BCT Mini Project

Shubham More - 2021300079

Jay Nadkarni - 2021300081

Shivam Patil - 2021300097

Adwait Purao - 2021300101

Title

AarogyaCoin: Secure and Scalable Blockchain-based Electronic Health Records Management

Introduction

The healthcare industry is undergoing a digital transformation, with the adoption of electronic health records (EHRs) becoming increasingly widespread. However, the centralized nature of traditional EHR systems poses significant challenges in terms of data security, privacy, and interoperability.

This paper presents the AarogyaCoin framework, which leverages blockchain technology to address these issues and provide a secure, scalable, and interoperable solution for EHR management.

Tech Stack

The AarogyaCoin framework is built upon the following key technologies:

1. Blockchain: The core of the system is a blockchain-based architecture, which ensures the immutability and traceability of EHR data.

2. InterPlanetary File System (IPFS): IPFS is used for the off-chain storage of large medical records, providing a scalable and decentralized approach to data management.

3. Ethereum: The Ethereum blockchain is utilized for the deployment and execution of smart contracts, which define the access control rules and data management policies for the EHR system.

4. Ganache: A local Ethereum blockchain development environment used for testing and deployment of the smart contracts.

5. Metamask: A browser extension that enables secure connection between the user interface and the Ethereum blockchain.

Methodology

The AarogyaCoin framework follows a multi-layered approach to address the challenges of traditional EHR systems:

1. Blockchain-based data storage: The EHR data is stored on the blockchain, ensuring its immutability and transparency. Smart contracts define the access control rules and data management policies, providing fine-grained control over the data.

2. Off-chain data storage: To address the scalability limitations of blockchain, the large medical records are stored off-chain using IPFS, while their hashes are recorded on the blockchain.

3. Interoperability:T he framework ensures interoperability by adhering to healthcare datas tandards and providing secure data exchange mechanisms between different healthcare providers and systems.

4. User access control: The system implements a robust user access control mechanism, allowing patients to granularly control the permissions and sharing of their health records.

Experimental Setup

The AarogyaCoin framework was developed and tested in a local environment using the following setup:

1. Ganache: A local Ethereum blockchain development environment

2. Truffle: A development framework for Ethereum-based applications

3. IPFS: The InterPlanetary File System for off-chain data storage

4. Metamask: A browser extension for secure interaction with the Ethereum blockchain

5. NodeJS and npm: The JavaScript runtime and package manager for developing the frontend application

Result

Analysis and Discussion The AarogyaCoin framework was evaluated based on the following criteria:

1. Data security and privacy: The blockchain-based architecture and the implementation of fine-grained access control mechanisms ensure the security and privacy of EHR data.

2. Scalability: The use of IPFS for off-chain storage of large medical records addresses the scalability limitations of the blockchain, allowing the system to handle a large volume of data efficiently.

3. Interoperability: The adherence to healthcare data standards and the secure data exchange mechanisms facilitates seamless integration with existing healthcare systems.

4. User experience: The intuitive user interface and the ability for patients to manage their own health records contribute to an enhanced user experience.

The results of the evaluation demonstrate the effectiveness of the AarogyaCoin framework in addressing the key challenges of traditional EHR systems. The blockchain-based architecture, combined with the off-chain data storage and the robust access control mechanisms, provides a secure and scalable solution for EHR management.

Conclusion

The AarogyaCoin framework represents a significant advancement in the field of electronic health records management. By leveraging the power of blockchain technology, the framework addresses the pressing issues of data security, privacy, and interoperability that have plagued traditional EHR systems. The integration of IPFS for off-chain data storage ensures the scalability oft he system, while the user-centric accessc ontrolm echanismse mpowerp atientst o take control of their own health data.

The successful implementation and evaluation of the AarogyaCoin framework highlight the immense potential of blockchain technology in transforming the healthcare industry. As the adoption of EHRs continues to grow, the AarogyaCoin framework offers a promising solution that can revolutionize the way medical records are managed, shared, and secured, ultimately improving patient outcomes and enhancing the overall healthcare experience.

References

1. Nakamoto, S. (2008). Bitcoin: A Peer-to-Peer Electronic Cash System. https://bitcoin.org/bitcoin.pdf

2. Ethereum Foundation. (n.d.). Ethereum. https://www.ethereum.org/

3. Benet, J. (2014). IPFS - Content Addressed, Versioned, P2P File System. https://ipfs.io/

4. Truffle Suite. (n.d.). Truffle - A Development Framework for Ethereum. https://www.trufflesuite.com/

5. Metamask. (n.d.). Metamask - A crypto wallet & gateway to blockchain apps. https://metamask.io/