IT433 - BLOCKCHAIN TECHNOLOGY

END-SEMESTER PROJECT EVALUATION

BLOCKCHAIN-BASED PREFERENTIAL VOTING SYSTEM WITH DYNAMIC RE-VOTING

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ABSTRACT

- We propose a blockchain-based voting system that incorporates preferential voting (ranked-choice voting) and dynamic re-voting (allowing voters to modify their preferences within a voting window).
- The system will ensures transparency, tamper-proof results, and flexibility in voter decisions.
- Built using Solidity smart contracts on the Ethereum blockchain, it will supports secure, decentralized voting with vote counting and reallocation based on voter preferences.

INTRODUCTION

Voting Systems and Challenges:

- Traditional voting systems often face issues like lack of transparency, tampering, and inflexibility.
- Blockchain technology offers a way to decentralize and secure voting, making it transparent and resistant to fraud.
- Preferential voting is a more democratic method of voting, ensuring the winner has broad support.

LITERATURE REVIEW

1. **A Theoretical Examination of the Ranked Choice Voting Procedure:** It examines Ranked Choice Voting (RCV) in the context of social choice theory, highlighting its advantages over first-past-the-post (FPTP), such as reducing wasted votes and better reflecting voter preferences.
2. **BE-Voting: A Secure Blockchain Enabled Voting System:** A blockchain-based voting system designed for Bangladesh that enhances transparency, security, and privacy in elections. It offers a decentralized voting solution with anonymous voter data.
3. **ACB-Vote: Efficient, Flexible, and PrivacyPreserving Blockchain-Based Score Voting With Anonymously Convertible Ballots:** Presents a blockchain-based e-voting system utilizing score voting mechanisms with BBS+ signatures and convertibly linkable signatures, addressing multiple voting and computational overhead from complex range proofs.
4. **DTACB: Dynamic Threshold Anonymous Credentials With Batch-Showing:** Presents a dynamic threshold anonymous credential system that improves flexibility and scalability in decentralized environments by allowing dynamic adjustments of issuer participation without system rewinding.
5. **ElectAnon: A Blockchain-Based, Anonymous, Robust and Scalable Ranked-Choice Voting Protocol:** It focusses on enhancing voter anonymity, robustness, and scalability. By employing zero-knowledge proofs and off-chain ballot encoding, ElectAnon addresses privacy and scalability challenges.

PROBLEM STATEMENT

Current blockchain voting systems do not support advanced voting mechanisms like preferential voting, and once a vote is cast, voters cannot change their decision. This limits voter flexibility and doesn't guarantee a broad consensus for the winner.

OBJECTIVES

- Implement a blockchain-based preferential voting system using ranked-choice voting to ensure the winning candidate has majority support.
- Enable re-voting where voters can remove their vote.
- Ensure security, transparency, and integrity using a decentralized blockchain platform (Ethereum).

SYSTEM ARCHITECTURE

Overview of the Architecture:

- User Interface (Front-End): Allows voters to register, rank their choices, and update their vote if needed. The interface interacts with the blockchain through a web3 provider.
- Smart Contract (Back-End): A Solidity-based smart contract deployed on Ethereum that:
  - Handles voter registration and eligibility.
  - Records voter preferences and supports dynamic re-voting.
  - Runs the vote counting and reallocation logic (round-based elimination).
- Blockchain (Ethereum): Ensures transparency, tamper-resistance, and decentralized storage of the votes.
- Consensus and Security: Smart contracts ensure that once a vote is cast, it is securely stored, and all vote changes are tracked on-chain.

SYSTEM ARCHITECTURE

Key Components:

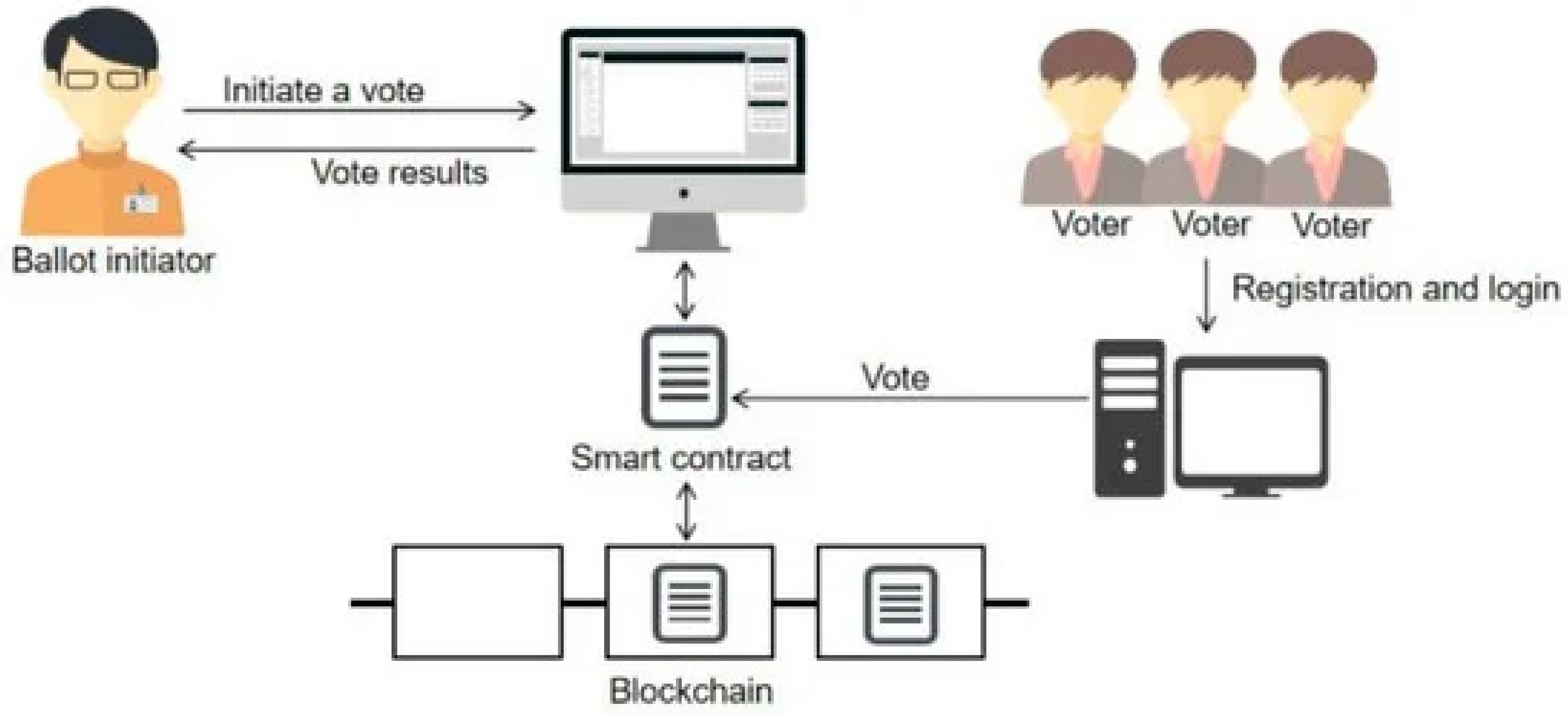
1. Voter Registration Module: Registers voters, validates eligibility.

2. Voting Module: Records and updates ranked preferences; allows re-voting.

3. Vote Counting Module: Performs vote rounds and eliminates candidates, reallocating votes based on next preferences.

4. Dynamic Re-Voting: Logic to overwrite a voter's previous rankings within the voting window.

ARCHITECTURE



METHODOLOGY

Example of Preferential Voting:

- Voter 1 ranks the candidates as: Alice >Bob >Carol.
- Voter 2 ranks the candidates as: Bob >Alice >Carol.
- Voter 3 ranks the candidates as: Carol >Bob >Alice.

The smart contract processes the votes in the following way:

1. **Initial Vote Count**: Each voter's first preference is counted.
2. Alice receives 1 vote, Bob receives 1 vote, and Carol receives 1 vote.
3. **Elimination Process**: The candidate with the fewest votes, Carol, is elimi nated.
4. **Redistribution of Votes**: Voter 3's vote is redistributed to their second pref erence, Bob. Now, Bob has 2 votes, while Alice has 1 vote.
5. **Final Check**: After redistribution, Bob has more than 50% of the remaining votes, making Bob the winner

METHODOLOGY

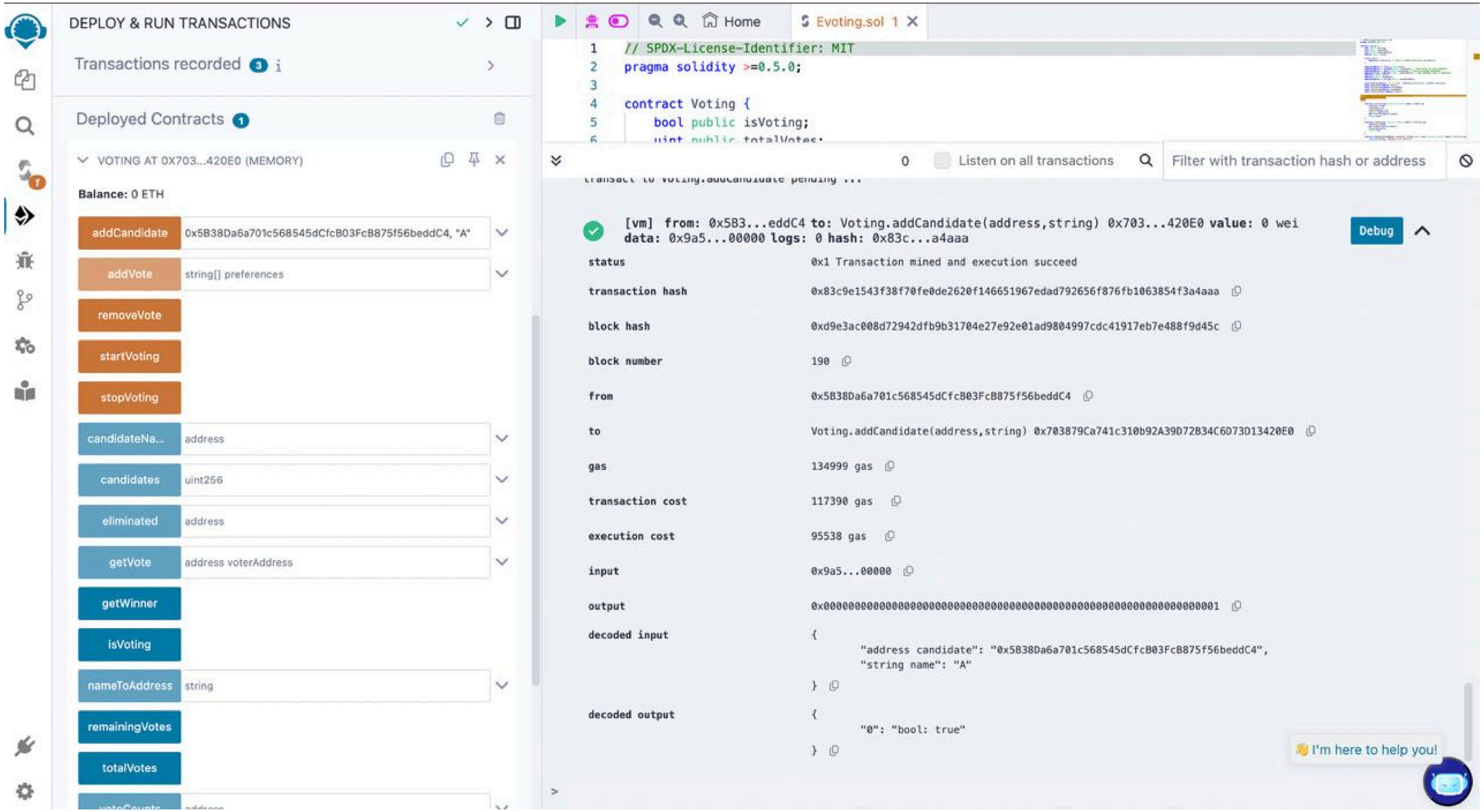
Winner Determination

Algorithm 1 Winner Determination in Ranked Choice Voting

```
While remainingVotes >0
    Find the loser:  loser ← findLoser()
    Eliminate the loser:  eliminated[loser] ← True
    Decrement remainingVotes by voteCounts[loser]
    Redistribute votes:  RedistributeVotes()
    For each candidate:
        If voteCounts[candidate] >remainingVotes / 2
            Declare the winner: winner ← candidate
            Emit AnnounceWinner(winner)
            Return
    End For
End While
```

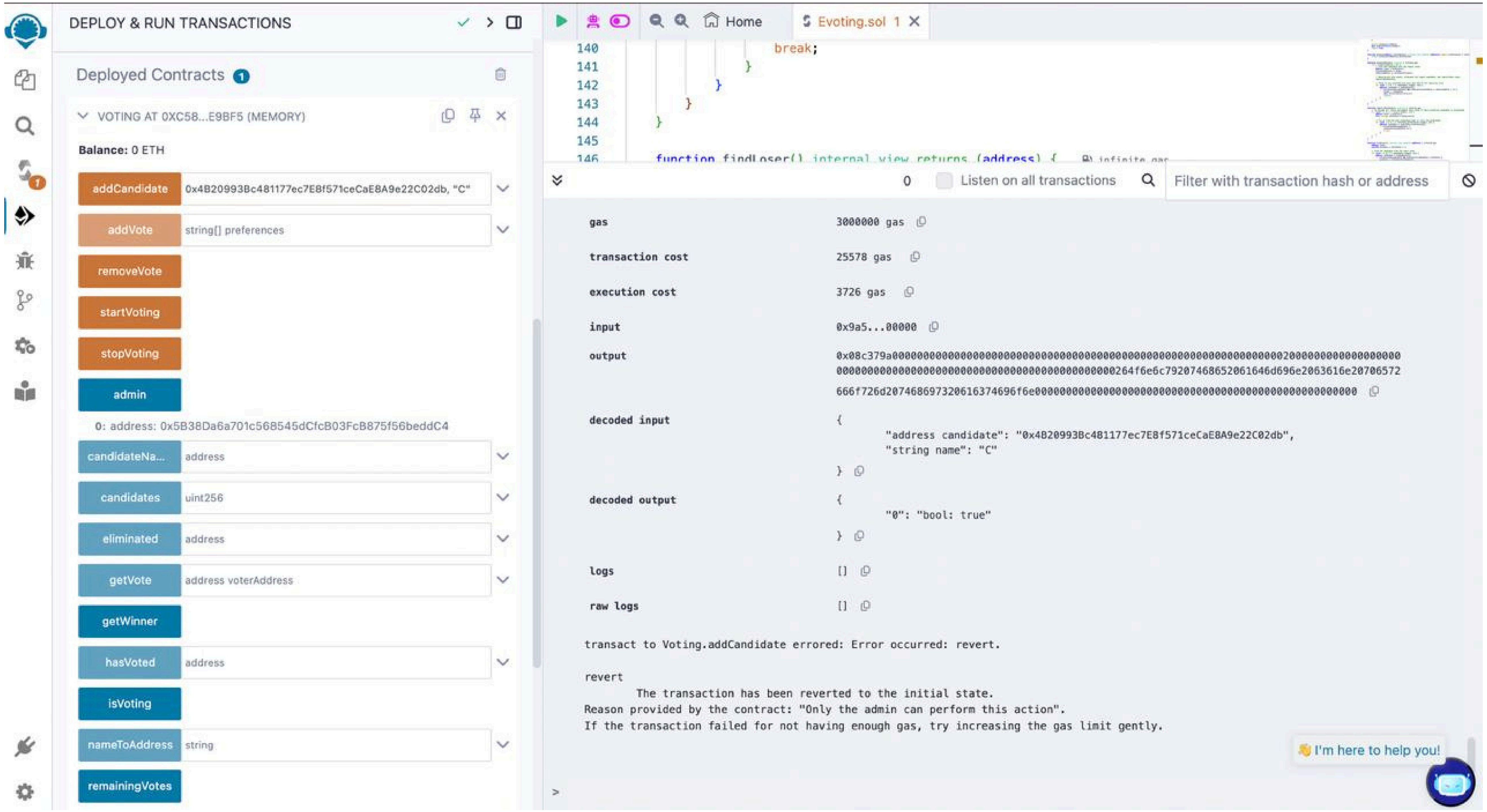
RESULTS AND ANALYSIS

ADD CANDIDATE FUNCTION



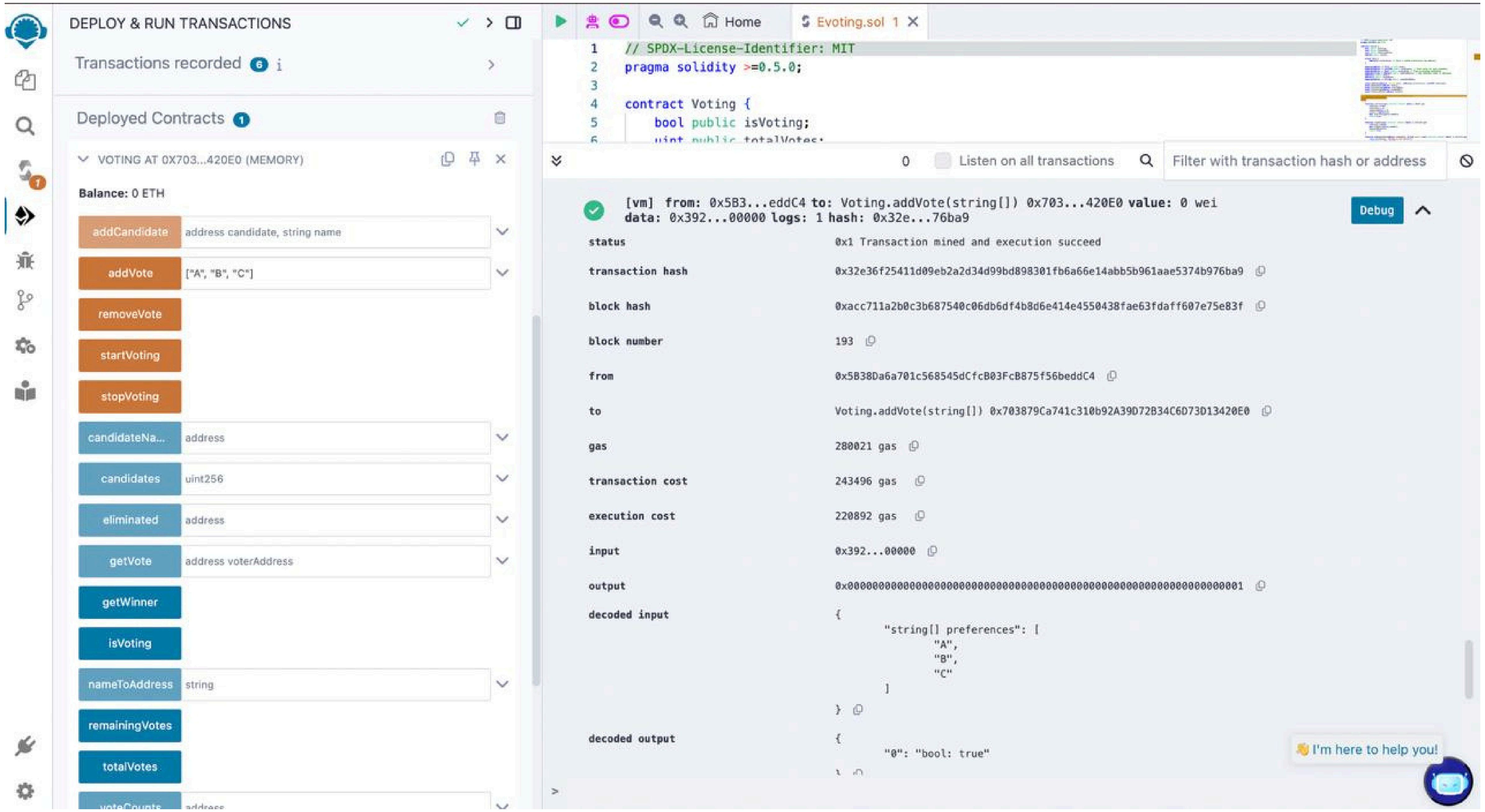
RESULTS AND ANALYSIS

ADMIN-ONLY RESTRICTION FOR ADDING CANDIDATES



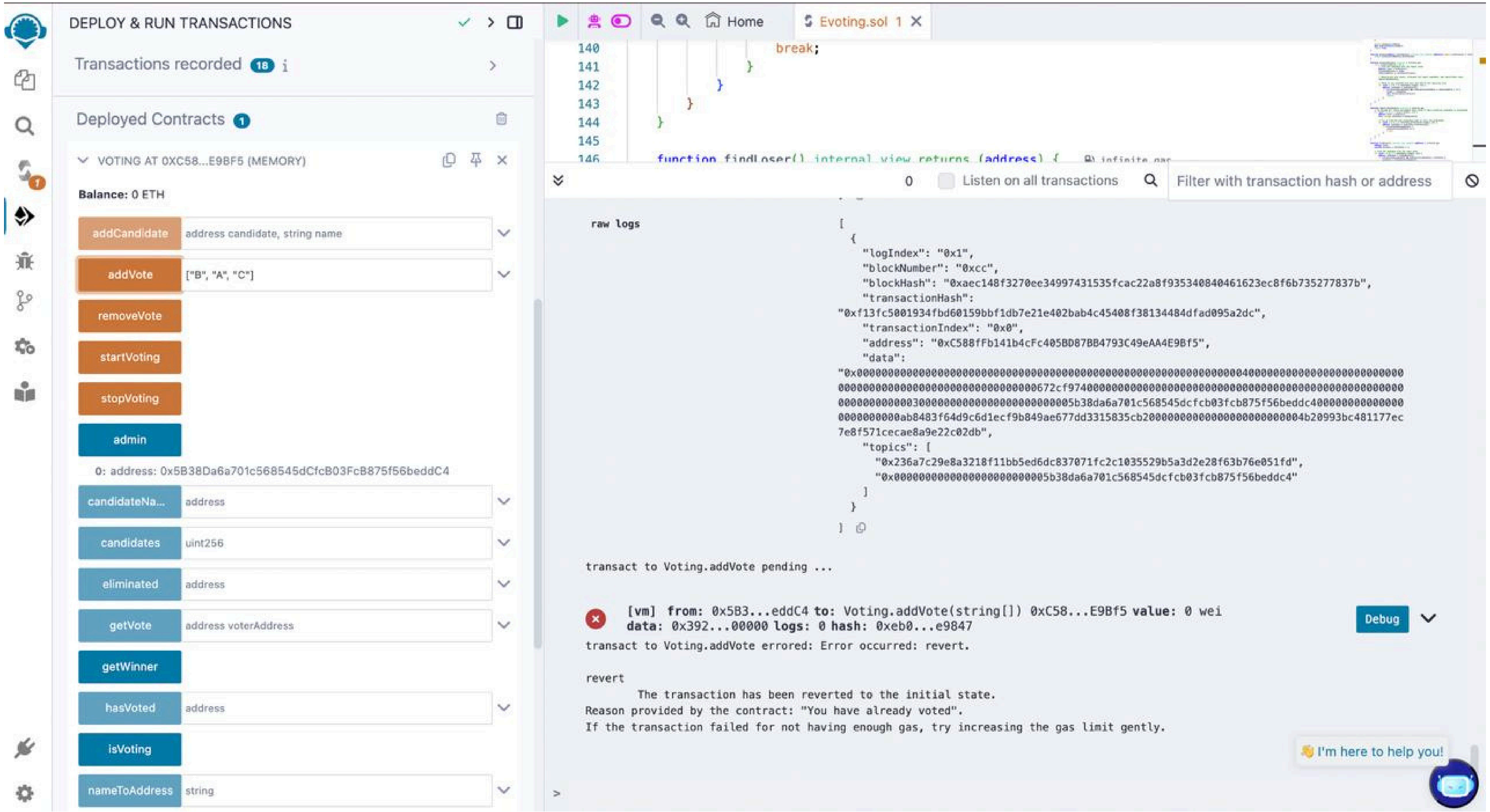
RESULTS AND ANALYSIS

ADD VOTE FUNCTION



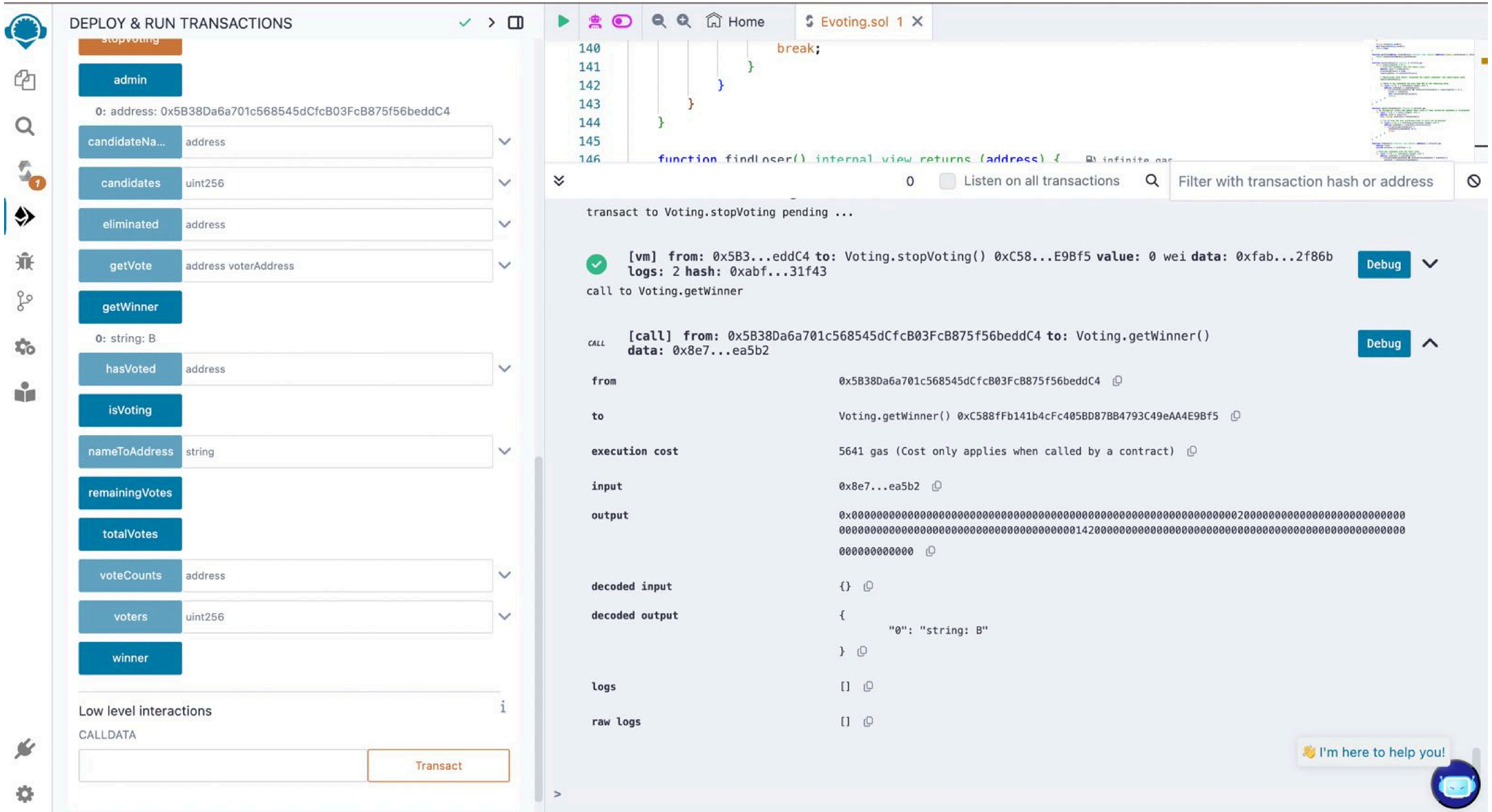
RESULTS AND ANALYSIS

ONE VOTE PER PERSON RESTRICTION



RESULTS AND ANALYSIS

GET WINNER FUNCTION



CONCLUSION AND FUTURE WORKS

CONCLUSION

- Advancement in Electoral Modernization: Blockchain and Ranked Choice Voting (RCV) enhance transparency, security, and fairness in elections.
- Seamless Smart Contract Functionality: Secure, auditable vote recording, candidate elimination, and vote redistribution validate blockchain's practicality.

FUTURE WORKS

- **User Interface**: Simplify for accessibility and broader participation.
- **Enhanced Security**: Integrate zero-knowledge proofs for privacy.
- **Gas Optimization:** Improve gas efficiency and assign gas limits effectively.
- **Multi-language Support**: Expand usability in diverse contexts.

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