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A Comparative Study of Online Voting Systems Using Blockchain and Traditional Web Technologies

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Abstract: ***With the increasing demand for secure and transparent digital elections, online voting systems have become a focus of research. This paper provides a comparative study between traditional web - based voting platforms and emerging blockchain - based voting mechanisms. The study highlights key differences in architecture, security, transparency, scalability, and implementation challenges. Results indicate that while blockchain offers enhanced integrity and auditability, traditional systems remain more cost - effective and easier to implement.***

Keywords: Online Voting, Blockchain, Web Technologies, Cybersecurity, Digital Elections, Smart Contracts.

1. Introduction

Online voting has gained traction in recent years, driven by the need for contactless, efficient, and scalable electoral processes. Traditional web - based systems, although functional, often suffer from concerns around security, privacy, and centralization. Blockchain, a decentralized ledger technology, has emerged as a promising alternative due to its transparency, immutability, and tamper - resistance. This paper aims to compare both approaches and analyze their suitability for modern democratic processes.

2. Literature Review

Various studies have been conducted on digital voting. Authors like Chaum (2004) introduced end - to - end verifiable voting systems, while Swan (2015) explored blockchain's impact on governance. Research from MIT (2018) raised concerns about security vulnerabilities in internet - based voting. Blockchain - based projects like Estonia's i - Voting and Voatz have also demonstrated practical implementations but faced scrutiny over scalability and privacy.

3. Problem Statement

Despite advancements, online voting systems still face three core issues:

1) Security: Risks of hacking and tampering in centralized systems.
2) Transparency: Limited trust due to closed - source implementations.
3) Scalability: Blockchain systems struggle with large - scale deployment.

There is a need to evaluate whether blockchain can effectively address these challenges compared to traditional web technologies.

4. Proposed Methodology

This study uses a comparative framework analyzing two sample systems:

- Traditional Voting System: Developed using PHP, MySQL, and Bootstrap.
- Blockchain - Based Voting System: Developed using Ethereum, Solidity (Smart Contracts), and Web3. js.

Evaluation Criteria:

- Architecture and Design
- Data Integrity
- Security Measures
- User Privacy
- Deployment Complexity
- Cost and Scalability

The systems were tested in a controlled environment simulating 1, 000 users.

5. Results and Discussion

The comparison results are presented below:

Criteria	Traditional System	Blockchain - Based System
Security	Vulnerable to SQLi/XSS	Resistant due to immutability
Transparency	Limited (closed server)	Full audit trail on blockchain
Scalability	High (central server)	Limited (block time issues)
Privacy	Server - side encryption	Pseudonymity via addresses
Deployment Cost	Low	High (gas fees, dev tools)
Ease of Use	Simple UI, fast setup	Complex setup, wallet needed

Discussion

While the blockchain system proved more secure and transparent, it was harder to deploy and more expensive.

Traditional systems, although easier to manage, lacked trust and auditability. A hybrid approach could leverage blockchain for verification while using web platforms for front - end access.

6. Conclusion

This paper compared blockchain and traditional web technologies in the context of online voting. Blockchain provides stronger guarantees in terms of transparency and data integrity but comes with higher complexity and cost. Traditional systems are easier to implement but require improved security frameworks. The future may lie in hybrid systems that utilize blockchain as a backend verification mechanism while retaining the simplicity of web interfaces.

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