

BLOCKCHAIN BASED E-VOTING USING HYPERLEDGER FABRIC

Muhamad Hadri Mohd Zawawi and Abidah Haji Mat Taib
College of Computing, Informatics and Mathematics,
Universiti Teknologi MARA, Perlis Branch
hadrizawawi@gmail.com and abidah@uitm.edu.my

ABSTRACT - This research focuses on the application of Hyperledger Fabric, a blockchain technology, in e-voting systems to enhance transparency and security. The study aims to design, build, and test a secure and transparent e-voting system that promotes trust and accountability in the voting process. By leveraging the features of Hyperledger Fabric, such as smart contracts and distributed ledger technology, the proposed system ensures the integrity and immutability of voting data. This abstract provides an overview of the system's architecture, security considerations, implementation details, and the potential impact of adopting blockchain-based e-voting. By employing the principles of transparency and decentralization, the solution addresses the challenges inherent in traditional voting systems. The research contributes valuable insights into the effective utilization of Hyperledger Fabric for e-voting, offering a promising avenue to enhance transparency, security, and efficiency in the voting process.

Keywords: blockchain-based e-voting, Hyperledger Fabric, transparency, security, voting systems, smart contracts.

1. INTRODUCTION

In Malaysia, a democratic nation, and within private institutions, there is an active pursuit to enhance the efficiency, reliability, and security of the voting process. Conventional voting systems face common challenges, including potential fraud and a lack of trust among participants. In light of these challenges, this research seeks to provide a comprehensive understanding of a blockchain-based e-voting system utilizing Hyperledger Fabric, with a particular focus on its application within private institutions. By harnessing the power of blockchain technology, this study aims to introduce a solution that fosters transparency, strengthens security, and ensures accountability in the voting processes of private institutions. Such a system instills confidence among participants, promotes fair decision-making, and advances the democratic principles within private institutional settings.

2. METHODOLOGY

The information gathering stage includes understanding voter needs, studying existing systems, and identifying key functionalities. During the planning stage, a comprehensive plan is formulated, specifying the project scope, goals, timeline, and available resources. The design and development stage focuses on constructing the system's architecture, user interface, and smart contracts to ensure transparency, security, and efficiency in the voting process. Implementation and testing involve coding, programming, and integration of components to create a functional prototype that aligns with defined requirements. Finally, the documentation stage ensures the comprehensive recording of the entire process, including system specifications, user manuals, and technical documentation, enabling future replication and maintenance of the prototype.

3. RESULTS AND DISCUSSION

The implementation of the blockchain for the e-voting system using Hyperledger Fabric is still in progress. However, the e-voting system has run smoothly without any technical glitches or issues. The e-voting system has been able to capture the total number of votes and the percentage of students from each faculty who have cast their votes. In addition, the final year project has also tested the security of the e-voting system by conducting a penetration testing using BurpSuite, which has revealed vulnerabilities such as SQL injection that could pose a threat to the integrity and confidentiality of votes. The result of the penetration testing highlights the need to implement defense mechanisms such as firewalls and intrusion detection systems to enhance the security of the e-voting system. This project demonstrates the potential for blockchain technology to revolutionize the voting process by providing a secure and transparent platform for casting and counting votes, while also exposing the potential vulnerabilities that need to be addressed to ensure the integrity of the system.

4. NOVELTY OF RESEARCH / PRODUCT

The novelty of the product developed for blockchain-based e-voting using Hyperledger Fabric builds upon the insights provided by previous research studies. Ruhi Tas and Omer (2020) examined the risks associated with online voting and the need for careful evaluation of voting options on the internet. Ahamed Ben Ayed (2017) highlighted the lack of total anonymity and integrity in the current e-voting system, emphasizing the potential of blockchain technology to address these issues. Javier and Paula (2021) emphasized the persistence of antiquated voting methods and explored the feasibility of a decentralized solution that can support both public and private environments. By incorporating the findings from these studies, the developed product leverages Hyperledger Fabric to provide a decentralized and transparent platform for secure and efficient e-voting. This approach ensures the integrity of the voting process, enhances transparency, and eliminates the reliance on trust by utilizing the capabilities of Hyperledger Fabric, thus advancing the field of electronic

5. CONCLUSION

In conclusion, the blockchain-based e-voting project using Hyperledger Fabric demonstrated the potential of this technology to address the limitations of traditional voting systems. By leveraging features such as smart contracts and distributed ledger technology, the project aimed to enhance transparency, security, and efficiency in the voting process. While challenges were encountered during development, the project contributed valuable insights and methodologies for future advancements in blockchain-based e-voting systems. This research has paved the way for further exploration and improvement, highlighting the importance of decentralized governance and public verifiability in creating a secure and trustworthy platform for elections. With continued research and development, blockchain-based e-voting using Hyperledger Fabric has the potential to revolutionize democratic processes and promote greater trust and confidence in electoral systems.

REFERENCES

- Jafar, U., Aziz, M. J. A., & Shukur, Z. (2021). Blockchain for electronic voting system—review and open research challenges. In *Sensors* (Vol. 21, Issue 17). MDPI. <https://doi.org/10.3390/s21175874>
- Kshetri, N., & Voas, J. (2018). Blockchain-Enabled E-Voting. *IEEE Software*, 35(4), 95–99. <https://doi.org/10.1109/MS.2018.2801546>
- Taş, R., & Tanrıöver, Ö. Ö. (2020). A systematic review of challenges and opportunities of blockchain for e-voting. In *Symmetry* (Vol. 12, Issue 8, pp. 1–24). MDPI AG. <https://doi.org/10.3390/sym12081328>
- Tamas Blummer, Sean Bohan, Mic Bowman, Christian Cachin, Nick Gaski, Nathan George, Gordon Graham, Daniel Hardman, Ram Jagadeesan, Travin Keith, Renat Khasanshyn, Murali Krishna, Tracy Kuhrt, Arnaud Le Hors, Jonathan Levi, Stanislav Liberman, Esther Mendez, Dan Middleton, Hart Montgomery, ... Baohua Yang. (2018). *An Introduction to Hyperledger*.