



Blockchain in Healthcare Applications: Research Challenges and Opportunities

Ramesh Rout*

Introduction

Blockchain technology has emerged as a transformative force in the healthcare industry, offering a secure and transparent way to manage patient data and streamline clinical workflows. However, its widespread adoption is hindered by several research challenges, including scalability, interoperability, privacy, and regulatory compliance [1-3].

Research Challenges

Scalability: One of the primary challenges is the limited scalability of blockchain networks. Traditional blockchain architectures, such as Proof of Work (PoW), require significant computational resources and energy consumption, which makes them unsuitable for large-scale healthcare applications. Research is ongoing to develop more efficient consensus mechanisms, such as Proof of Stake (PoS) and Delegated Proof of Stake (DPoS), to address this challenge.

Interoperability: Healthcare data is often siloed within different organizations and systems, making it difficult to share and analyze. Blockchain-based solutions need to be interoperable with existing healthcare information systems (HIS) and electronic health records (EHR) to ensure seamless data exchange and collaboration among healthcare providers.

Privacy and security: While blockchain offers enhanced security through its distributed ledger and cryptographic techniques, it also raises concerns about data privacy. Healthcare data is highly sensitive, and ensuring its confidentiality and integrity is paramount. Research is focused on developing privacy-preserving techniques, such as zero-knowledge proofs and homomorphic encryption, to protect patient information.

Regulatory compliance: The healthcare industry is heavily regulated, and blockchain-based solutions must comply with various legal and regulatory requirements, such as the Health Insurance Portability and Accountability Act (HIPAA) in the United States. Research is needed to explore how blockchain can be designed to meet these regulatory standards while maintaining its core benefits.

*Corresponding author: Ramesh Rout, Department of medicine and health science, Samblapur University, Odisha, India E-mail: routh788@gmail.com

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