

ABSTRACT

Since its inception, the electronic health records (EHRs) sector has undergone a remarkable growth. The current landscape has seen an increase in individual's concerns about the significance of electronic health records. The significant growth of the electronic health records (EHRs) domain can be linked to the widespread availability of Internet-enabled devices. This has greatly led to the creation of large amounts of data within the healthcare sector. In order to efficiently handle the substantial increase in data, a centralized client-server architecture has emerged as a practical resolution, facilitating smooth access to relevant information for both users and healthcare practitioners. Nevertheless, although the centralized technical strategy demonstrates efficacy within the present digital context, it has constraints in promptly addressing unforeseen circumstances such as the COVID-19 pandemic. The aforementioned insufficiency has emphasized the necessity for prompt responsiveness, specifically within the framework of pandemic circumstances.

Blockchain technology represents a highly sophisticated digital platform that offers a unique set of capabilities. It essentially operates as a decentralized and distributed ledger, which ensures transparency, security, and immutability of data. In the context of electronic health records, blockchain technology addresses the shortcomings of the centralized model by enabling secure and rapid data sharing among stakeholders, even in the midst of crises. This technology's inherent features, including data integrity, consensus mechanisms, and cryptographic protection, are instrumental in ensuring that critical healthcare information remains accessible and trustworthy, even under the most challenging circumstances. As a result, the adoption of blockchain technology has gained significant attention.

In this light, the researcher has emphasized the importance of improving the security of electronic health records through the integration of blockchain technology,

as detailed in the proposed thesis. The first phase entails performing a Systematic Literature Review (SLR) that focuses on the incorporation of blockchain technology within the healthcare sector. The researcher has developed a set of five research questions with the objective of elucidating the specific domains within the healthcare industry where the incorporation of blockchain technology yields greater benefits. The elucidation of these preset queries has been achieved through a comprehensive analysis of 50 main papers. Subsequently, the researcher has also identified the key challenging areas of healthcare sector through SLR.

In this direction, the researcher has investigated the combined utilization of blockchain and artificial intelligence to address COVID-19 epidemic situations. The work assesses emerging instances of applying these technologies to combat pandemics like COVID-19, encompassing both technological and motivational challenges. The research also explores the need for additional developments in establishing a health monitoring system. Furthermore, the thesis delves into the components and functioning of smart contracts, evaluating their diverse applications and advantages within blockchain systems and concludes by discussing potential use cases of smart contracts in real-world scenarios moving forward.

Furthermore, the researcher has conducted an analysis on the severity of COVID-19 instances and the underlying causes of their transmission. Based on rigorous analysis, it has been ascertained that SIR mathematical models serve as efficacious methods for monitoring the transmission dynamics of COVID-19. Consequently, the researcher has effectively predicted the rate of COVID-19 cases for the forthcoming eight weeks. Furthermore, a wide range of effective preventive actions has been thoroughly discussed in order to mitigate the continued spread of COVID-19.

In addition, the researcher has proposed a novel solution based on blockchain technology that enhances trust among healthcare practitioners and individuals seeking

medical care, hence mitigating the inadvertent spread of COVID-19. This methodology not only monitors individuals diagnosed with COVID-19 but also improves the management of Electronic Health Records (EHRs), effectively resolving prevalent issues such as data loss, privacy concerns, security measures, and establishing agreement on record upkeep. The researcher has proposed a patient-centric electronic health record (EHR) system for COVID-19, which is based on blockchain technology. This system utilizes JavaScript smart contracts to construct a decentralized healthcare system. The security and authenticity of the model are ensured through the use of Hyperledger Fabric and a prototype based on Composer. The utilization of the Hyperledger Caliper tool for performance measurement demonstrates its potential across several scenarios. The results highlight the importance of utilizing blockchain technology to transform healthcare administration in both the immediate and long-term effects of the COVID-19 pandemic. This strategy has the potential to enhance clinical outcomes and promote patient-centered care.

Additionally, the researcher has proposed a web application that prioritizes the needs and preferences of patients, utilizing a public blockchain system. The architectural design under consideration is based on the utilization of the Ethereum blockchain, with a specific emphasis on electronic health records (EHRs) that prioritize the needs and well-being of patients. The proposed framework uses smart contracts and utilizes transaction records implemented in Java, Spring Boot, and SQL. Furthermore, it will enforce access restrictions to electronic health records (EHRs) by means of a security key and a specified account. This aids in effective privacy preservation of electronic health records.

The integration of blockchain technology into the healthcare industry represents a significant transformation. The proposed solutions not only serve as a valuable addition to the current digital infrastructure but also offer a robust framework that can effectively manage the challenges presented by unexpected occurrences like

pandemics. The technology possesses the potential to revolutionize healthcare approaches, enhance patient results, and contribute to the advancement of a healthcare system that is more secure, efficient, and focused on the needs of patients.