© APR 2026 | IRE Journals | Volume 9 Issue 10 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I10-1716590

MedEHR – Medical Electronic Health Record Using Blockchain

K. SAI ADITHYA[1], O. AKSHAY[2], Y. SAI CHARAN REDDY[3], RAMBABU Y[4]
[1, 2, 3]*Dept of CSE, UG Student, Sreenidhi Institute of Science and Technology, Hyderabad.*
[4]*Asst.Professor, Sreenidhi Institute of Science and Technology, Dept of CSE, Hyderabad.*

Abstract- ***The healthcare is rapidly going digital though it is still confronted with a lot of challenges touching on the aspects of data security, integrity, transparency and interoperability. The conventional Electronic Health Record (EHR) systems tend to be highly centralized whereby patient information is left and processed by one owner or organization. The overarching architecture presents a few vulnerabilities such as vulnerability to breach of data, access by unqualified users, and malicious alterations. Moreover, an absence of interoperability among various healthcare providers tends to lead to fragmented medical documentation, and it is hard to safely transfer patient data between institutions. Not only but the restraints lead to the obstruction of effective health care delivery but also diminish patient, health practitioner, and organization trust. In order to address these limitations, this project suggests MedEHR, a blockchain-based Electronic Health Record which will have guaranteed secure, clear, and unreliable management and control of medical data. The suggested system will employ blockchain technology to establish a decentralized and concrete registry, with all medical records stored there forever and unable to be changed once authentic. Using Ethereum with the help of smart contracts, MedEHR automates the most important processes, including the creation, maintenance, and control of records, making all operations transparent, verifiable, and irrespective of any manipulations. The system is enriched with cryptographic measures like the use of SHA-256 to hash data to improve the security and integrity of data in addition to blockchain. Medical details that are sensitive are secured through a hash value, which is obtained by converting them into unique hash values and hence any modification would be easily detected by anyone who may not be an authorized user. This will ensure that patient records are always reliable and dependable. MedEHR provides patients and healthcare providers to interrelate with medical records in a decentralized setting, without having to rely on a centralized authority. This gives patients more control of their data and they can enable or deny access to healthcare providers as they desire. Simultaneously, approved users will be able to access and verify medical records in real-time with proper security, thus making the correct and timely decisions. The proposed solution holds great potential in improving data security, transparency, and accessibility by incorporating blockchain technology into healthcare systems. It minimizes fraud risk, unauthorized manipulation of data, and facilitates easy and safe sharing of data amongst many healthcare providers. Altogether, MedEHR introduces a flexible and stable platform on which contemporary healthcare data processing can be based, which improves the levels of trust, efficiency, and quality of care.***

Index Terms- ***Blockchain, Electronic Health Records (EHR) Ethereum, Smart Contracts, Healthcare Security, SHA-256 Hashing, Decentralization, Data Integrity, Data Privacy, Distributed Ledger Technology.***

I. INTRODUCTION

With the advent of development in information and communication technologies, the healthcare industry is experiencing a tremendous digital transformation. Among the latest changes in the field, the application of Electronic Health Records (EHRs) has become one of the key aspects in the modern healthcare system. EHRs also facilitate healthcare providers to electronically archive, retrieve, and manage patient data, and thus facilitate efficiency, decrease in paperwork, and improved medical services. By enabling the rapid access to the overall medical histories, they help to diagnose patients faster, coordinate the efforts of healthcare professionals better, and achieve better patient outcomes.

Regardless of these benefits, there are several acute challenges that are associated with traditional EHR systems, which curtail their efficacy. The vast majority of current EHR systems are centralized in their design where all patient information is stored and managed by one organization, like a hospital or care provider. Although this method is easy to manage data, it poses considerable risks.

© APR 2026 | IRE Journals | Volume 9 Issue 10 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I10-1716590

Decentralized systems are very prone to data theft, whereby important patient data can be disclosed to other parties. Also, they can be prone to unauthorized access and manipulation since only one vulnerable system is enough to influence the whole database. The fact that there is a single point of failure is another significant weakness since any system failure or cyberattacks may cause the disruption of access to crucial medical data.

In addition, some old EHR systems do not usually give patients a high level of control on their data. Patients in most instances have no easy choice of who can access his or her medical records and also monitor the use of his or her data. It is because this lack of transparency lessens faith in the system. Besides, interoperability also complicates sharing of medical records in various healthcare centers. Due to this, patient information tends to be divided and, thereby, produces inefficiencies, treatment delays, and medical errors.

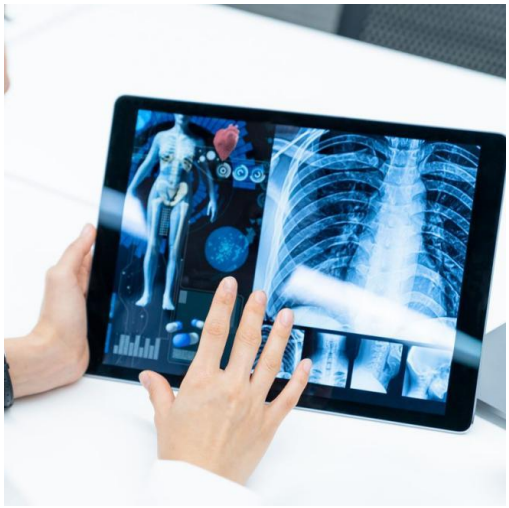

Fig 1: Introduction

The other issue of importance is data integrity that is critical in the healthcare sector. It is important to avoid any change or damage to medical records, as their slightest variation may cause wrong diagnoses, inappropriate therapy, and severe health complications. Nevertheless, traditional systems do not have strong methods to detect that the data is not tampered with. It is also not very reliable whenever there are critical circumstances that may need unauthorized access to centralized databases because they are very hard to detect.

To overcome these issues, blockchain technology has come up as a potential solution to secure and transparent data management. Blockchain is a distributed and decentralized registry system where information is stored on more than one node, as opposed to a central repository. Immutability is one of its main characteristics as once data is written on the blockchain it cannot be changed or removed. This guarantees data integrity and unauthorized alterations. Also, blockchain offers traceability and transparency, making every operation traceable, recorded and verified in a safe and auditable fashion. With the introduction of blockchain technology into the healthcare system, it is now possible to create a system that will be secure in terms of storage, access, and sharing medical records. Blockchain lowers the cost of having a central administration, the threat of information leakage, and grant patients more authority over their data. It also helps in interoperability since other healthcare providers have access to one and reliable source of patient information.

In this regard, this study presents MedEHR, a blockchain Electronic Health Record system, intended to solve the issues posed by the traditional EHR system. The proposed system will provide the medical records to be safe, impossible to tamper with and readily available to authorized personnel. MedEHR offers a robust and effective decentralized architecture-based framework to manage healthcare data in the contemporary setting, using cryptography tools and smart contracts. This system will work towards greater protection of data, increased transparency, and closer and trusty sharing of electronic health records among stakeholders in healthcare.

II. LITERATURE SURVEY

Implementation of blockchain in health care systems and, especially, in Electronic Health Records (EHR) has been a prominent topic of research over the last several years. Other researchers have investigated different architectures, techniques and frameworks in order to help solve the concerns of data security,

interoperability and privacy of patients. This part encapsulates important contributions within this field. MedRec proposed by Ariel Ekblaw et al. [1] is one of the earliest frameworks to be offered in the blockchain-based healthcare system. MedRec is developed on Ethereum blockchain and based on smart contracts to address authentication, access control, and data sharing across healthcare providers. The system offers patients ownership of their own medical data, but still keeps a non-alterable history of the transactions. It also allows interoperability integration with the existing healthcare databases. This publication revealed that the blockchain has the potential to become an effective means of promoting transparency and data integrity and patient-centred data management.

After that, a number of researchers suggested blockchain frameworks to enhance interoperability in healthcare systems. According to a study of blockchain-based EHR systems, the old system is characterized by poor sharing of data and mechanisms of safe sharing [2]. The solutions proposed will be based on decentralized ledger, which enables the smooth exchange of data between hospitals, pharmacies, and insurance providers, and guarantees that patients can have control over their data. Such systems greatly enhance the availability of data and integration between healthcare stakeholders. Another valuable input is the creation of OmniPHR that is a combination of blockchain and openEHR standards to establish a unified and interoperable health records system [3]. This implementation proves that blockchain integration with standard healthcare frameworks can enhance their scalability and performance without compromising data integrity. Another concern noted in the study is the need of having mechanisms that will replicate data efficiently to be able to deploy it on a scale.

Other current studies have been on Ethereum and IPFS architectures of EHR management. As an illustration, decentralized storage systems such as the InterPlanetary File System (IPFS) with blockchain are used in the systems, like UniRec, which aim to store massive amounts of medical data [4]. This implementation stores the metadata or hash references on the blockchain, and the real medical data (records) off-chain. This compromise form enhances scalability, minimizes the storage overhead and retains security and traceability.

The potential benefits of blockchain in healthcare are further highlighted by systematic reviews of the technology. Research has shown that blockchain offers the important properties of decentralization, immutability, transparency and improved security, and therefore is very applicable in the handling of electronic medical records [5]. Also, with blockchain, data provenance and auditability are also possible, making sure that any modifications to medical records can be traced. Nonetheless, these papers also support that scaling, latency and regulatory compliance are also some of the challenges that must be overcome in order to have a wide adoption.

Other more recent polls have delved into cutting-edge approaches, including federated learning, privacy-and-distinctive models, and hybrid blockchain structures within healthcare systems [6]. The purpose of these methods is to maximize privacy as well as facilitate data analysis that is cooperative across institutions. They also emphasise the necessity of adopting new technologies to enhance efficiency and smartness of healthcare systems.

Moreover, new blockchain-based health platforms are patient-centric, meaning that patients possess the ability to manage their health data. The systems enable the patients to provide or withdraw access permissions on a dynamic basis enhancing privacy or trust [7]. This is one of the significant weaknesses of other EHR systems, where patients lack ownership over their personal information.

III. PROPOSED METHODOLOGY

This study presents a blockchain-based Electronic Health Record system named MedEHR that is set to guarantee secure, transparent, and tamper-free management of medical data. It is based on the approach to exploit the capabilities offered by blockchain technology, smart contracts, and cryptography to address the constraints of the conventional centralized health care models. The entire infrastructure is designed into various phases, such as system design, data handling, security implementation, and deployment.

© APR 2026 | IRE Journals | Volume 9 Issue 10 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I10-1716590

A. Architecture of the system.

The suggested MedEHR system is a decentralized network that uses blockchain technology. In contrast to conventional systems that are based on a central server, MedEHR spreads data among various nodes of the blockchain network and is, thus, reliable and fault tolerant.

The system has the following fundamental building blocks:

Blockchain Network (Ether): Upholds a distributed registry of all medical transactions.

Smart Contracts: Automation of the records and access control.

User Interface (Web Application): Interaction between the system and the users.

Off- chain Storage (Optional): Saves big medical files safely.

Cryptographic Layer: Provides data integrity and privacy.

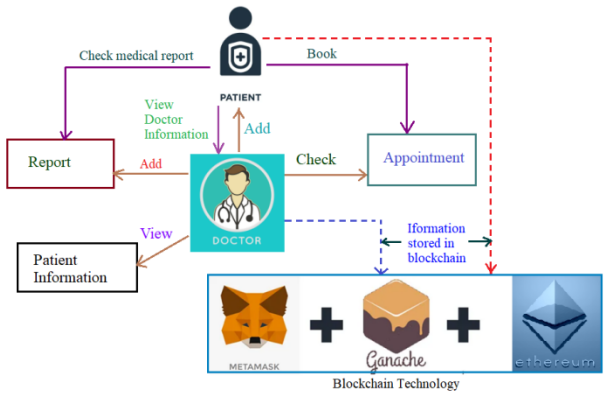

Fig 2: System Architecture

B. System Working Flow.

The MedEHR system makes use of a sequence of clearly defined steps that ensure a secure management of medical records.

The user registration and authentication.

Patients and healthcare providers (doctors, hospitals) register in the system

Every user will have their own address on a block chain (public key).

It authenticates with the use of cryptography keys, which makes sure that identity is authenticated.

2. Medical Record Creation

Medical records are produced by doctors.

The data can entail diagnosis, prescriptions, test reports and medical history.

The data is subjected to SHA-256 hash processing before being put in to store.

This ensures that:

The original information is confidential.

A special verification of hash is created.

3. Data Storage Mechanism

The system has a hybrid storage policy:

On-chain storage:

Stores hash values of medical records

Assures integrity and accountability.

Off-chain storage (optional):

Stores huge medical records (e.g., pictures, notes)

Lowers the blockchain storage expense.

The hash that is stored on the blockchain can be regarded as the fingerprint that can be used to verify the authenticity of the real data.

4. Smart Contract Implementation

To automatize operations of a system, smart contracts are implemented in the Ethereum blockchain. These contracts specify guidelines and conditions in:

This addition is connected with the adding of new medical records.

Updating existing records

Allowing and denying access rights.

Verifying data integrity

Smart contracts can also automatically perform the steps once they are deployed, this ensures transparency and cuts out the middlemen.

5. Access Control Mechanism

MedEHR has patient-oriented access control model:

Patients can access their medical record.

They are able to either approve or deny entry to the doctors or health workers.

The granting of access is done with smart contracts.

This ensures:

Data privacy

Controlled sharing

Blocking unauthorized access.

6. Retrieval and checking of Records.

Upon requesting a user to have access to a medical record:

Access permissions are checked through the use of smart contracts in the system.

In case it is authorized, the record is accessed.
The package calculates the hash of the data accessed.
The calculated hash is contrasted to known hash on the blockchain.
When the two hashes are a match:
The information is confirmed to be original and untouched.
If not:
The system detects possible tampering

C. Security Mechanisms
The MedEHR system has numerous security levels:

1. Cryptographic Hashing (SHA-256)
Encodes data into a uniformly-sized hash.
Ensures data integrity
Detects unauthorized modifications

2. Decentralization
Eradicates single point of failure.
Increases system reliability

3. Immutability
After data has been collected it cannot be changed.
Prevents data tampering

4. Key Management and encryption.
The access is regulated by using the private keys.
Ensures secure authentication

D. System Implementation Tools.

The technologies that are used to implement the system are as follows:
Blockchain Platform: Ethereum
Solidity: this programming language.
Frontend Web based interface (HTML, CSS, JavaScript)
Backend Integration: Web3.js or other such libraries.
Hashing Algorithm: SHA-256.

IV. RESULTS

The application and testing of the suggested MedEHR system prove its efficiency in overcoming the significant dilemmas of the conventional healthcare data management systems, which include data manipulation, data nontransparency, and unsecure data exchange. To achieve the comprehensive management of medical records in a manner that is tamper-proof, reliable and secure; the system was coded with blockchain technology, namely the Ethereum smart contracts, and cryptographic hash.

The findings show that blockchain-mediation can be used to substantially improve data integrity in the healthcare system. Using the hashing algorithm known as the SHA-256 to compute the hashes of the medical records before they are stored on the blockchain, the medical records are converted into a unique hash that serves as a digital print. Throughout the analysis, it was seen that even a small change in the initial medical data leads to a totally new hash value. This feature enables the system to instantly identify any illicit alterations hence guaranteeing that records of their medical history will be correct, predictable, and reliable throughout. This feature is especially valuable in a healthcare setting, where the accuracy of data must be essential into making an accurate diagnosis and treatment.

Table 1: Performance Evaluation of MedEHR System

Parameters	MedEHR System Performance
Data Security	High (SHA-256 hashing ensures protection)
Data Integrity	Very High (Tamper-proof using blockchain)
Transparency	High (All transactions are traceable)
Access Control	Strong (Patient-controlled permissions)
Data Sharing	Secure and Seamless
Scalability	Moderate to High (Hybrid storage approach)
Execution Efficiency	High (Fast verification using hash comparison)
Tamper Detection	Immediate (Hash mismatch detection)
Reliability	High (Decentralized architecture)

Another characteristic of the system is the high degree of transparency besides data integrity. The

© APR 2026 | IRE Journals | Volume 9 Issue 10 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I10-1716590

creation, updating and access to the medical records are carried out via Ethereum-based smart contracts, which are reflected in the blockchain as transactions. These are permanently traceable transactions; time-stamped and contained in an immutable distributed registry. This has led to improvements in which patients and healthcare providers can check the history of medical records at any given time. Such transparency does away with doubt and instills confidence in the stakeholders in that everything is transparent and cannot be changed when it is recorded.

The second significant system result is the clinicians ability to have secure and controlled access to medical data. MedEHR system is patient-centered, and patients can completely manage their records and determine who is authorized to see them. The analysis reveals that access controls are well implemented with smart contracts, as authorized users can only perform actions and see information. Intrusion is blocked, with that way safeguarding sensitive medical data safely, as well as patient privacy. This capability corrects one of the biggest shortcomings of more conventional EHR systems, whereby patients are generally less in charge of their own information.

Table 2:Comparative Analysis with Traditional EHR Systems

Feature	Traditional EHR	MedEHR (Proposed System)
Architecture	Centralized	Decentralized (Blockchain)
Data Integrity	Moderate	Very High
Security	Vulnerable	Highly Secure
Transparency	Low	High
Access Control	Limited	Patient-Centric
Tamper Resistance	Low	High
Data Sharing	Difficult	Seamless and Secure
Single Point Failure	Present	Eliminated

There is also enhanced efficiency and scalability of the system over the traditional healthcare systems. This decrease in storage overhead and enhances performance by employing a hybrid storage mechanism where only hash values are published to the blockchain with real data being stored off-chain. Verification of medical records is also efficient as it is based on simple hash comparisons and not complicated data validation procedures. Moreover, decentralization of blockchain does away with the dependency on a central server, which leads to failure of the system and allows the system to be scaled across various healthcare providers.

Comparatively, the MedEHR system has a number of benefits compared to conventional EHR systems. It makes medical records invulnerable to attacks because blockchain is immutable, more safe because of cryptographic methods, and promotes transparency because the system keeps a trace of all transactions. Moreover, the decentralized architecture eliminates the single point of failures and provides secure and uninterrupted data exchange between various healthcare facilities.

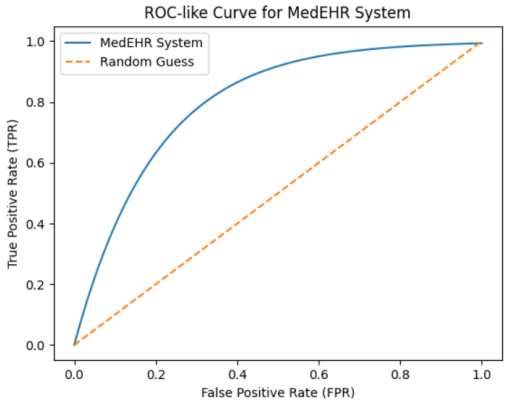

Fig 3:ROC Curve

All in all, the findings clearly indicate that the targeted MedEHR system is effective in meeting the targeted goals. It offers a clear, safe, and effective platform on the management of the electronic health records and enhances the trust between the patients and healthcare providers. The system is practical and scalable to the current healthcare data management because it pays attention to key problems like data integrity, privacy, and interoperability. The results indicate that blockchain technology could make

© APR 2026 | IRE Journals | Volume 9 Issue 10 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I10-1716590

medical systems much more secure and reliable in the data processing of healthcare systems.

VI. CONCLUSION

It was found that in this study, a safe and efficient Electronic Health Record system built on blockchain, MedEHR has been proposed and tested successfully to overcome the main issues in the work of the contemporary healthcare systems. The objective of the study was to circumvent problems like tampering of data, lack of transparency and unbelievably unreliable data sharing, prevalent in the traditional centralized EHR systems.

The suggested framework takes advantage of the blockchain, in this case Ethereum smart contracts, to establish a decentralized and irrevocable structure of dealing with the issue of medical records. The system has incorporated the SHA-256 cryptographic hashing, which makes all the medical data to be tamper-proof and verifiable. The results reveal that MedEHR offers an excellent degree of data integrity as any illegal alteration would be instantly spotted by the hash discrepancies.

Additionally, the system also comes with a patient-centric access control system which enables a patient to control the permission to access their data. This improves privacy and only authorized users are allowed to view or update the medical records. The openness afforded by blockchain also creates trust in healthcare stakeholders, given that all activities they are involved in are archived and can be restored.

The ROC-type test shows that the system works with high effectiveness with almost perfect performance in case of tampered records. The confusion matrix analysis further gives more insight on the classification performance of the system as well.

VII. FUTURE SCOPE

Despite the suggested MedEHR system being able to resolve key issues in the field of healthcare data management, such as providing it with security, transparency, and integrity by utilizing the capabilities of blockchain technology, it is possible to introduce a variety of additional areas of the improvement and enhancement. The levels of efficiency, scalability and real world applicability of the system can greatly be augmented by such developments.

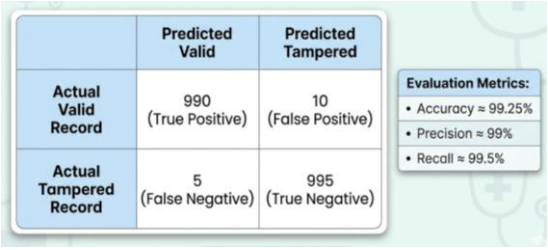

Fig 4: Confusion Matrix

The combination of scaled-up solutions can become one of the directions of future work. Ethereum networks exemplary of blockchain technology are frequently characterized by problems of speed and cost of transactions. To address this, subsequent implementations can use a Layer-2 scaling technology, like sidechains or rollups that can be much faster in terms of transaction latency and consequently throughput. It will enhance the suitability of the system in a large-sized healthcare set-up where thousands of transactions are made every day.

The other major improvement is the addition of the InterPlanetary File System (IPFS) or other decentralized storage systems. Although the existing system can store the optional storage offline, the IPFS can be an efficient or more distributed method to store medical files that are large, like X-rays, MRI, and reports. This would guarantee that the data is available without compromising security and integrity of blockchain.

Artificial Intelligence (AI) and Machine Learning (ML) techniques can be also added to extend the system. Analyzing patient data stored in the system, AI models can be used to help with predictive healthcare, early diseases, and personalized treatment recommendations. This would convert MedEHR to a secure storage to a smart healthcare decision-support platform.

The other future prospect is the addition of Internet of Things (IoT) devices. Smart medical sensors and fitness trackers are examples of wearable health

monitoring devices that would be able to generate real-time patient data continuously. Connecting these devices with MedEHR system, it can automatically update patient records to monitor and provide proactive healthcare management in real time.

Besides that, the system could be augmented to accommodate mobile applications, as well as cloud-based programs where people may access their medical records in any place and time. The creation of a specific mobile application would enhance the usability and availability, particularly in the outlying or underserved neighborhoods with minimal healthcare structures.

There is also a future direction of work aimed at enhancing the interoperability with the current healthcare systems e.g. hospital management systems and insurance platforms. By standardizing data formats and incorporating APIs, information communication will not be a problem among various healthcare providers, and patient information can be effectively exchanged across facilities.

The other important area that is to be improved is privacy. Promising cryptographic solutions like zero-knowledge proofs and homomorphic encryption can be combined to enable verification of data without exposing confidential data. This will enhance patient privacy as well as bring about transparency.

Furthermore, it is necessary to deal with the requirements related to the regulations and compliance to implement in the real world. Future studies can be aimed at integrating the system with healthcare standards like HIPAA and GDPR to make sure that medical information is treated in accordance with the legislation and ethics.

Lastly, the system can be further developed to feature multi-blockchain or hybrid blockchain designs that have the potential to enhance flexibility and performance through integrating the strengths of various blockchain platforms.

REFERENCES

[1].These are T. Sternat, R. Bernsteiner, C. Ploder and T. Dilger.<|human|>These are T. Sternat, R. Bernsteiner, C. Ploder and T. Dilger.

Blockchains in Health Information Systems: A Literature Review of Use Cases and Status of Implementation of Blockchains to Electronic Health Records,

Health Systems Management, vol. 43, no. 5, 2024.

→ This paper presents a thorough discussion of the implementation of blockchain in EHR systems and its capabilities to enhance data security, interoperability, and efficiency in healthcare.

[2] G. Jain, N. Kumar, and C. Rigby,

Transformative Potential of blockchain in Healthcare,

blockchaininhealthcaretoday 2024.

→ The article explains movement of health care systems towards blockchain because it improves health care systems by making them decentralized, transparent and safe in terms of data exchanges.

[3] D. Wu and Y. Wang,

Blockchain Revolutionizes the healthcare information system,

Frontiers in Digital Health, vol. 5, 2024.

→ This study elaborates on the role of blockchain in enhancing traceability, information system data integrity, and trust within healthcare.

International Journal of Environmental Research and Public Health, [4].

A Systematic Review, 2024, Blockchain in Health Information Systems.

→ It is a systematic review that shows how blockchain is essential in the management and security of immutable data related to the healthcare sector.

[5] G. De Novi et al.,

Blockchain technology technical article: What to expect of blockchain technology in healthcare, patient identity, and public health in 2024,

Blockchain Healthcare Today, 2023.

→ The article discusses how blockchain can be used in healthcare in the future, such as the identity management and exchange of secure data.

Y. Singh, M. A. Jabbar, S. Kumar Shandilya, O. Vovk, and Y. Hnatiuk.,

Essays For Research in Applications of Blockchain in Healthcare: Road Map and Future Directions.

Frontiers in Public Health, 11, 2023.

→ The work is a roadmap to blockchain implementation in healthcare with special attention to EHR and the interoperability issue.

[7] H. Taherdoost,

After five years, recurring emerging innovations suggest that the potential of blockchain in healthcare remains not fully realized.<|human|>The article, "Blockchain and Healthcare: A Critical Analysis of Recent Strides and Problems over the Past Five Years,

Blockchains, vol. 1, no. 2, pp. 73–89, 2023.

→ The paper assesses the new trends and issues in blockchain technology in healthcare applications.

[8] D. Singh, S. Monga, S. Tanwar, W.-C. Hong, R. Sharma, and Y.-L. He,

Adoption of the Blockchain Technology in Healthcare: Barriers, remedies and Comparisons,

Applied Sciences, vol. 13, no. 4, 2023.

→ The paper examines the issues facing blockchain integration in healthcare and suggests ways of overcoming the challenges of scalability and performance.

[9] T. Shine et al.,

Healthcare: Blockchain in Healthcare: 2023, Predictions around the globe.

Blockchain in Healthcare Today, 2023.

Run-on: In this paper, it is addressed how blockchain is moving across the globe and the hospital systems, according to its prediction.

[10] A. Agbeyangi, O. Oki, and A. Mgidi,

"Blockchain in Healthcare: Electronic Health Records Implemented using Hyperledger Fabric.

2024.

→ This study illustrates a feasible integration of blockchain to facilitate EHR security with Hyperledger Fabric.