IMPLEMENTATION OF HEALTHCARE SYSTEM USING BLOCKCHAIN : A SURVEY

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Abstract

Sharing patient data and electronic medical records are crucial and are seen as important issues in healthcare. When sharing medical information among various healthcare service providers or agents, it is critical to think about how to store patient information securely, how to access the information, and how to guarantee patient privacy. Hyperledger Fabric, a blockchain-based platform, will be helpful to manage such important factors. A permissioned blockchain system called Hyperledger Fabric offers a mechanism to protect communications between a number of recognized participants. The deployment of Hyperledger Fabric to store, manage, and preserve electronic medical records can help to ensure the security and privacy of patient data, as we shall demonstrate in this paper. According to the literature, this paper will look into blockchain solutions that have been proposed in the healthcare system using Blockchain Technology and system and emphasizes the importance of Hyperledger fabric.

Keywords: Blockchain, Healthcare, Security and Privacy, Hyperledger fabric.

Introduction

Blockchain technology is one of the most important and disrupting technologies in the world. Blockchain is an architecture and technology platform that started in 2009. It functions by keeping data in decentralized registers spread across all computer devices that are a part of the blockchain architecture. The way that each industry maintains its information, data, and financial services may be disrupted by this technology. The legal, supply chain, government, energy, food, retail, healthcare, insurance, travel, hospitality, and educational sectors are a few examples. An emerging field of technology that links all computer and system functions is this one. Blockchain technology permits the chronological grouping of transactions into cryptographic chains and blocked and registered blocks. Bitcoin that is created and distributed through the Bitcoin network is made possible by blockchain. Blockchain is the technology that underpins bitcoin, not bitcoin itself. The blockchain serves as a register to track who has the digital tokens, and bitcoin is the digital token. Bitcoin employs Distributed Ledger Technology (DLT) to create a decentralized payment system and offers the Proof of Work (PoW) mechanism to address the vulnerability to duplication. In the Bitcoin network, the nodes taking part in this process are known as miners. Distributed applications (DApps) on blockchain were made possible by the second generation of technology brought about by Ethereum blockchain's implementation of smart contracts. It seems like smart contracts are comparable to cloud- based software as a service (SaaS). Simply said, smart contracts are pieces of blockchain-based software that are activated when certain conditions are met. They are frequently used to automate the signing of contracts so that all parties can be certain of the outcome right away, without the need for a middleman or a waste of time [16]. Blockchain has been an attractive research area of research for a long time and the advantages it offers have been used by some diverse industries. Likewise, the health sector will greatly benefit from blockchain technology because of security, privacy, confidentiality, and decentralization. The current interoperability issues in health IT systems may be resolved by blockchain technology, which also has the potential to become the industry standard for the robust sharing of electronic health data between patients, healthcare professionals, organizations that provide healthcare, and researchers in the field of medicine. Due to the realities of change and aversion to innovative approaches, the health sector is described as a conventional one that is relatively difficult to measure. In recent years, health-related issues, such as privacy, care

quality, and information security, have drawn attention from all around the world. The main benefits of technological advances are enhanced safety, user experience, and other aspects of the health sector. This technology provides a secure and temperamental platform to store medical records and other health care information.

Implementation of Health-Care using blockchain and Healthcare records to secure and there is stored information all about hospital information, doctor specialization and patient medical report. The main aim of the research is reviewing the feasibility of secure Healthcare using blockchain and to find the challenges and problems, discovering the new domains where it can be used.

- Access to and exchange of data are both security issues that are specific to civilian health records.
- Fraud detection is the application of blockchain.
- To provide security and privacy for patient medical health records.

Related Work

Madine et.al [1] proposed system uses decentralized storage of interplanetary file systems (IPFS) and trusted reputation-based re-encryption oracles to access, save, and share patients' medical data in a secure manner. They created Ethereum blockchain-based smart contracts so that patients may have decentralised, immutable, transparent, traceable, trustworthy, and secure control over their data. They put the suggested smart contracts into practise using two important performance indicators, such as price and accuracy. The limitations of this system are interoperability, key management, immutability and upgradability of smart conracts.

Tariq et.al [2] work involves security and privacy through cryptographic access control to store data in the cloud and attribute encryption. The traditional security machine does not support all safety rations in the IoT-enabled smart healthcare system be of its reduced capacity, higher cost, and single-point-of-failure. Due to the IoT devices limited functionality, high cost, single point of failure, and resource limitations, standard security procedures are unable to meet all the security requirements of the IoT- enabled smart all care system.

Alaa A. Abd- al Razzaq et.al [3] confirmed the difficulties associated with COVID-19 as described in the literature. Blockchain technology has the potential to be a key component of the COVID-19 pandemic response. There is a critical need to survey how capable they are of justifying the challenges. In the interim, until a vaccine is created, blockchain technologies are anticipated to allow individuals get back to their regular lifestyles that were unaffected by the pandemic.

Pandey et.al [4] suggested that the blockchain technology can avoid fake drugs indoors in the drug supply chain. The technology has a built-in ability for thorough tracing. Each technology has its own set of limitations. Blockchain is no different, and it presents plenty of obstacles for developers to get around and new ideas. It is clear that a blockchain cannot simultaneously satisfy the demands for speed, security, and decentralization. Decentralization and speed cannot yet be achieved combined. It was suggested that strict rules be created to make data falsification illegal. The proposed effort will be extended in the future by identifying and testing solutions for additional use cases, such as corrupt healthcare systems and pharmaceutical businesses.

These Researchers in both academia and industry include in progress to examine the application to be geared to healthcare utilize. Smart contracts, fraud detection, and identity authentication are all included in these applications. Since blockchain technology has its own unique risks and problems, there is still some trepidation. Current key management methods cannot be used with blockchain owing to the risk of having a single key for all blocks in the event that the key is compromised. However, it is impossible to have one key for each block since it would be costly to store and recover (nearly) all of the keys for each block ever created. In order to create a decentralized and reliable cloud data provenance architecture, tamper-proof records, higher accountability for data, and improved data privacy and availability are all made possible by blockchain technology. [5].

A secure data bank that lets individuals keep their own healthcare information and records is anotherway that blockchain technology is being used to improve data exchange and interoperability between medical professionals [6].

Khezr et.al [7] conducted a controlled review, and using organized mapping study development, created a map of all pertinent studies. The study goals were to identify healthcare applications for blockchaintechnology [7].

A person might use the distributed ledger to show their identification and that they existed at a certain time and place with the aid of the distributed natureof the blockchain. Meinert et.al [8] talked about how up observanceof a permanent and easy document, as video display units each of the events occurred on the device. They defended the decision of the perfect blockchain agreement used for the use of future situations. The use of blockchain technology to combat prescription drug fraud is also apossibility. Healthcare delivery generates a huge amount of complex and rich data in all situations, ranging from sensitive patient-identifiable data to operational analyses [8].

Luca Brunese et.al [9] proposed method uses the executive confirmation technique to protect reactivity in sequence on hospital networks. As such, the agreed information is not modified by an attacker. They believe that the systematic evaluation will identify parts of the health care blockchain architecture that need further study. Proposed review excludes studies published in languages other than English, which is one of its limitations. They anticipated that the findings of these studies will connect patients with top researchers and healthcare professionals who can inform them about blockchain in the healthcare industry, as systematic reviews offerthe strongest form of evidence.

Table 1: Blockchain based solutions in healthcare

S.No.	Author & Reference	Findings	Limitations
1.	Jack Huang et. Al [11]	The implementation uses MedBlock, which uses encryption techniques to provide access control and to secure health records and smart contract.	In order to emulate a production setting, need to conduct more benchmarking using MedBloc on a bigger scale.
2.	Ayesha et. Al [12]	The implementation of blockchain technology for electronic health record (EHR).	In order to implement this system they need to frame some rules and policies.
3.	Liu, Yiying, et. Al [13]	The implementation bridges the gap between traditional system and blockchain based healthcare system	Scalability and ledger optimization
4.	Alzahrani, Ahmed et. Al [14]	The implementation provides a frame work to share data securely among health care organizations using blockchain	Scalability
5.	Usman, et. Al [15]	The implementation provides a frame work to share data using Hyperledger fabric	It needs to be tested on real data

In this methodical evaluation, a study of the situationof blockchain examination in the health care sector isconducted. The goal is to highlight the obstacles andpotential directions of blockchain research in the field of healthcare while also exposing the potential applications of knowledge. Blockchain search and itsrestoration in health care are growing, according tothe study. Typically, it is employed for data sharing,medical operations, and contact management. The findings show that research into blockchaintechnology's potential applications in the medicalfield is expanding. These applications include datadistribution, health record management, and accesscontrol. There are very few other situations. Themajority of research tries to propose new architecturalor structural designs as frameworks, templates, orarchitectures. The results also show that most of the papers under evaluation lack technical detailsabout the components of the blockchain that areemployed and that the majority of studies lack information about prototype implementation or implementation specifications [10]. We conduct acontrolled review in which we establish an ordered

mapping study to create a map of all relevant studies. The goal of the study was to find examples of blockchain technology in health care and explained in Table 1. The study technique is based on PRISMA (preferential reporting elements for systematic and meta-analysis guidelines) and a systematic mapping process, in which scientific databases are searched, relevant material is identified,retrieved, and analysed using a well-developed research protocol.

Conclusion

In the overall study, we conclude the Blockchain technology can solve some of the healthcare industry problems. The most well-researched applications of blockchain technology, namely: secrecy, integrity, decentralized design, availability, and authentication principles, have the most potential in the healthcare industry because of the commonledger and block-related infrastructure. A shared distributed view of the health data is provided byblockchain technology, which also tackles interoperability issues and is based on open standards. Blockchain technology will be widely adopted and developed across many industries. The collection, storage, and dissemination of this data would establish the scientific basis for the development of precision medicine, aid in the discovery and development of novel approaches to the diagnosis, treatment, and prevention of disease, and assess the extent to which the use of mobiledevices could increase patient engagement in theirhealthcare for better health and disease prevention. A permissioned blockchain system called Hyperledger Fabric offers a mechanismto protect communications between patients and doctors.

References

[1] Madine, Mohammad Moussa, et al. "Blockchain for giving patients control over their medical records." *IEEE Access* 8 (2020): 193102-193115.

[2] Tariq, Noshina, et al. "Blockchain and smart healthcare security: a survey." *Procedia Computer Science* 175 (2020): 615-620.

[3] Abd-Alrazaq, Alaa A., et al. "Blockchain technologies to mitigate COVID-19 challenges: A scoping review." *Computer methods and programs in biomedicine update* 1 (2021): 100001.

[4] Pandey, Prateek, and Ratnesh Litoriya. "Implementing healthcare services on a large scale: challenges and remedies based on blockchain technology." *Health Policy and Technology* 9.1 (2020): 69-78.

[5] McGhin, Thomas, et al. "Blockchain in healthcare applications: Research challenges and opportunities." *Journal of Network and Computer Applications* 135 (2019): 62-75.

[6] Raju, Saravanan, Vandita Rajesh, and Jitender S. Deogun. "The case for a data bank: an institution to govern healthcare and education." *Proceedings of the 10th International Conference on Theory and Practice of Electronic Governance*. 2017.

[7] Khezr, Seyednima, et al. "Blockchain technology in healthcare: A comprehensive review and directions for future research." *Applied sciences* 9.9 (2019): 1736.

[8] Meinert, Edward, et al. "Blockchain implementation in health care: Protocol for a systematic review." *JMIR research protocols* 8.2 (2019): e10994.

[9] Brunese, Luca, et al. "A blockchain based proposal for protecting healthcare systems through formal methods." *Procedia Computer Science* 159 (2019): 1787-1794.

[10] Agbo, Cornelius C., Qusay H. Mahmoud, and J. Mikael Eklund. "Blockchain technology in healthcare: a systematic review." *Healthcare*. Vol. 7. No. 2. MDPI, 2019.

[11] Huang, Jack, et al. "Sharing medical data using a blockchain-based secure EHR system for New Zealand." *IET Blockchain* 2.1 (2022): 13-28.

[12] Shahnaz, Ayesha, Usman Qamar, and Ayesha Khalid. "Using blockchain for electronic health records." *IEEE Access* 7 (2019): 147782-147795.

[13] Liu, Yiying, et al. "Blockchain Bridges Critical National Infrastructures: E-Healthcare Data Migration Perspective." *IEEE Access* 10 (2022): 28509-28519.

[14] Alzahrani, Ahmed G., Ahmed Alhomoud, and Gary Wills. "A Framework of the Critical Factors for Healthcare Providers to Share Data Securely Using Blockchain." *IEEE Access* 10 (2022): 41064-41077.

[15] Usman, Muhammad, and Usman Qamar. "Secure electronic medical records storage and sharing using blockchain technology." *Procedia Computer Science* 174 (2020): 321-327.

[16] Aggarwal, Shubhani, et al. "Blockchain for smart communities: Applications, challenges and opportunities." *Journal of Network and Computer Applications* 144 (2019): 13-48.