

Blockchain-Driven Solutions for Enhanced EHR Management in Health Care

Zahid Hussain Shaik

Research Scholar, Dept. of Computer Science
Shri JTT University
Rajasthan, India

Dr. Kelapati Poonia

Assistant Professor & HOD, Dept. of Computer Science
Shri JTT University
Rajasthan, India

Abstract—In healthcare, blockchain technology can enhance efficiency and security. In particular, this technology can manage Electronic Health Records. A systematic literature review is conducted in this paper by analyzing the relevant databases. The purpose of this paper is to inform hospitals and health organizations about the benefits of blockchain in healthcare systems. With the advent of Bitcoin in 2009, blockchain emerged. Since then, it has been considered a secure, decentralized payment system. It is secure and cannot be tampered with. Research on how blockchain can manage Electronic Health Records in healthcare systems is scarce. A search through the databases in question led to 26 articles being found. Among 26 articles, 8 were selected for quality assessment based on the required criteria. Each article was tested in terms of building structure, empirical data availability, and relevance to the research topic, namely blockchain implementation in healthcare. A total of eight articles in the research discuss blockchain approaches in EHR management and classification. Moreover, they evaluate the usefulness and efficiency of the system and suggest improvements in the future.

In this paper, blockchain is evaluated as a method of securely exchanging health information. Apparently, the article proposes to use Blockchain's Decentralized Ledger Technology to share medical records between patients, healthcare providers, and insurers efficiently and securely. Additionally, the paper compares the pros and cons of implementing blockchain in healthcare. Healthcare systems today are outdated and inefficient due to paper records. A blockchain can improve patient access to their records, as well as health providers' data visibility, diagnosis, and treatment efficiency. Healthcare systems will benefit from this research as it identifies the most effective blockchain tools for securely and efficiently managing EHRs.

Keywords—Blockchain, Electronic Health Record, Hospital, Healthcare, Literature

I. INTRODUCTION

In legacy healthcare systems, transferring sensitive patient health information is a challenge. The systems lack interoperability at key points in the process, including baseline subordinated authorization, billing, and claims processing. Furthermore, several chronic conditions are difficult to record and paper health records are lost. There are also problems associated with the legibility of clinicians' handwriting. The process is further complicated by fake prescriptions, incorrect records of the patient's consent, and incomplete patient healthcare histories. To address modern healthcare's security and privacy concerns, there is an increasing need for a reliable platform [2]. Blockchain-based solutions are decentralized and

trusted, so EHR will utilize them for secure transactions. Due to registration's immutability, all transactions are transparent and often recorded on a tamper-proof shared ledger. Transactions are confirmed across the network by the nodes forming the Blockchain [3]. Medical systems can implement this solution for the delivery and exchange of critical medical data. Through the utilization of the Blockchain, records can be validated, authenticated, and securely stored in blocks across the network. In such systems, the patient's fingerprint alphabet stores information on health records and generates transaction data once shared with healthcare providers [4],[5]. Patients can consent to the tablet's use to access their electronic records.

TABLE I. LIMITATIONS AND BENEFITS OF BLOCKCHAIN

S. No.	Benefits	Challenges	Explanation
1.	Transparency	Storage capacity	Data is stored in blockchain network without any issues in tampering the proof and storage very high volume of data on network
2.	Decentralized framework	Standard regulations	Blockchain platforms are designed and distributed to work across the network and there no suitable regulations that can be applied universally
3.	privacy	Social and negotiable skills	Shifting the domain technology needs upgrading of human skills and proper understanding. Blockchain platform is secure and private, public and consortium which can be used based on the requirement

II. LITERATURE REVIEW

Health care is one of the fields which aspires great potential to manage the medical data securely using block chain technology. This technology uses disparate system to support

access control, clinical trial for patient centric approach. In relation with literature collected the authors' comparison on literature highlight the challenges and problems associated with blockchain privacy and security of the data in various application domains in distributed networks. The studies published are towards blockchain technology and 80% of research papers focus on Electronic health record management applications with technological platforms for implementation for increasing the impact of peer-to-peer devices. First counterfeit is storing of medical data as it is more sensitive. The attacks and failures of medical data provide several questions according to Wurst and Gervais decision model [1]. The factors considered are data storing and access by multiple parties. The Block chain should be used in public, private permission less scenario for mutual trust and shared access. The study from literature revealed that the change of block chain over time and major elements of block chain technology in health care [6].

These days block chain has greater importance in the field as it is widely spread into various sectors. The block chain technology has operational infrastructure with different health care startups such as Gem health which has good collaboration to promote integrity, security, and easy transfer. Similarly, other startups like Cyph, MedRec and GuardTime have secure medical records with digital identities and management [2]. This technology helps in avoiding security breach in health care industry and acts as a reliable method for trustworthy digital protection [7].

According to article of the block chain technology involves five different mechanisms such as digital access, liquidity, patient identification, and Identity, Immutability data [8]. The health care organization should become interoperable to drive institution and patient. This operability has historical need and entities for integration to maintain the medical data [9]. Some of the challenges analyzed in the existing work are:

- Evolvability where the system storage of health support
- Inefficient data access with online
- Some concerns are privacy, data transparency, and relevant data recording events.

III. EVALUATION AND SELECTION

The criteria followed in the inclusion was involved independently by considering the following factors such as language, area/theme, keyword, full article, year, renowned publications, download restrictions. The exclusion involved abstracts, incomplete articles, unpublished work, and no relevance [10]. Similarly, if any article is not fitting with any improper details then it is excluded from the selection criteria.

IV. SYNTHESIS

The articles considered were analyzed to properly match with latest trends and themes and cross verified with a qualitative analysis software (MAXQDA11). The other authors have also independently agreed and reviewed the content analysis by summarizing the set of themes and sub themes as well.

V. RELATED WORK

This literature study considered 226 articles published in a timeframe of 2017 to 2020 and the gray literature has been excluded in our analysis. This analysis has been performed to give insight understanding about the current trends of blockchain technology and software used in implementation. The second purpose in this analysis is to view the approaches used in multidisciplinary applications. The last point in this analysis is to evaluate various parameters such as privacy, security, interoperability to maintain the records of users.

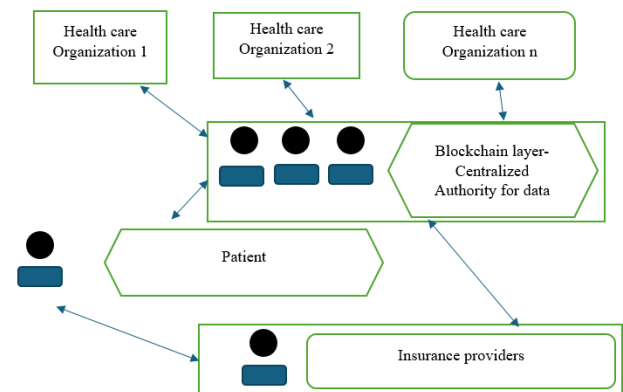


Fig. 1. Medical Organizational Structure

VI. ACADEMIC, SCIENTIFIC AND INNOVATION SIGNIFICANCE

Block chain technology is the best method for health care industry as electronic health records can revolutionize the standard with accountability, security, and interoperability [15]. This technology is more effective and cost efficient as it is streamlined to perform sharing of data to perform better diagnosis and treatment. Healthcare providers have enabled shared access with specific features of data tracking and security provision. The monitoring and transparency are suitably documented for effective transactions. The process of hash method is transparent for uninterrupted connectivity for authorization. According to the recent survey [14] conducted by for 2017-2025, the present global health care organization of about 42.9% are using electronic health records (EHR) with block chain implementation and 28.6 % are ready to use the block chain technology with interoperability and make the medical system faster [11]. The remaining percentage are performing research to improve storage capacity and accuracy for better cost-effective system [12].

VII. EVALUATION

The literature review is to complement the existing research and contribute further to the interest of blockchain and Electronic Health record management in hospitals. Electronic Medical Records Management is a way to secure patient health records through private blockchain known as Hyperledger fabric.

Medical data management is totally under the control of the patients. Hence in the existing work blockchain platform are used to showcase medical data or access management [13]. The blocks in the medical chain management is patient, doctor, Hospital and Insurance provider and highest access levels in the hierarchy is patient to select the doctor from any hospital.

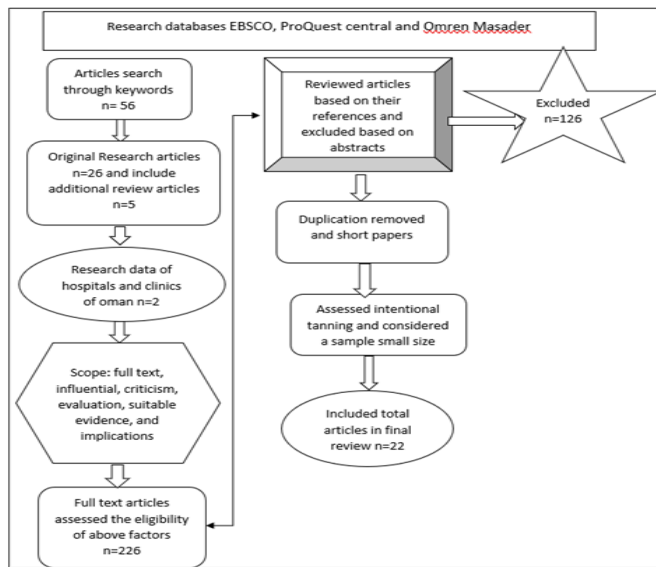


Fig. 2. Articles selection criteria considered in inclusion and exclusion.

VIII. ANALYSIS

The literature and its analysis were started from November 2019 to August 2020 to review the best implementation tool for Electronic health Record Management and monitoring where this study happen to have with various barriers and limitations across the work. The search was limited to English language, experience in teaching facilities and databases allied to blockchain technology. Additional citations were also included in the work to finalize the results and eliminate the duplication for the citations which were not relevant in the topic on interest and area of research. The below table demonstrates the total 20 articles used in the study from all the databases discussing on EHR systems to perfectly identify and evaluate a best open-source tool for Electronic Health Record Management system in hospitals of Oman.

IX. CONCLUSION

The result of this report highlights how to know which block chain technology platform is suitable for implementation of EHR. As per my readings from the literature study, it was hyper ledger composer fabric that showed best results for centralized authority to certify information and communicate securely between health organizations and Application vendors to transmit data. The design of EMR is to monitor as a patients record is created from the time he/she visits the doctor with suitable diagnosis, diseases or treatment plan. It is widely addressed in block chain application through their efficiency, durability, and a large-scale database transaction opens. Some of the literature read based on individual property, scenarios and databases that serve the needs of industries. At the end of the review, I attest that EHRM is safely secured and suitable with hyper ledger fabric as permission block chain. It ensures that exchange in the world of digital is trusted. The approach to the problem is Electronic medical records that ensure the secure handling of data and sharing the data in an integrated way between patient, payer, and provider.

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