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# Blockchain Integrated Smart Healthcare Frameworks for Secure and Transparent Electronic Health Record Management

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# Blockchain Integrated Smart Healthcare Frameworks for Secure and Transparent Electronic Health Record Management

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## Abstract

Blockchain technology has emerged as a transformative solution for enhancing security, transparency, and interoperability in electronic health record (EHR) management. This chapter explores blockchain-integrated smart healthcare frameworks designed to secure sensitive medical data while enabling efficient and transparent sharing among authorized stakeholders. The integration of decentralized ledger technology addresses critical challenges in traditional healthcare systems, such as data tampering, unauthorized access, and lack of patient control over records. Key components including permissioned blockchain architectures, off-chain data storage strategies, and real-time interoperability via APIs are examined in detail. Furthermore, governance models and performance optimization techniques relevant to healthcare consortium blockchains are analyzed to demonstrate their role in fostering trust and scalability. The chapter also highlights future research directions aimed at advancing blockchain adoption in healthcare, emphasizing enhanced data privacy, regulatory compliance, and system integration. This comprehensive overview provides valuable insights for researchers, practitioners, and policymakers striving to implement secure, transparent, and patient-centric EHR solutions.

**Keywords:** Blockchain, Electronic Health Records, Decentralized Ledger, Data Security, Healthcare Interoperability, Smart Healthcare Framework

## Introduction

Blockchain technology has increasingly gained attention for its potential to revolutionize data management in various sectors, with healthcare emerging as a prominent area of application [1]. The management of electronic health records (EHRs) is one of the most critical challenges faced by modern healthcare systems, often hindered by issues such as data fragmentation, security vulnerabilities, and limited patient control over their information [2]. Traditional centralized databases are susceptible to cyberattacks and unauthorized data manipulation, which can compromise patient privacy and clinical outcomes [3]. Blockchain's decentralized ledger system offers a novel approach to these problems by enabling secure, immutable, and transparent record-keeping that is accessible only to authorized stakeholders [4]. This chapter explores how

blockchain integration can establish smart healthcare frameworks that ensure the confidentiality, integrity, and availability of medical data while supporting interoperability across diverse healthcare providers [5].

The core advantage of blockchain lies in its decentralized architecture, which eliminates the single point of failure associated with conventional healthcare information systems [6]. By distributing copies of the ledger across multiple nodes, blockchain enhances the resilience of data storage against cyber threats and system outages [7]. The algorithms underpin the verification of transactions, preventing unauthorized alterations and ensuring data authenticity [8]. Healthcare organizations adopting permissioned blockchain networks can implement stringent access controls while facilitating data sharing among trusted partners, such as hospitals, insurers, and regulatory authorities [9]. This trust model fosters collaborative care and enables patients to exercise greater ownership over their health information, addressing growing demands for transparency and patient-centric services in healthcare delivery [10].