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COLLEGE OF ENGINEERING
ज्ञानम् सकलजनहिताय

Approved by AICTE, New Delhi, Recognized by Government of Maharashtra
Affiliated to Savitribai Phule Pune University and recognized 2(f) and 12(B) by UGC
(Id.No. PU/PN/Engg./093 (1992)
Accredited by NAAC with "A+" Grade | NBA - 7 UG Programmes

Department of Computer Engineering

"BCT Miniproject"

Develop a Blockchain based application dApp (de-centralized app) for e-voting system.

Submitted in partial fulfillment of the requirements for the degree of

BACHELOR OF ENGINEERING

In

COMPUTER ENGINEERING

Submitted By

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Academic Year: 2025-26 (Term-I)

Savitribai Phule Pune University

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CERTIFICATE

This is to certify that **Piyusha Rajendra Supe** from **Fourth Year Computer Engineering** has successfully completed her work titled "**BCT Mini-project**" at AISSMS College of Engineering, Pune in the partial fulfillment of the Bachelor's Degree in Computer Engineering.

Prof. N. A. Rai	**Dr. S. V. Athawale**	**Dr. D. S. Bormane**
(Faculty In-charge)	(Head of Department)	(Principal)
Computer Engineering	Computer Engineering	AISSMSCOE, Pune

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Academic Year: 2025-2026

Piyusha Rajendra Supe (23CO315)

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ABSTRACT

In the modern digital era, secure, transparent, and tamper-proof voting mechanisms have become increasingly essential for maintaining the integrity of democratic processes. Traditional electronic voting systems, while convenient, are often susceptible to fraud, double voting, data tampering, and centralized control vulnerabilities. To address these challenges, this project proposes a Blockchain-based E-Voting System (dApp) that leverages the inherent features of blockchain technology—immutability, decentralization, and transparency—to provide a secure and trustworthy platform for conducting elections.

The proposed system is implemented as a single-directory Streamlit application, simulating a decentralized voting environment. Each vote is treated as a transaction, which is grouped and recorded in blocks, forming an immutable blockchain ledger. The blockchain ensures that votes cannot be altered or deleted once recorded, providing a permanent and auditable record of all voting activities. Furthermore, the system incorporates mechanisms to prevent double voting, ensuring that each registered voter can cast their vote only once.

The user interface is designed with simplicity and clarity, allowing voters to select from a list of candidates displayed with images, cast their votes securely, and view real-time results. The system simulates mining of blocks, which confirms and finalizes votes on the blockchain, reinforcing transparency. Additionally, the blockchain and voter records are stored persistently, allowing continuity across sessions and ensuring data integrity even if the application is restarted.

This e-voting system demonstrates how blockchain technology can transform the election process by providing a secure, transparent, and verifiable voting platform. The project not only highlights the practical use of blockchain in governance but also offers a scalable solution that can be extended for real-world elections, corporate voting, or any scenario requiring tamper-proof decision-making. By integrating blockchain principles with an intuitive front-end application, this project provides a robust foundation for future research and deployment of decentralized voting systems in society.

INTRODUCTION

Voting is one of the most fundamental processes in a democratic society, allowing citizens to express their choices and influence governance. Traditional voting systems, whether paper-based or electronic, often face several challenges including vote tampering, fraud, double voting, and lack of transparency. These limitations can undermine trust in the electoral process and lead to disputes or manipulation.

The advent of blockchain technology has opened new possibilities for creating secure, decentralized, and tamper-proof voting systems. Blockchain is a distributed ledger that maintains a permanent record of transactions across multiple nodes, ensuring that data cannot be altered without consensus from the network. By leveraging these properties, blockchain-based voting systems can ensure immutability, transparency, traceability, and security of votes, thereby enhancing public confidence in the election process.

The objective of this project is to design and implement a decentralized e-voting system (dApp) using blockchain principles, simulated through a Python-based Streamlit application. The system records each vote as a transaction in a blockchain, grouped into blocks to maintain a permanent, auditable, and tamper-proof ledger. The system also includes mechanisms to prevent double voting by maintaining a secure registry of voters and validating each vote before it is recorded.

Additionally, the project focuses on providing a user-friendly interface that allows voters to select their preferred candidates from a visually appealing list, cast votes securely, and view real-time voting results. The system simulates the mining process, which confirms votes and adds them to the blockchain, demonstrating how decentralized verification can ensure the integrity of elections.

This project demonstrates a practical application of blockchain technology in governance and decision-making, offering a transparent, secure, and reliable alternative to conventional voting systems. It provides a foundation for future implementation in real-world elections, organizational voting, or any scenario requiring verifiable and tamper-proof voting mechanisms.

REQUIREMENTS

Category	Component / Input	Minimum Requirement / Description	Recommended / Example
Hardware	Processor (CPU)	Intel Core i3 / AMD equivalent	Intel Core i5 or higher
	RAM	4 GB	8 GB or higher
	Hard Disk	100 MB free space	500 MB or higher
	Display	1024 x 768 pixels	1920 x 1080 pixels
	Internet Connectivity	Required for downloading packages	Stable broadband connection
Software	Operating System	Windows 10 / Linux / MacOS	N/A
	Python	Python 3.9 or higher	Latest version
	Streamlit	Latest version	For web interface
	JSON	N/A	For storing candidates and blockchain data
	IDE / Code Editor	VS Code, PyCharm, or any preferred editor	N/A
	Web Browser	Google Chrome / Firefox / Edge	Latest version
Dataset / Input	Candidates List	Names of candidates participating in the election	`candidates.json` (e.g., `[{"name":"Alice","image":"images/alice.png"}, ...]`)
	Voter IDs	Unique identification numbers for voters	Alphanumeric strings (e.g., `VOTER001`)
	Votes	Each vote cast by a voter	Stored in blockchain as `{ "voter_id": "VOTER001", "candidate": "Alice" }`
	Blockchain Ledger	Records all mined votes in blocks	Stored in `blockchain_data.json` as persistent JSON

METHODOLOGY

The Blockchain-based E-Voting System is designed to provide a secure, transparent, and tamper-proof voting platform by leveraging blockchain principles. The system is implemented as a Python-based Streamlit application with persistent storage to simulate a decentralized environment.

1. System Initialization

Upon launching the application, the blockchain is loaded from blockchain_data.json. If the file is missing or empty, a genesis block is created. Candidate data, including names and images, is loaded from candidates.json.

2. Voter Verification

Each voter enters a unique Voter ID. The system maintains a voters set to prevent double voting. Attempts to vote multiple times are rejected.

3. Vote Casting

Voters select a candidate from the interface, which displays candidate images and names. Votes are temporarily stored in a pending votes list before being added to the blockchain.

4. Mining Votes

Pending votes are grouped into a new block. Each block contains its index, timestamp, votes, previous block hash, and its own hash. Mining confirms votes and appends the block to the blockchain. The ledger is saved to ensure persistent storage.

5. Result Calculation

All votes in mined blocks are aggregated to compute current results, which are displayed dynamically in a table format on the Streamlit interface.

6. Blockchain Ledger Display

All blocks are displayed with index, vote count, and hash, providing full transparency and an auditable voting record.

7. Security and Integrity

Blockchain ensures immutability; votes cannot be altered or deleted once recorded. The system prevents double voting and maintains the integrity of the election process.

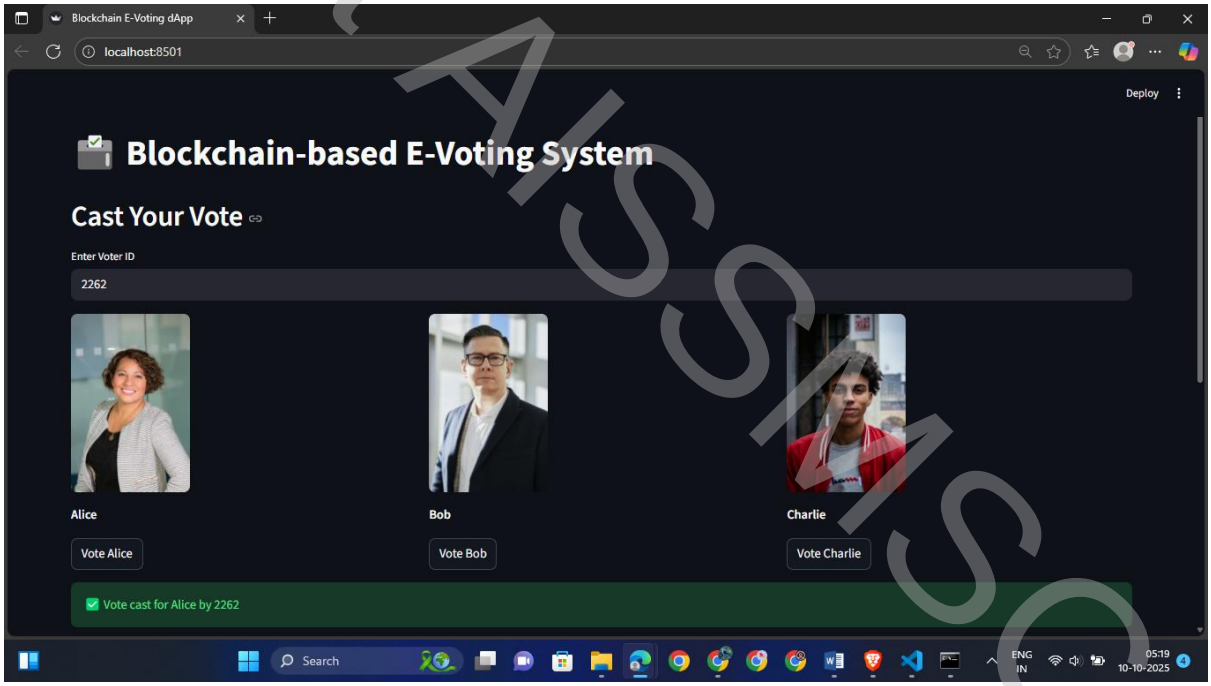
8. System Persistence

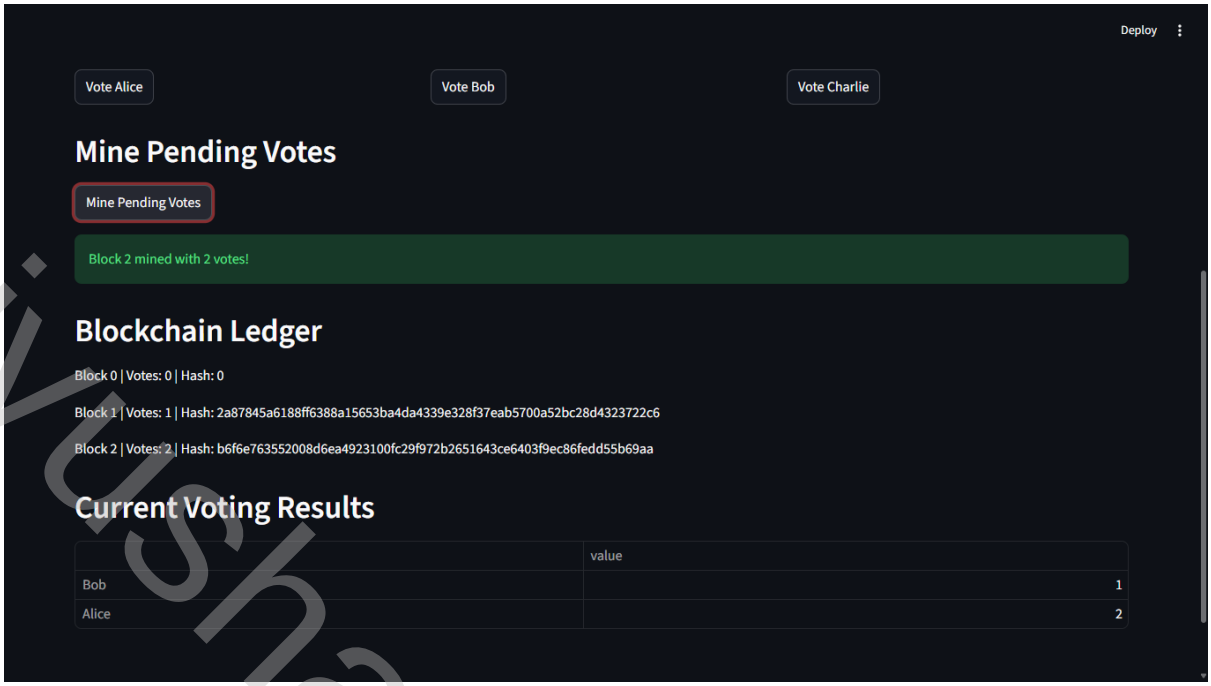
Blockchain and voter data are stored persistently. Even after restarting the application, the previous state is preserved, ensuring continuity.

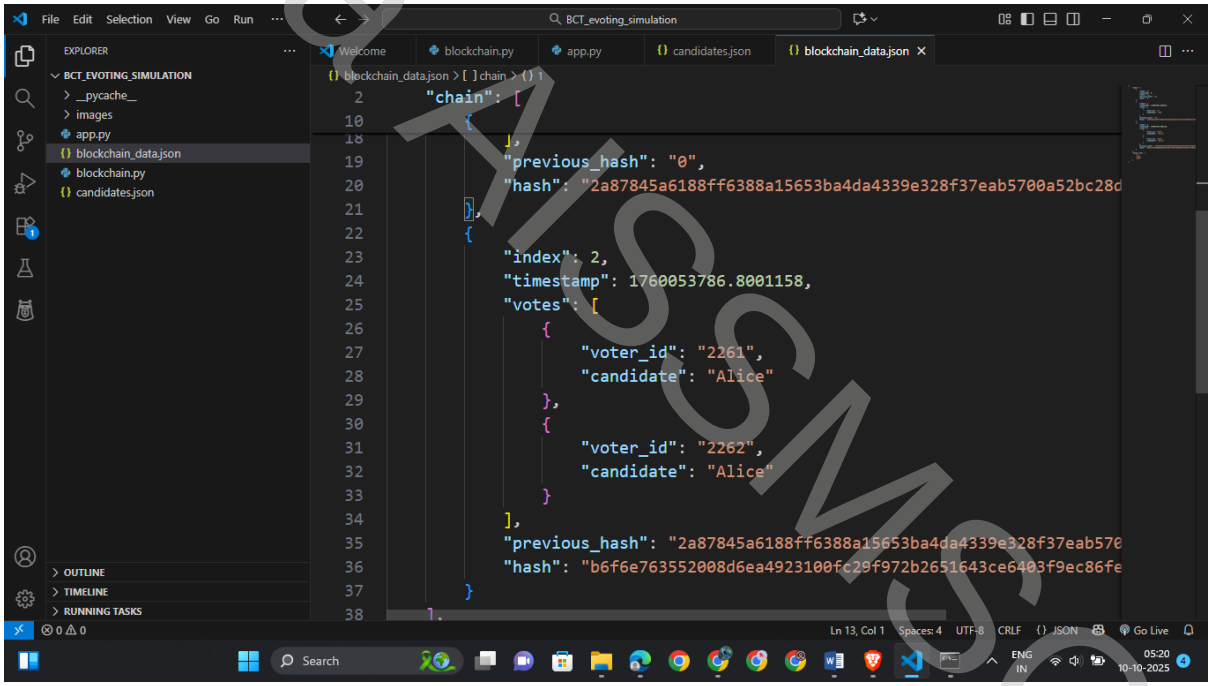
IMPLEMENTATION

The Blockchain-based E-Voting System is implemented as a Python Streamlit application that simulates a secure and decentralized voting environment. The system uses a blockchain to record votes immutably, where each vote is stored in a block containing the voter ID, selected candidate, timestamp, and hash of the previous block. The application prevents double voting by maintaining a voter registry and ensures data persistence by storing the blockchain in a JSON file. Users interact with a visually intuitive interface to cast votes and view candidate images, while mined blocks confirm and store the votes securely. Real-time results are calculated by aggregating votes from all blocks, and the complete blockchain ledger is displayed for transparency, demonstrating the security, integrity, and auditability of a blockchain-based e-voting system.

The implementation is as follows:







CONCLUSION

The Blockchain-based E-Voting System represents a significant advancement over traditional voting methods by combining the principles of blockchain technology with a user-friendly digital interface. The system successfully demonstrates how votes can be securely recorded, verified, and stored in a decentralized and immutable ledger, ensuring integrity, transparency, and auditability of the entire electoral process. By preventing double voting through a robust voter registry and employing cryptographic hashes to link blocks, the system effectively mitigates risks associated with vote tampering, fraud, or unauthorized alterations.The implementation of the project using Streamlit provides an intuitive interface that allows voters to cast their votes seamlessly while visualizing candidate information through images, making the voting process more accessible and engaging. The mining mechanism confirms and finalizes votes into blocks, and the persistent storage of the blockchain ensures continuity even across multiple sessions. Real-time aggregation of votes and the dynamic display of results enhance transparency, allowing all stakeholders to monitor the election progress and outcomes. In conclusion, the Blockchain-based E-Voting System not only provides a secure, reliable, and tamper-proof platform for conducting elections but also serves as a foundation for further research and development in digital governance, corporate voting, and decentralized decision-making applications. It demonstrates that modern technology can enhance democratic processes while ensuring fairness, accountability, and transparency in elections.

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