



A Blockchain-Based Secret-Data Sharing Framework for Personal Health Records in Emergency Condition

Priyanka Changdev Shendage¹, Lochan Gokul Bhoge², Akash Dattatray Bhogil³,
Dipika Maruti Ilag⁴, Prof. Anjali Almale⁵

Student, Department of Computer Engineering,
JSPM's Bhivarabai Sawant Institute of Technology & Research, Pune, India¹⁻⁴

Associate Professor & Guide, Department of Computer Engineering, JSPM's Bhivarabai Sawant Institute of
Technology & Research, Pune, India⁵

Abstract: Blockchain technology is the most trusted all-in-one cryptosystem that provides a framework for securing transactions over networks due to its irreversibility and immutability characteristics. Blockchain network, as a decentralized infrastructure, has drawn the attention of various startups, administrators, and developers. This system preserves transactions from tampering and provides a tracking tool for tracing past network operations. A personal health record (PHR) system permits patients to control and share data concerning their health conditions by particular peoples. In the case of an emergency, the patient is unable to approve the emergency staff access to the PHR. Furthermore, a history record management system of the patient's PHR is required, which exhibits hugely private personal data (e.g., modification date, name of user, last health condition, etc.). In this paper, we suggest a healthcare management framework that employs blockchain technology to provide a tamper protection application by considering safe policies. These policies involve identifying extensible access control, auditing, and tamper resistance in an emergency scenario. Our experiments demonstrated that the proposed framework affords superior performance compared to the state-of-the-art healthcare systems concerning accessibility, privacy, emergency access control, and data auditing.

Keywords: access control; auditability; blockchain; emergency access; hyperledger composer; hyperledger fabric; personal health record; privacy & security.

I. INTRODUCTION

The adoption of Electronic Medical Records (EMRs) plays a critical role in the enhancement of the intelligence, quality, user experience and costs related to the healthcare system [1]. The EMR stores the patient private information regarding diagnosis and treatments. This private information is highly sensitive but is frequently shared among untrusted peers, such as healthcare providers, pharmacies, patient families and other physicians [2]. Therefore, EMR management imposes a challenge for preserving privacy while assuring data availability for the authorized peers. The patient is supposed to control the delivery of his/her information only to the peers in which he/she trusts. Moreover, EMR data has to be accessible by various peers from different institutions. The lack of interoperability between provider and hospital systems hampers information sharing among peers on the healthcare system [3]. Thus, records are mainly kept fragmented in local databases, which prevents a patient from having a consolidated electronic medical record [4]. Likewise, a patient loses control of where his/her health data are and who is accessing them.

II. Objective

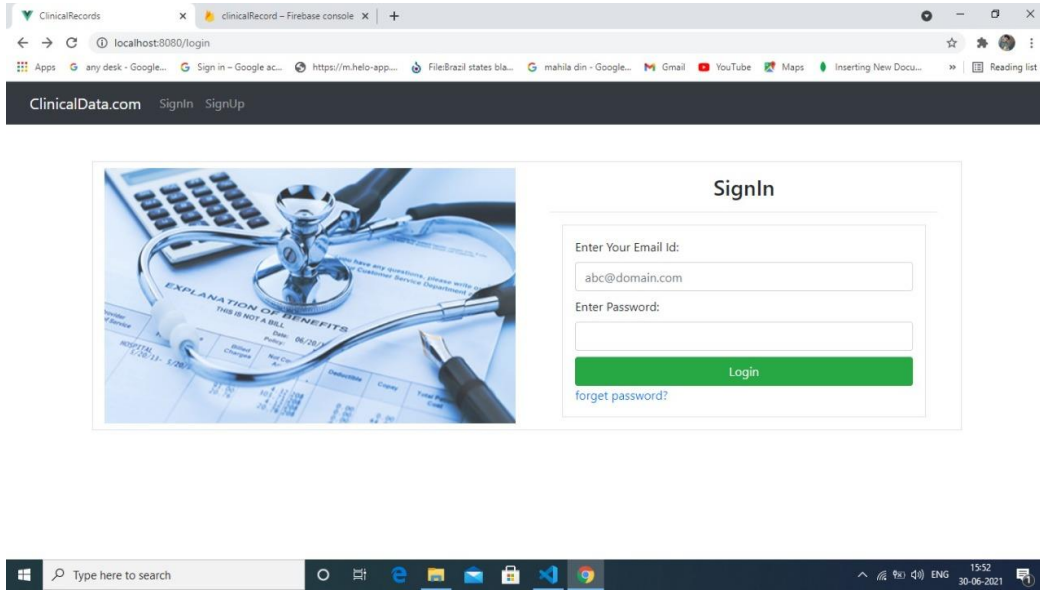
Our goal was to develop a system that will facilitate secure, trustable management, sharing, and aggregation of EHR data. Our patient-centric system allows patients to manage their own health records across multiple hospitals. The system will ensure patient privacy protection and guarantee security with respect to the requirements for health care data management, including the access control policy specified by the patient.

III. METHODS

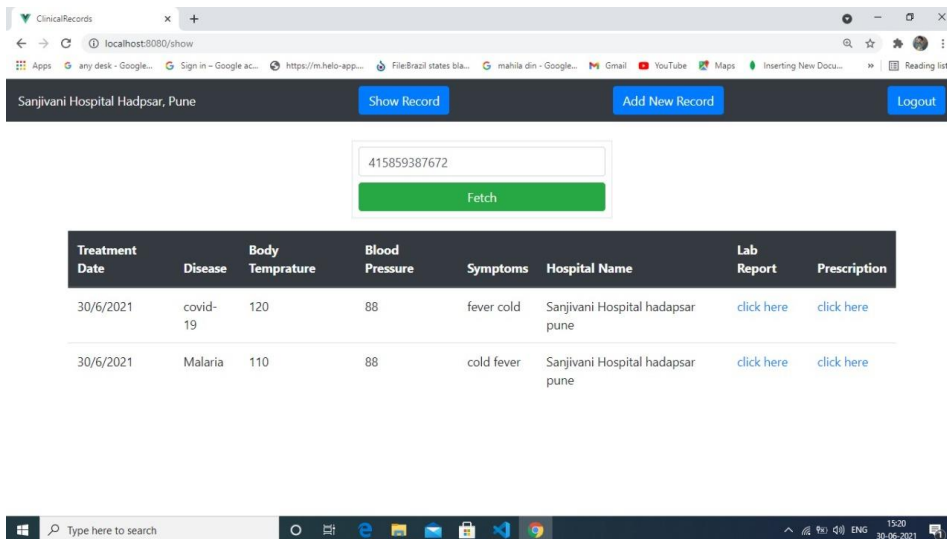
We propose a permissioned blockchain-based system for EHR data sharing and integration. Each hospital will provide a blockchain node integrated with its own EHR system to form the blockchain network. A web-based interface will be used for patients and doctors to initiate EHR sharing transactions. We take a hybrid data management approach, where only management metadata will be stored on the chain. Actual EHR data, on the other hand, will be encrypted and stored off-



chain in Health Insurance Portability and Accountability Act-compliant cloud-based storage. The system uses public key infrastructure-based asymmetric encryption and digital signatures to secure shared EHR data.



patient-centered interoperability brings with it numerous challenges around patient consent, governance, security, privacy, and patient engagement. Blockchain technology, by creating a platform for the secure exchange of data, is an attractive method of addressing these challenges.





IV. RESULTS

In collaboration with Stony Brook University Hospital, we developed ACTION-EHR, a system for patient-centric, blockchain-based EHR data sharing and management for patient care, in particular radiation treatment for cancer. The prototype was built on Hyperledger Fabric, an open-source, permissioned blockchain framework. Data sharing transactions were implemented using chaincode and exposed as representational state transfer application programming interfaces used for the web portal for patients and users. The HL7 Fast Healthcare Interoperability Resources standard was adopted to represent shared EHR data, making it easy to interface with hospital EHR systems and integrate a patient's EHR data. We tested the system in a distributed environment at Stony Brook University using deidentified patient data.

V. CONCLUSION

We studied and developed the critical technology components to enable patient-centric, blockchain-based EHR sharing to support cancer care. The prototype demonstrated the feasibility of our approach as well as some of the major challenges. The next step will be a pilot study with health care providers in both the United States and Switzerland. Our work provides an exemplar testbed to build next-generation EHR sharing infrastructures.

REFERENCES

- [1] X. Yue, H. Wang, D. Jin, M. Li, and W. Jiang, "Healthcare data gateways: Found healthcare intelligence on blockchain with novel privacy risk control," *Journal of Medical Systems*, vol. 40, no. 10, Aug. 2016.
- [2] A. Dubovitskaya, Z. Xu, S. Ryu, M. Schumacher, and F. Wang, "Secure and trustable electronic medical records sharing using blockchain," in *AMIA '17*, vol. 2017, 2017, pp. 650-659.
- [3] A. Azaria, A. Ekblaw, T. Vieira, and A. Lippman, "MedRec: Using blockchain for medical data access and permission management," in *OBD '16*, Aug. 2016, pp. 25-30.
- [4] M. Mettler, "Blockchain technology in healthcare: The revolution starts here," in *Healthcom '16*, Sept 2016, pp. 1-3.
- [5] M. Merz, "Potential of the blockchain technology in energy trading," in *Blockchain Technology: An Introduction for Business and IT Managers*, D. Burgwinkel, Ed. Alemanha: DE GRUYTER, 2016, ch. 2, pp. 51-97.
- [6] X. Zhang and S. Poslad, "Blockchain support for flexible queries with granular access control to electronic medical records (EMR)," in *ICC'18*, May 2018, pp. 1-6.
- [7] K. Christidis and M. Devetsikiotis, "Blockchains and smart contracts for the internet of things," *IEEE Access*, vol. 4, pp. 2292-2303, 2016.
- [8] S. Nakamoto, "Bitcoin: A peer-to-peer electronic cash system," *Tech. Rep.*, 2008.