International Journal of Information Engineering and Science
Vol. 1 No. 1 February 2024
e-ISSN: 3048-1953, p-ISSN: 3048-1902, Page 20-25
DOI: https://doi.org/10.62951/ijies.v1i2.55
Available online at: https://international.arteii.or.id/index.php/IJIES

Blockchain-Based Secure Data Sharing Framework For Healthcare Information Systems

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Abstract.*Health information systems face major challenges in terms of data security and integrity. This article proposes a blockchain-based framework that enables secure data sharing among various entities in a health information system. The framework ensures the confidentiality, integrity, and transparency of patient data through the use of smart contract technology and hash-based encryption. Case studies on several hospitals demonstrate improved data security without sacrificing system efficiency.*

Keywords: *Blockchain, Healthcare information systems, Data security, Smart contracts, Data sharing, Privacy.*

1. INTRODUCTION

Today's health information systems (HIS) face significant challenges related to data security and integrity. With the increasing number of cyberattacks targeting health data, it is critical for healthcare institutions to adopt solutions that can protect sensitive patient information. According to a report from the Cybersecurity & Infrastructure Security Agency (CISA), the healthcare sector is one of the most attacked, with more than 600 data breach incidents reported in 2020 alone (CISA, 2020). In this context, blockchain technology emerges as an innovative solution that can improve data security and integrity. in health information systems.

Blockchain is a technology that enables secure and distributed data storage. By using a decentralized data structure, every transaction that occurs in the system can be recorded permanently and cannot be changed, thus ensuring data integrity. A study by Kuo et al. (2017) showed that the implementation of blockchain in HIS can reduce the risk of data breaches and increase trust between patients and healthcare providers. By utilizing this technology, healthcare institutions can share data securely without compromising patient privacy.

One of the key features of blockchain is the use of smart contracts that allow automation of data sharing processes. Smart contracts are programs that execute automatically when certain conditions are met, reducing manual intervention and increasing efficiency. For example, in a case study in a hospital in Singapore, the implementation of smart contracts helped speed up the process of verifying patient data, which previously took days (Goh et al., 2021). Thus, blockchain technology not only improves security but also operational efficiency in health information systems.

In this paper, we propose a blockchain-based framework for secure data sharing among entities in a HIS. The framework is designed to ensure the confidentiality, integrity, and transparency of patient data through the use of smart contract technology and hash-based encryption. With this approach, we hope to make a significant contribution to the development of a more secure and efficient health information system.

Overall, this study aims to explore the potential of blockchain technology in improving health data security. By utilizing current data and statistics, we will show how the implementation of this framework can overcome existing challenges and provide effective solutions to data security issues in health information systems.

2. LITERATURE REVIEW

In this literature review, we will discuss various studies that have been conducted related to the application of blockchain in health information systems. Several studies have shown that blockchain technology can improve data security through strong encryption mechanisms and decentralization of data storage. According to Zhang et al. (2018), blockchain can reduce the risk of data breaches by storing patient information in an encrypted form that can only be accessed by authorized parties. This shows that blockchain not only offers security but also better control over data access.

In addition, research by Ekblaw et al. (2016) suggests that the use of blockchain in HIS can increase transparency and accountability. With every transaction recorded in a public ledger, the parties involved can track and verify any changes that occur to patient data. This is especially important in the healthcare context, where data errors can have serious consequences. By implementing a blockchain-based system, healthcare institutions can ensure that all data changes are clearly recorded and auditable.

One example of blockchain application in healthcare is the MediLedger project, which aims to improve the security of the drug supply chain. The project uses blockchain technology to track the origin and movement of drugs, thereby reducing the risk of counterfeiting and ensuring that patients receive safe drugs (MediLedger, 2021). This case study shows how blockchain can be practically applied to improve data security and integrity in the healthcare sector.

However, despite the many potentials offered by blockchain technology, there are still challenges that need to be overcome. For example, the issue of scalability and interoperability between different systems is a major concern. According to a study by Reddy et al. (2020), to implement blockchain effectively in CIS, there needs to be clear standards and protocols to

ensure that different systems can communicate with each other and exchange data securely. This shows that although blockchain offers a promising solution, collaboration between various stakeholders is essential for its successful implementation.

Overall, this literature review shows that blockchain technology has great potential to improve data security and integrity in health information systems. With a better understanding of the applications and challenges, we can develop a more effective framework for secure data sharing among entities in the health sector.

Proposed Framework

Our proposed blockchain-based framework consists of several key components that work together to ensure the security and integrity of patient data. First, the system will use hash-based encryption technology to protect sensitive data. Hash encryption is a method that converts data into a random string of characters, which cannot be read without the proper decryption key. This ensures that even if the data is successfully stolen, the information contained within it remains inaccessible (Nakamoto, 2008).

Second, the framework will leverage smart contracts to regulate and manage data access. Smart contracts will set clear rules and policies about who can access data and under what conditions. For example, if a doctor wants to access a patient's medical history, a smart contract can verify the doctor's identity and ensure that he or she has the patient's permission before granting access (Christidis & Devetsikiotis, 2016). In this way , the framework not only improves security but also gives patients greater control over their data.

Third, the system will implement a transparent audit mechanism. Every transaction that occurs in the system will be recorded in a blockchain ledger that can be accessed by authorized parties. This allows for easy and fast audits, as well as increasing trust between patients and healthcare providers. According to research by Yew et al. (2020), the transparency offered by blockchain can help reduce suspicion and increase collaboration between various entities in the healthcare system.

Fourth, the framework will be designed to support interoperability with existing systems. This is important to ensure that blockchain technology can be seamlessly integrated into existing healthcare infrastructure. By providing standard APIs and protocols, we hope to facilitate secure data exchange between different healthcare information systems (Reddy et al., 2020). This approach will enable healthcare institutions to leverage blockchain technology without having to replace existing systems.

Finally, the framework will include an education and training component for end users. In order for blockchain technology to be accepted and used effectively, it is important to provide a good understanding of how the system works and the benefits it offers. By educating medical staff and patients about the technology, we hope to increase the adoption and use of blockchain-based systems in HIS.

Case Studies

To illustrate the effectiveness of the proposed blockchain-based framework, we will discuss several case studies from hospitals that have implemented this technology. One prominent example is Mount Sinai Hospital in New York, which has used blockchain to manage patient data and improve the security of medical information. By implementing a blockchain-based system, the hospital reported a significant decrease in data breach incidents, as well as increased efficiency in managing medical records (Mount Sinai, 2021).

In another case study, the University Hospital in Tokyo also successfully implemented blockchain technology to share data between departments. Using smart contracts, the hospital was able to ensure that only authorized staff could access specific patient data. As a result, they saw an increase in the speed of data access and a reduction in the time it took to verify patient information (Tanaka et al., 2022). This shows that blockchain implementation can improve operational efficiency without compromising security.

In addition, the HealthChain project in Australia is another example of blockchain implementation in health information systems. This project aims to create a secure data sharing platform between hospitals and other healthcare providers. By using blockchain technology, HealthChain managed to reduce the time required to share data from several days to just minutes, while maintaining the security and integrity of patient data (HealthChain, 2021). This case study shows the great potential of blockchain technology in improving efficiency and security in health information systems.

However, it is important to note that blockchain implementation is not without its challenges. Some hospitals report difficulties in integrating the technology with existing systems, as well as the need to train staff on how to use new systems. According to a survey by HIMSS (2020), 60% of hospital leaders admitted that a lack of understanding of blockchain technology was a major barrier to adoption. Therefore, it is important to provide adequate educational and training resources to ensure successful implementation.

Overall, the case studies we have discussed demonstrate that implementing a blockchain-based framework can provide significant benefits in terms of security and

efficiency in healthcare information systems. By studying the experiences of hospitals that have successfully implemented this technology, we can identify best practices and challenges that need to be addressed to ensure successful adoption in the future.

3. CONCLUSION

In conclusion, this study shows that the implementation of a blockchain-based framework in a healthcare information system can improve data security, integrity, and efficiency. By using hash-based encryption technology and smart contracts, healthcare institutions can share data securely without compromising patient privacy. The case studies we discuss provide concrete evidence of the effectiveness of this technology in improving data security and operational efficiency.

However, despite the many potentials offered by blockchain technology, there are still challenges that need to be overcome, including interoperability issues and the need for user education. To ensure successful implementation, it is important for stakeholders to work together to develop the necessary standards and protocols.

By continuing to explore and develop the application of blockchain technology in health information systems, we can create a safer and more efficient environment for sharing patient data. Further research is needed to overcome existing challenges and find innovative solutions that can be widely applied in the healthcare sector.

Finally, we hope that the blockchain-based framework proposed in this study can be the first step towards a more secure and transparent health information system. By utilizing this technology, we can increase trust between patients and healthcare providers, and create a better health ecosystem for all.

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