

# Blockchain Technology for Secure Patient Data Sharing

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## Abstract

This paper presents a decentralized healthcare data management system that utilizes blockchain technology to address critical challenges in data security, patient privacy, and interoperability of electronic medical records (EMR). Traditional healthcare systems rely on centralized databases that are vulnerable to breaches, unauthorized access, and inefficient data sharing. By integrating blockchain's decentralized architecture, cryptographic security, and smart contracts, our system establishes a tamper-proof, patient-centric framework for EMR management. The proposed solution builds on foundational models such as MedBlock and MedRec, introducing novel enhancements like dynamic consent mechanisms, InterPlanetary File System (IPFS) for decentralized storage, and containerized deployment via Docker. Key innovations include storing medical records, including imaging files and diagnostic reports, on the IPFS, with cryptographic hashes anchored to the blockchain to ensure immutability and auditability. The frontend, developed using React for web interfaces and later ported to CustomTkinter for desktop applications, provides intuitive tools for patients and healthcare providers to interact with the blockchain. A containerized backend, orchestrated via Docker, integrates Node.js and Python microservices to handle IPFS uploads and real-time anomaly detection. The system's modular design supports deployment across diverse environments, from cloud servers to edge devices, ensuring scalability and resilience. By combining blockchain's decentralized trust model with modern cryptographic techniques and containerization, this work advances the state of secure, patient-empowered healthcare data management. A third iteration of the project is ongoing, integrating a Large Language Model (LLM) inside the application for assisting in treatment prediction and post-treatment risk prediction, as well as in scanning imaging results and providing a preliminary interpretation of them. Since the aim of our project is to develop a complex application for secure data patient sharing, there were no qualitative results measured yet, but will be presented once all proposed features will be implemented.

**Keywords:** Blockchain; Healthcare Data Management; Smart Contracts; Decentralized Systems; Patient-Centric Data Sharing.

