accurately recorded and counted without interference.

3. Single Point of Failure:

- Centralized databases used in conventional e-voting systems present a single point of failure, making them vulnerable to hacking or manipulation.
- The need for a decentralized and distributed system to eliminate the risk associated with a central authority controlling the entire election process.

4. Voter Privacy:

- Concerns regarding the privacy of voters and the potential for the exposure of sensitive information during the voting process.
- Ensuring that the anonymity of voters is maintained while still allowing for the verification of the legitimacy of their votes.

5. Accessibility and Usability:

- Challenges in making blockchain-based e-voting systems user-friendly and accessible to a diverse population, including individuals with limited technical proficiency.
- The need for a system that is inclusive, ensuring that all eligible voters can participate without facing barriers.

6. Legal and Regulatory Compliance:

- Navigating legal and regulatory frameworks to ensure that the blockchain-based e-voting system complies with existing election laws.
- Addressing concerns related to the acceptance and recognition of blockchain-based voting by relevant authorities.

7. Scalability:

- The ability of the system to handle a large volume of votes efficiently and securely, especially during peak election periods.
- Ensuring that the blockchain infrastructure can scale to meet the demands of national or large-scale elections.

8. Education and Adoption:

- Limited awareness and understanding among voters, election officials, and other stakeholders about the benefits and functionalities of blockchain-based e-voting systems.
- Overcoming resistance to change and fostering widespread adoption of the new technology.

Addressing these challenges through the implementation of a blockchain-based e-voting system can contribute to a more secure, transparent, and trustworthy electoral process, ultimately enhancing the democratic foundations of voting systems

CHAPTER 3: LITERATURE REVIEW

AUTHOR :

Dr. D. Y. Patil in the year – October 2023

Prof. Mrunal Pathak in the year – 2021

Amol Suradkar in the year – 2020

Aiswarya indapur in the year -2021

The literature on blockchain-based e-voting systems has evolved to encompass innovative technologies such as Ganache and integration with MetaMask, enriching the landscape with improved functionality and security. Scholars delve into the core principles of blockchain, emphasizing its role in providing secure and transparent e-voting platforms. Ganache, a personal blockchain for Ethereum development, is discussed as a valuable tool for testing and simulating blockchain networks, offering researchers a controlled environment for refining and validating their e-voting systems. Integration with MetaMask, a popular Ethereum wallet and gateway to decentralized applications, emerges as a pivotal aspect, enhancing user experience and facilitating secure interactions with the blockchain. Researchers explore the cryptographic techniques embedded in Ganache and MetaMask integration to bolster the overall integrity of the e-voting process while ensuring voter privacy. Decentralization remains a focal point, with scholars acknowledging the distributed nature of blockchain networks as a means to enhance resilience against cyber threats. Additionally, studies delve into the practical implementations, employing Ganache and MetaMask to showcase prototypes and case studies that highlight the feasibility and advantages of integrating these technologies into blockchain-based e-voting systems. The literature underscores the importance of addressing scalability concerns and optimizing performance, while also emphasizing the user-friendly interfaces enabled by MetaMask integration to cater to diverse technical abilities. Furthermore, discussions extend to regulatory considerations and legal frameworks, providing insights into compliance challenges and the potential for public acceptance of blockchain-based e-voting systems augmented by technologies like Ganache and MetaMask.

CHAPTER 4: PROJECT DESCRIPTION

Overview:

The Transparent Ballot project aims to revolutionize the democratic process by developing an innovative E-Voting System based on blockchain technology. Leveraging the decentralized and tamper-resistant nature of blockchain, this system seeks to address the security, transparency, and trust issues associated with traditional electronic voting systems.

Key Features:

1. Decentralized Infrastructure:

- Implementation of a decentralized blockchain network to eliminate the risks associated with a single point of failure, ensuring the integrity and security of the entire voting process.

2. Smart Contracts for Voting Logic:

- Utilization of smart contracts to encode the rules and logic of the voting process. Smart contracts enable automated execution of predefined rules, ensuring transparency and reducing the potential for human error or manipulation.

3. Immutable Voting Records:

- Every vote cast is recorded as a transaction on the blockchain, creating an immutable and transparent ledger. This ledger serves as a tamper-proof audit trail, allowing for verifiable and trustworthy election results.

4. Privacy-Preserving Mechanisms:

- Implementation of cryptographic techniques to ensure voter privacy while maintaining the ability to verify the legitimacy of each vote. This involves techniques such as zero-knowledge proofs to confirm the validity of a vote without revealing the voter's identity.

5. User-Friendly Interface:

- Designing a user-friendly and accessible interface to cater to a diverse population, including individuals with varying levels of technical proficiency. The system will be intuitive, ensuring that all eligible voters can confidently participate in the electoral process.

6. Verification and Auditing:

- Introducing mechanisms for voters, election observers, and relevant authorities to independently verify and audit the election results. The transparency of the blockchain allows for real-time monitoring and scrutiny of the entire voting process.

7. Scalability and Performance:

- Implementing a scalable blockchain architecture to handle a large volume of votes efficiently, especially during peak election periods. The system will be designed to meet the demands of national or large-scale elections without compromising performance.

8. Legal Compliance:

- Ensuring compliance with existing election laws and regulations by working closely with legal experts and relevant authorities. The goal is to create a system that aligns with legal frameworks while introducing the benefits of blockchain technology to the electoral process.

9. Education and Outreach:

- Conducting educational campaigns to raise awareness among voters, election officials, and other stakeholders about the advantages and functionalities of the Transparent Ballot system. This includes training programs to facilitate a smooth transition and widespread adoption.

By combining blockchain technology with a user-centric approach, Transparent Ballot aims to restore confidence in the democratic process, providing a secure, transparent, and efficient platform for citizens to exercise their voting rights. This project represents a significant step towards building the future of trustworthy and inclusive electronic voting systems.

CHAPTER 5: REQUIREMENTS

Software Requirements

- Blockchain Platform
- Smart Contract Language
- Development Environment
- Version Control
- Frontend Development
- Backend Development
- Authentication and Authorization
- Security Tools
- Testing Framework
- Backup and Recovery Tools

Hardware Requirements

- Server Infrastructure
- Blockchain Nodes
- Database Server
- Firewalls and Network Security
- Backup Systems
- Networking Equipment
- Monitoring Tools
- Power Backup
- Client Devices

Functional Requirements

- Voter Registration
- Identity Verification
- Ballot Creation
- Vote Casting
- Blockchain Integration
- Real-time Auditability
- Results Declaration

Non-Functional Requirements

- Performance
- Reliability
- Availability
- Security
- Usability
- Interoperability
- Cultural and Political Sensitivity

CHAPTER 6: METHODOLOGY

The methodology for developing an E-Voting System using blockchain technology involves a systematic and phased approach, ensuring the integration of key features such as decentralization, transparency, security, and user-friendliness.

The first phase involves comprehensive research and requirement analysis. Understanding the specific needs of the electoral process, legal frameworks, and potential user demographics is crucial. This phase also includes a thorough examination of existing e-voting systems to identify weaknesses that blockchain technology can address. Following the research phase, system architecture and design are formulated. Decentralization is a cornerstone, requiring the selection of a suitable blockchain platform and consensus mechanism. Smart contracts are designed to encode the voting logic, ensuring automation, transparency, and immutability of the voting records. Special attention is given to privacy-preserving mechanisms, such as zero-knowledge proofs, to protect voter anonymity.

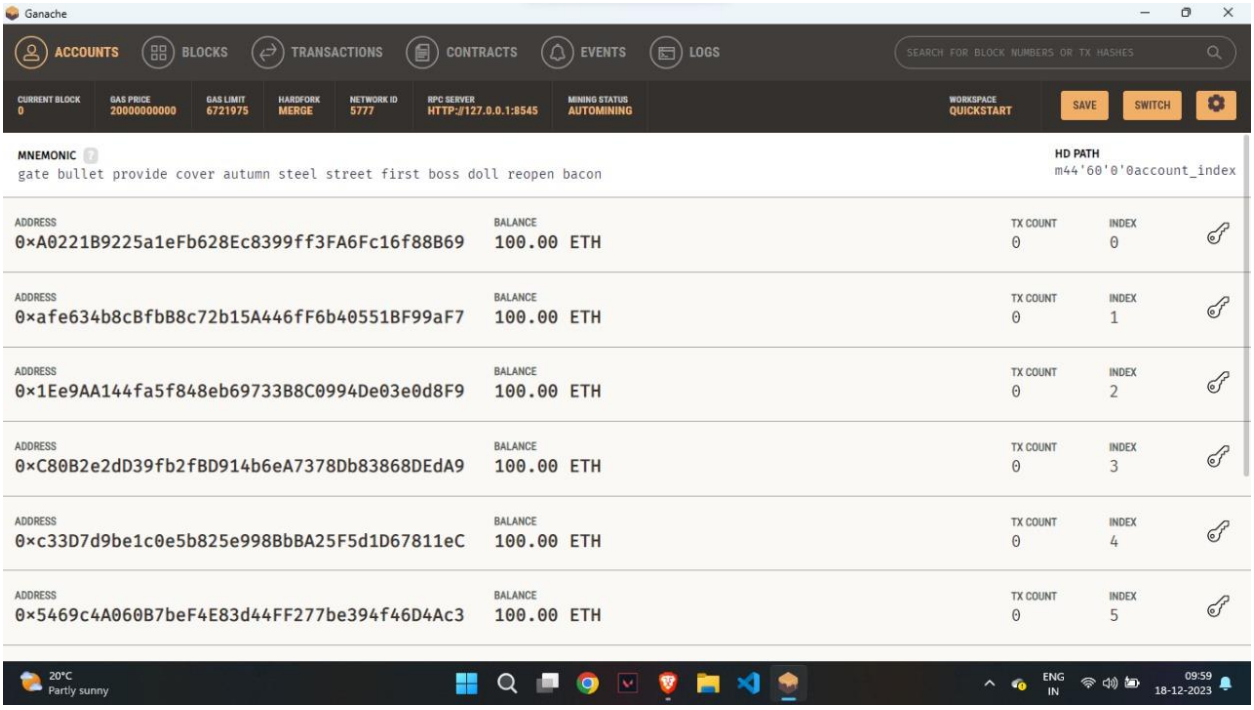
The second phase is the development and implementation of the blockchain-based E-Voting System. Smart contracts are deployed on the selected blockchain, and the system is integrated with a user-friendly interface, emphasizing inclusivity and accessibility. Security measures, including cryptographic techniques and consensus algorithms, are implemented to fortify the system against potential threats. User testing and feedback collection constitute the fourth phase. The system is subjected to rigorous testing to identify and address any usability issues, bugs, or vulnerabilities. Stakeholder feedback, including voters and election officials, is invaluable in refining the system for optimal performance and user satisfaction.

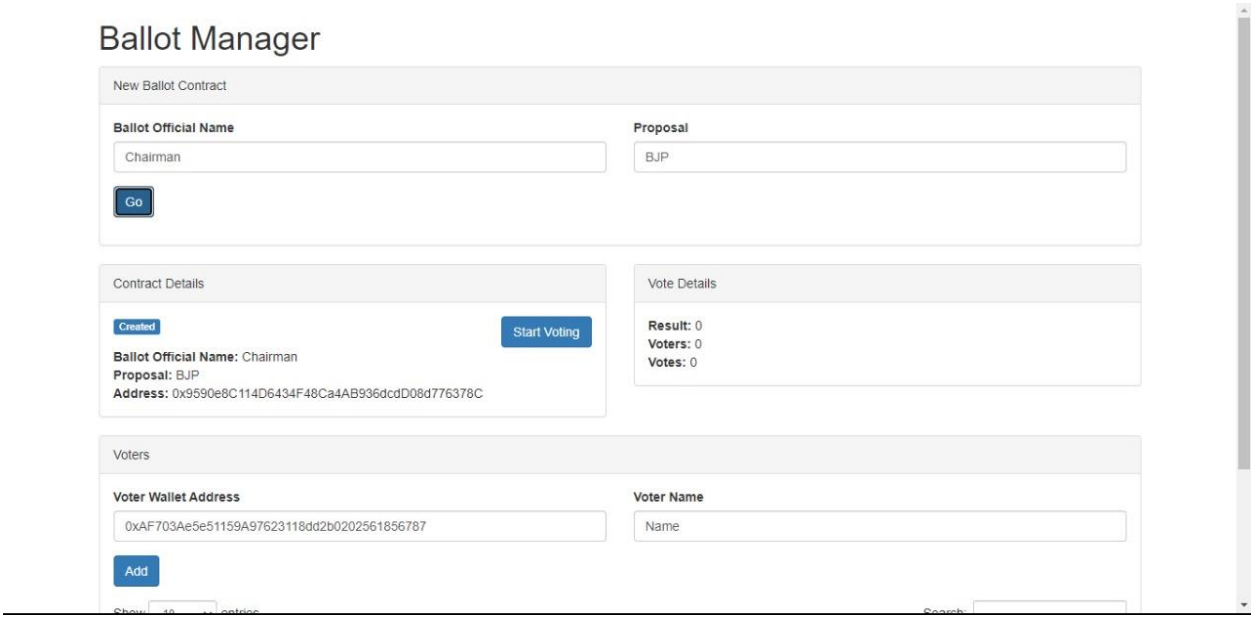
In the third phase, the system undergoes an extensive security audit. Ethical hackers and cybersecurity experts assess the system's vulnerabilities, ensuring that it meets the highest standards of resilience against potential attacks. This phase is critical in establishing the trustworthiness of the E-Voting System.

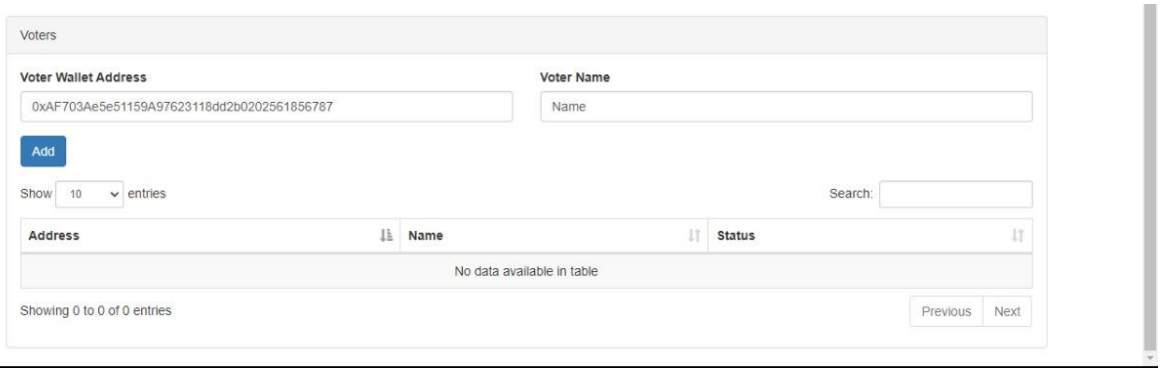
Finally, the system is ready for deployment and live usage in a controlled environment, such as a pilot election. The voting process is monitored closely, and any issues that arise are addressed promptly. Post-election, a comprehensive evaluation is conducted to gather insights for further improvements.

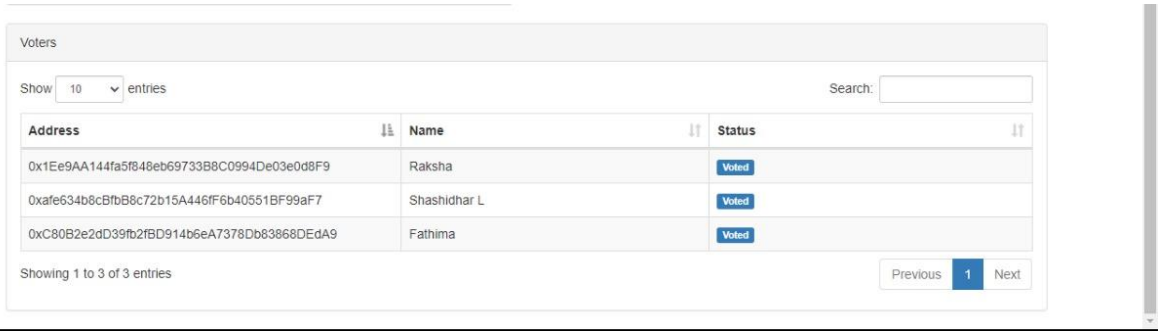
This phased methodology ensures a holistic and systematic approach to developing an E-Voting System using blockchain technology, addressing technical, legal, and social aspects to create a robust and trustworthy electoral process.

CHAPTER 7: EXPERIMENTATION

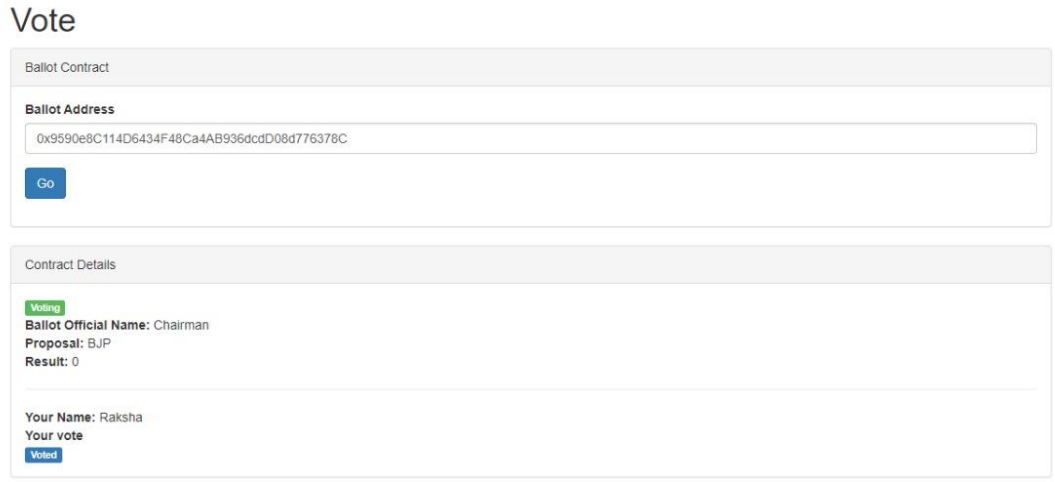


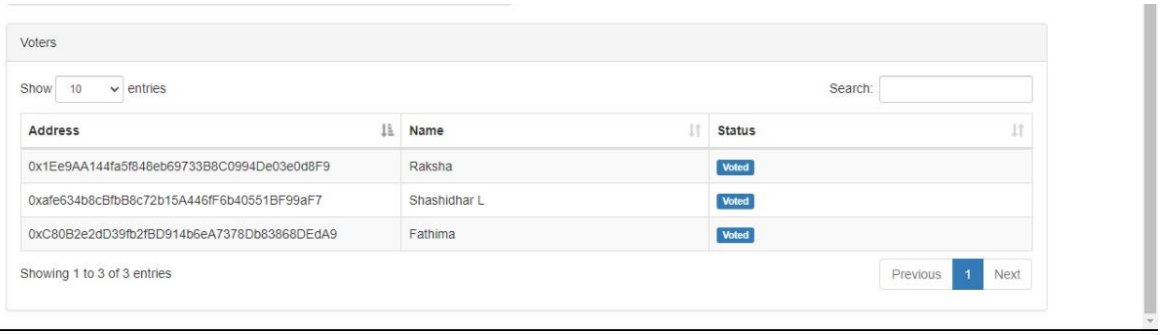



Voters
Voter Wallet Address
0xAF703Ae5e51159A97623118dd2b0202561856787
Voter Name
Name
Add
Show 10 entries
Search:
Address
Name
Status
No data available in table
Showing 0 to 0 of 0 entries
Previous
Next

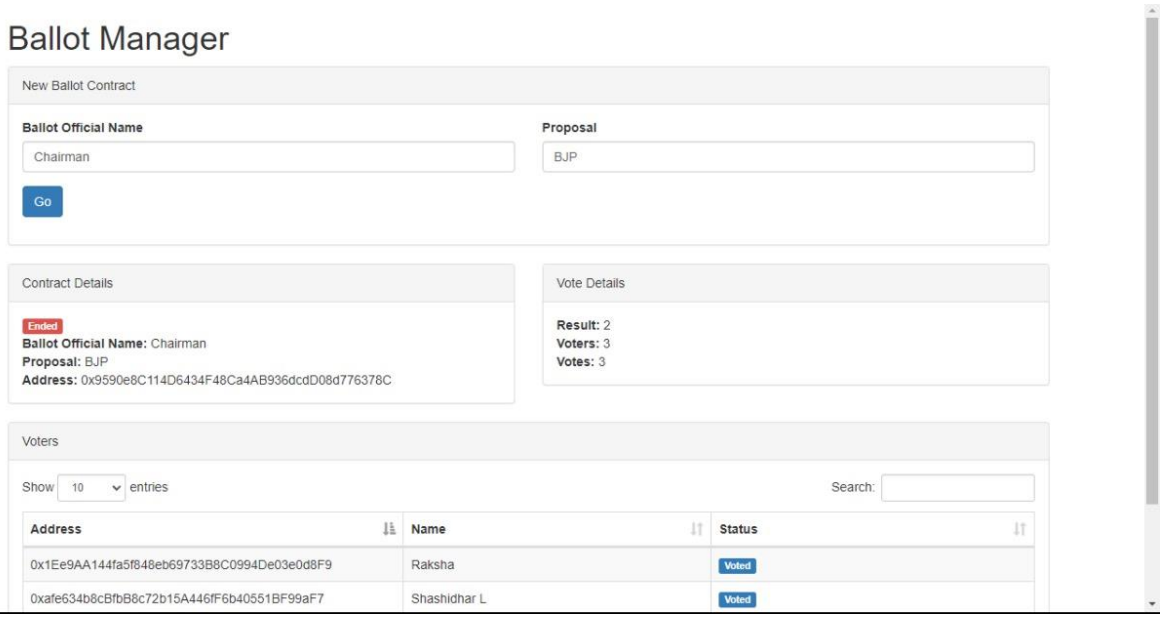

Voters
Show 10 entries
Search:
Address
Name
Status
0x1Ee9AA144fa5f848eb69733B8C0994De03e0d8F9
Raksha
Voted
0xafe634b8cBfbB8c72b15A446fF6b40551BF99aF7
Shashidhar L
Voted
0xC80B2e2dD39fb2fBD914b6eA7378Db83868DEdA9
Fathima
Voted
Showing 1 to 3 of 3 entries
Previous
1
Next

CHAPTER 8: TESTING





RESULTS


Ballot Manager
New Ballot Contract
Ballot Official Name
Chairman
Proposal
BJP
Go
Contract Details
Ended
Ballot Official Name: Chairman
Proposal: BJP
Address: 0x9590e8C114D6434F48Ca4AB936dcdD08d776378C
Vote Details
Result: 2
Voters: 3
Votes: 3
Voters
Show 10 entries
Search:
Address
Name
Status
0x1Ee9AA144fa5f848eb69733B8C0994De03e0d8F9
Raksha
Voted
0xafe634b8cBfbB8c72b15A446fF6b40551BF99aF7
Shashidhar L
Voted

REFERENCES

1. Rodriguez, Salvador, et al (2018). "Privacy issues emerge as major business risk for Facebook." *Reuters*, https://www.reuters.com/article/us-facebook-privacy-costs-analysis/privacy-issues-emerge-as-major-business-risk-for-facebook-idUSKBN1GW01F.

2. Martiny, Amaury (2021). "MetaMask Tutorial: One-click Login With Blockchain Made Easy." *Toptal*, https://www.toptal.com/ethereum/one-click-login-flows-a-metamask-tutorial.

3. Wright, Paul (2021). "The advantages and disadvantages of Social Logins: What you need to know." *Rubber Cheese*, https://www.rubbercheese.com/insights/social-logins.

4. Nakamoto, Satoshi (2009). "Bitcoin: A Peer-to-Peer Electronic Cash System." Research Gate, https://www.researchgate.net/publication/228640975_Bitcoin_A_Peer-to-Peer_Electronic_Cash_System.

5. Hitesh Sant, (2022). "What is MetaMask and How to Use it". Geek Flare,
6. https://geekflare.com/beginners-guide-to-metamask/

7. Choi, Nakhoon, and Heeyoul Kim (2019). "A Blockchain-based User Authentication Model Using MetaMask -Journal of Internet Computing and Services." *KoreaScience* https://koreascience.kr/article/JAKO201905960168896.page.