



## **BLOCKCHAIN TECHNOLOGY FOR STORING ELECTRONIC HEALTH RECORDS**

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### **Abstract**

In recent times, the incorporation of blockchain technology into medical and e-health services has attracted considerable attention owing to its decentralized and reliable characteristics. Blockchain presents significant potential across various e-health sectors, particularly in facilitating the secure exchange of Electronic Health Records (EHRs) and streamlining data access management among multiple medical entities. Nonetheless, the integration of blockchain in healthcare poses challenges, especially concerning ensuring secure EHR sharing within mobile cloud environments.

This project responds to the necessity for effective and secure access control mechanisms for EHR sharing within mobile cloud environments. Traditional access control methodologies often rely on centralized servers, thereby introducing security vulnerabilities and privacy risks. Conversely, blockchain-based access control offers numerous benefits, including immutability, transparency, and decentralized authentication. The proposed system harnesses blockchain technology and smart contracts to establish a reliable access control mechanism for EHR sharing. By capitalizing on blockchain's immutable ledger and smart contract-based authentication, the system guarantees data integrity, confidentiality, and secure access to patient records. Furthermore, the incorporation of the InterPlanetary File System (IPFS) facilitates efficient EHR storage and retrieval while reducing data redundancy.

The system employs an immutable ledger to record EHR transactions, ensuring transparency and data integrity. Smart contracts are utilized for enforcing access control policies and authenticating users. Decentralized interfaces are provided for uploading, sharing, and accessing patient records. Compliance with healthcare regulations, such as the Health Insurance Portability and Accountability Act (HIPAA), is maintained to safeguard data privacy and security.

In summary, the proposed system offers a dependable and secure solution for EHR sharing within mobile cloud environments, mitigating the challenges associated with conventional access control methodologies.

**Keywords:** Blockchain Technology, InterPlanetary File System (IPFS), Ethereum and Hyperledger Fabric Blockchain Technology, Decentralized blockchain with smart contract.

### **Introduction**

Maintaining good health is fundamental to a fulfilling life. Concerns about public healthcare have consistently remained at the forefront of societal attention. Electronic Health Records (EHRs) serve as vital healthcare information utilized by medical practitioners for patient diagnosis and treatment. However, due to the sensitive and private nature of this information, it necessitates secure storage and protection against unauthorized access. EHRs encompass personal details such as name, gender, age, address, contact number, alongside clinical data including diagnoses, medications, and laboratory reports. Traditional paper-based health records are prone to disadvantages like damage, loss, theft, and limited accessibility. Additionally, prevailing healthcare systems often prioritize the needs of healthcare providers over interoperability, resulting in fragmented care coordination. Patients frequently seek medical assistance from multiple clinics or physicians, necessitating the sharing of medical data across different healthcare institutions.

However, existing systems lack seamless interoperability, hindering efficient data sharing and coordination of care. Moreover, patients typically lack control over their medical records, leading to



concerns regarding data tampering, theft, or unauthorized sharing. Addressing these challenges necessitates improvements in security, privacy, management, and efficient sharing of medical records. In light of the contemporary demands for privacy and security in EHR systems, there arises a pressing need for a blockchain-based healthcare system that ensures efficient, secure, and intelligent management of medical data while empowering patients with control over their data.

In this project, we introduce an electronic health records (EHRs) preservation system leveraging blockchain technology to provide enhanced, secure, and reliable storage, alongside facilitating easy accessibility and availability of medical records. We have opted for permissioned blockchain technology, specifically Hyperledger, to fulfil these objectives.

### **Literature Survey**

In recent years, numerous researchers have delved into the integration of blockchain technology within the healthcare domain. Our extensive literature review has focused on understanding the applications of blockchain technology in managing electronic medical records (EMRs) within healthcare systems. While many studies have adopted a theoretical approach, only a handful have ventured into the practical implementation of blockchain-based medical record systems.

Sofia et al. introduced a conceptual framework for accessing and sharing electronic health records using blockchain and smart contracts. Their decentralized healthcare platform aims to enhance the preservation of patient's medical records while facilitating efficient access mechanisms.

Hongyu Li et al. proposed a blockchain-based data preservation system tailored for electronic medical records, with a primary focus on preserving patient privacy and ensuring the reliability of data storage. They demonstrated a prototype of this system using the Ethereum platform, known for its permissionless blockchain architecture.

Tengfei Xue et al. proposed a medical data sharing model leveraging blockchain technology, elucidating the foundational principles and system components. However, their design encountered implementation challenges.

Asaph Azaria et al. introduced MedRec, a blockchain-based solution for medical record management, utilizing the Ethereum blockchain platform. Notably, MedRec employs the Proof of Work (POW) consensus algorithm, which necessitates substantial computational resources for mining, rendering it a costly solution.

### **Conclusion**

This project presents a scheme for sharing Electronic Health Records (EHRs) facilitated by mobile cloud computing and blockchain technology. Our objective is to identify key challenges in current EHRs sharing systems and propose effective solutions through a tangible prototype implementation. Our focus lies in devising a reliable access control mechanism based on a single smart contract to govern user access, ensuring efficient and secure EHRs sharing.

To evaluate the performance of our proposed approach, we deploy an Ethereum blockchain on the Amazon cloud, enabling medical entities to interact with the EHRs sharing system through a dedicated mobile Android application. Additionally, we integrate the peer-to-peer InterPlanetary File System (IPFS) storage system with blockchain to achieve decentralized data storage and sharing capabilities. Our implementation results demonstrate that our framework facilitates reliable and expeditious sharing of medical data over mobile cloud environments compared to traditional schemes.

Notably, our access control mechanism effectively identifies and prevents unauthorized access to the e-health system, thereby safeguarding patient privacy and network security. Furthermore, we provide comprehensive security analysis and evaluations on various technical aspects of our proposed system, highlighting its advantages over existing solutions. Based on the merits of our model, we believe that our blockchain-enabled solution represents a significant step towards efficient management of e-health records on mobile clouds, holding promise for various healthcare applications.



## References

- [1] Sofia, X., et al. "A Conceptual Framework for Accessing and Sharing Electronic Health Records Using Blockchain and Smart Contracts." *Journal of Medical Systems*, vol. 43, no. 5, 2019, pp. 1-9.
- [2] Hongyu Li, et al. "Blockchain-based Data Preservation System for Electronic Medical Records." *IEEE Access*, vol. 7, 2019, pp. 117704-117713.
- [3] Tengfei Xue, et al. "A Medical Data Sharing Model Leveraging Blockchain Technology." 2018 IEEE 17th International Conference on Cognitive Informatics & Cognitive Computing (ICCI), IEEE, 2018, pp. 130-135.
- [4] Asaph Azaria, et al. "MedRec: Using Blockchain for Medical Data Access and Permission Management." 2016 2nd International Conference on Open and Big Data (OBD), IEEE, 2016, pp. 25-30.
- [5] Mark, A.E., Hitching Healthcare to the Chain: An Introduction to Blockchain Technology in the Healthcare Sector. *Technology Innovation Management Review*, 2017. 7(10).
- [6] Lefeuvre, D., et al., Quality comparison of electronic versus paper death certificates in France. *Population Health Metrics*, 2014. 12(1): p. 3.
- [7] Vukoli, M. and #263, Rethinking Permissioned Blockchains, in *Proceedings of the ACM Workshop on Blockchain, Cryptocurrencies and Contracts*. 2017, ACM: Abu Dhabi, United Arab Emirates. p. 3-7.
- [8] Hyperledger White paper 2017; Available from: <https://www.hyperledger.org/resources/>.
- [9] White paper. Ethereum: A next-generation smart contract and decentralized application platform. 2014; Available from: <https://github.com/ethereum/wiki/wiki/White-Paper>.
- [10] Ethereum Homestead Documentation. Available from: <http://www.ethdocs.org/en/latest/>.