Blockchain In Healthcare:Portal For Electronic Health Records

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Abstract. Blockchain is a technology that uses sophisticated algorithms and a digitally distributed ledger to prevent data tampering. It started out in the financial sector, but it is now used in the Internet of Things, banking, supply chain, defense, and healthcare, among other major sectors. Patients, providers, payees, organizations, and intermediaries all require streamlined transactions in a secure, authentic, and transparent environment in healthcare. Blockchain technology, which is based on the internet, has the potential to revolutionize the way healthcare data is used in a decentralized and interoperable manner, without relying on intermediaries. With this technology, it is possible to develop applications that ensure secure, transparent, and unchangeable records, which can help prevent systematic fraud. This study examines previous literature to identify the key challenges of implementing blockchain in healthcare and explores potential solutions to address these issues.
Keywords—blockchain, electronic health record, EHR,healthcare.

I. INTRODUCTION

The rapid adoption of digitalization in the healthcare sector has resulted in the creation of enormous numbers of electronic patient records. Such expansion places a lot of demands on how healthcare data is used and shared, which must be protected. In the healthcare sector, there are significant issues with data privacy, security, and integrity. The inclusion of blockchain technology as a responsible and transparent method of data storage and distribution in different sectors is creating new opportunities for addressing these issues. Over the past few years, blockchain technology has drawn a lot of interest from both the industry and the academic community. In fact, fresh blockchain applications and academic research is published every day. Particularly in the fields of healthcare, medical research, and insurance, blockchain is being hailed as an effective tool for managing sensitive data.

The healthcare system comprises three main components:

- (a) core medical care providers such as doctors, nurses, hospital administrators, and technicians;

- (b) essential medical services including medical research and health insurance; and

- (c) recipients of medical and health-oriented services, which are the patients or the general public.

Over the past three decades, the healthcare industry has undergone a digital transformation, reshaping many crucial functions of healthcare delivery systems [1]. This revolution is expected to bring added value in the form of improved healthcare outcomes in healthcare facilities [1].

In recent years, the healthcare industry has experienced a surge in security and privacy breaches, with over 300 incidents reported in 2017 and an alleged compromise of 37 million medical records between 2010 and 2017. With the increasing digitization of the medical field, the safe and secure management, sharing, and storage of personal health records and medical data have become a significant concern. The rise in articles related to deep learning in healthcare from 2013 to 2016 indicates the growing use of machine learning algorithms to develop predictive models in medicine.

The healthcare sector faces significant issues related to the safe exchange of medical records and adherence to data protection rules. One potential solution that has been proposed to tackle these challenges is the adoption of blockchain technology. Patient data management is one of the most well liked blockchain applications in healthcare. Since health organizations frequently separate medical records, it is impossible to ascertain a patient's medical history without first contacting their previous healthcare provider. This procedure can be time-consuming, and mistakes brought on by human error may frequently occur. A promising opportunity exists for a medical data system that is both more

extensive and more secure given the popularity of blockchain technology and cryptocurrencies like Bitcoin. This is because a blockchain's use of cryptography to guarantee the integrity and accuracy of its ledger is its most important feature.

Data can be stored using blockchain technology in a way that is accessible to all network users, completely mutable, and unalterable. A single, dependable platform would give medical professionals control over the flow of information in electronic health records built on the blockchain technology. The similar information would be accessible to everyone, and any updates that will occur would be immediately provided to everyone on the network. A system like this might be used in hospitals and medical offices all across the world in a variety of ways. However, a vital piece of technology that can enable all of this already exists in the wallets of a large portion of the population: mobile smartphones. Phones and other comparable devices now have the computing capacity and networking capabilities to keep track of a person's vital signs and serve as a hub for entering and retrieving data. Many people already monitor their exercise, caloric consumption, and even mental health with their phones or smart watches, to mention a few.

As a result, blockchain facilitates the development of various services. It is more efficient to combine various types of health monitoring into a single, standardized platform that is available to medical practitioners since it enables better control over the grade of care being delivered. Blockchain data backup ensures that once data is inputted, it cannot be changed or really altered in any manner. In some circumstances, it may even be possible to use a gamified and rewards system to encourage healthy lifestyle choices through blockchain-based electronic health data. Electronic health record (EHR) data do not directly capture information about patients and their physiological conditions, but rather the intricate set of recording processes that are involved in healthcare[4].

II. OBJECTIVE

Blockchain technology is a ledger where data of multiple users is compiled to facilitate our operations of transaction. It offers high transparency. It gives us multiple techniques for authentication and authorization which helps a lot of administrators. Its main objective is to give assurance to customers that their records are safe so that there should not be any stress to anyone about their data, it also increases transparency in the process. It increases customers satisfaction for their end-to-end communication, when data gets collected from a lot of users then Artificial Intelligence is applied for keeping their data safe and dealing with it.

In the field of healthcare, the rate of development is advancing at an ever-increasing rate. High-quality medical facilities backed by an advanced technology are in high demand right now in different sectors. It is widely recognized that protecting the confidentiality of individuals' data is of utmost importance as it can be easily abused. The most significant hurdles in population health management are related to data sharing, privacy, and interoperability. Blockchain technology is a reliable solution to address these challenges, particularly concerning safeguarding privacy. If utilized effectively, blockchain technology can enhance several aspects such as security, data exchange, interoperability, integrity, real-time updates, and accessibility.

Data security is very important from user's point of view and also raises a lot of questions. Data collection, transmission, and analysis over networks must be made simple and secure for both patients and medical professionals. As a result, these problems are fixed with blockchain technology. As we know it is very important to keep privacy of each person's data as it can be used in a wrong way which doesn't keep that person private, so to provide high level of security of data multiple techniques like encryption and decryption are used to provide data from multiple attackers.

III. TECHNOLOGY USED

Blockchain technology has evolved through several stages of development. The initial stage was focused on cryptocurrencies, followed by the use of smart contracts in industries such as finance and real estate. The third stage saw the expansion of blockchain into non-financial fields like politics, healthcare, and culture. Currently, it is believed that blockchain is in its fourth stage of evolution, driven by advancements like data immutability and the integration of artificial intelligence. The wide-ranging applications of blockchain may be attributed to its ability to create decentralized and trustworthy transaction environments.

Blockchain technology is well-suited for the healthcare sector, as it has the potential to effectively tackle pressing issues like automated claim validation and improved public health management. This technology enables patients to maintain control over their data and determine with whom it is shared, which helps to alleviate concerns around data ownership and sharing. By utilizing consensus protocols, it facilitates the consolidation, secure exchange, and rapid access of data records by the appropriate authorities. This is a significant advantage over traditional methods, which require external parties to store the data. Furthermore, blockchain technology can increase transparency in data management processes while reducing the likelihood of data being mishandled or misused. Due to concerns around privacy and insecure electronic health record (EHR) systems, patients are hesitant to share their health records. Innovative technologies like blockchain provide a secure system that enhances patient privacy protection.

A small task that is stored in public blocks is referred to as a blockchain transaction. A majority of system participants must agree in order for each transaction to be confirmed. When transactions are added to the blockchain in this manner, tamper-proofing is guaranteed. According to blockchain immutability, each member replicates, hosts, and maintains the exact identical copy of the ledger.

The integration of blockchain technology with other enabling technologies is expected to bring about a significant transformation in the Internet of Things (IoT). As a matter of fact, most IoT devices are only capable of directly supporting blockchain technology, which can offer a secure and user friendly platform for distributing reliable data and information in the IoT ecosystem. This indicates that blockchain technology has the potential to revolutionize the way IoT devices function. [6].

Using smart contracts, a self-executing piece of code on the blockchain architecture that enables straight-through processing, the business logic is encoded regardless of the type of blockchain. Because nothing can be changed once it has been encoded, smart contracts contained in the blockchain become permanently tamper-proof. They also become self-verifying due to automated possibilities and self enforcing when the rules are followed at all times.

Among the key characteristics of blockchain are decentralization, which makes the ledger available to all participants, immutability, which makes the blockchain resistant to censorship, availability, which gives all peers access to a copy of the blockchain so they can access all time stamped transaction records, and anonymity, which allows each user to interact with the blockchain using a generated address that hides their true identities.

Blockchain may take some time to achieve the anticipated levels of business transformation due to social, organizational, and implementation challenges like governance and security. This is in part because the general public and individual users, like doctors or patients, are not familiar with the technical aspects and benefits of this technology for data management. In addition, the general lack of trust in the legal compliance and governmental regulations associated with the application of blockchain technology may make the situation even worse. By tackling these issues, current research is geared toward assisting blockchain's operational evolution and boosting its adoption.

IV. SYSTEM DESIGN AND ARCHITECTURE

To design a blockchain-based healthcare system, we need to consider the following aspects:

Architecture and Components: The blockchain-based healthcare system can have the following components:

- Blockchain network:A decentralized network that stores and shares healthcare data.

- Smart contracts: Self-executing digital contracts that enforce rules and automate processes.

- Cryptography: Algorithms that ensure data privacy and security.

- User interface: An intuitive and user-friendly interface that allows patients, doctors, and healthcare providers to interact with the system.

- Data Storage and Security: The healthcare data is sensitive and needs to be stored securely. In a blockchain-based system, the data is stored in a distributed ledger that is tamper-proof and transparent. The cryptography algorithms ensure the privacy and security of the data. Only authorized users with the right keys can access the data.

- Interoperability: The healthcare system needs to be interoperable with different healthcare providers, hospitals, and clinics. The blockchain-based system can achieve interoperability by creating a standard format for healthcare data and using smart contracts to automate the data exchange between different parties.

- Patient Control: Patients should have full autonomy and control over their healthcare data, including the ability to grant or revoke access to different healthcare providers. A blockchain-based system has the potential to empower patients in managing their data by utilizing smart contracts to enforce access control policies.

- Regulatory Compliance: The healthcare system needs to comply with various regulatory requirements, such as HIPAA, GDPR, and others. The blockchain-based system can ensure regulatory compliance by using smart contracts to enforce rules and automate compliance processes.

- Use Cases: The blockchain-based healthcare system can have various use cases, such as: Electronic health records (EHRs): Storing and sharing patient health records securely.

- Clinical trials: Recording and sharing data from clinical trials. Supply chain management: Tracking the supply chain of medical devices and drugs.

- Health insurance: Enabling fast and secure claims processing. Overall, the architecture of a blockchain-based healthcare system should be designed to ensure data privacy, security, and interoperability while complying with regulatory requirements. The system should also be scalable, efficient, and easy to use for patients and healthcare providers.
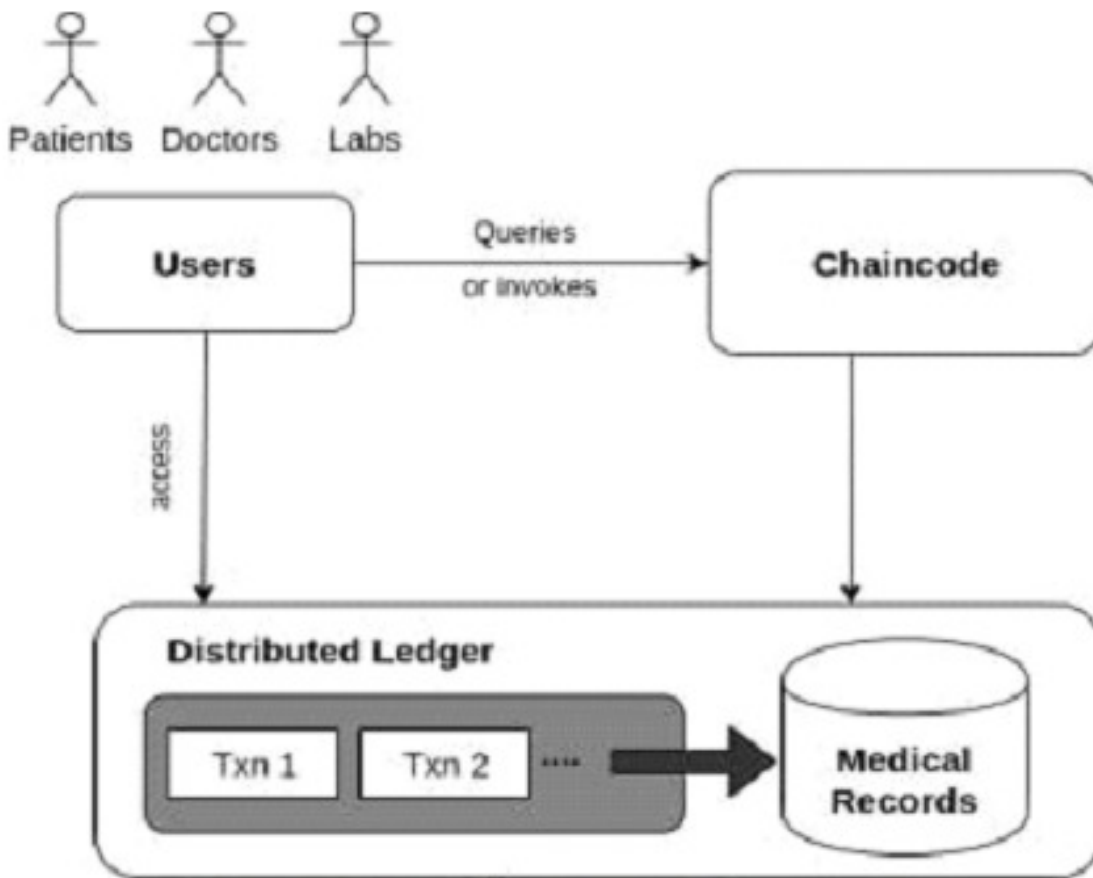
FIGURE 1. System Architecture

V. LIMITATIONS AND FUTURE SCOPE

Definitely blockchain has a future scope in field of healthcare. Blockchain could change the whole process of sharing and exchanging data from multiple clients. It also increases communication between receiver and sender at the level of payments.

The honesty of the data entered into the medical documents would also be guaranteed by the unchangeable nature of blockchain technology. The potential for more precise documentation of any medical mistakes and the capacity to track the effects of a specific treatment. The authors of the study, Yue et al., created an application called Healthcare Data Gateway (HDG) that utilizes blockchain technology and a secure computation technique known as MPC. This system allows for encrypted data to be processed on a private blockchain cloud without revealing the raw data, and produces computation results in a secure manner.[8]

Blockchain is simpler to use in creating and updating documents and records of different providers in healthcare sector but it is still in early stage and needs some more inventions to improve health sector. It also uses concepts like asymmetric key cryptography which involves use of both public and private keys to encrypt and decrypt data. One biggest problem in this people using this need should understand this completely and have enough knowledge where to apply this concept and it also uses power to run these types of applications which can affect scalability. Patient records, breach of data, consistent results, procedural rationalization, decreasing the use of drugs and supply chain tracking are all expected to be addressed by this technology. Healthcare is expected to be a huge success for blockchain technology.

VI. CONCLUSION

An overview of blockchain applications in healthcare was given in this study. Blockchain is being used in many sectors to improve the automation of medical services due to its exponential expansion. Based on our analysis, the majority of research on blockchain in the healthcare industry is primarily centered around the exchange and management of Electronic Health Records (EHRs). Blockchain applications in biological research, pharmaceutical supply chains, and insurance should be takeninto consideration by researchers.

In our research, we noticed a lack of discussion in papers regarding the implementation details of blockchain technology. Although this technology has potential benefits, further research is necessary to fully comprehend, develop, and evaluate it in a secure and effective manner. To encourage the adoption of blockchain technology among stakeholders, it is important to address its scalability, security, and privacy issues.

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