Examining the factor's influencing IoT-blockchain based secure transmission services

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Abstract

This study addresses the critical challenge of ensuring secure data transmission and management in Internet of Things (IoT) systems by proposing a blockchain-based architectural framework. Traditional IoT security models often lack fine-grained architectural validation and user-centric evaluation, leading to gaps in trust, data integrity, and operational transparency. To overcome these limitations, the research introduces a novel framework that integrates Transmission Nodes, Inspection Nodes, Forwarding Nodes, and a Blockchain Security Service to secure sensor data from source to destination. The study employs a mixed-method approach, combining conceptual modeling with subjective evaluation from 32 domain experts across development, administration, and IoT service delivery sectors. Key findings indicate that components like the Blockchain Security Service and Transmission Node scored highly in terms of security effectiveness, data integrity, and reliability, while Inspection Nodes revealed varied perceptions, highlighting areas for improvement. The contributions of this study are

fourfold: (1) introducing a user-informed performance assessment model for blockchain-based IoT architectures, (2) validating an operational case scenario using real-world transmission flows, (3) offering a detailed architectural breakdown with defined roles for each node, and (4) establishing a multi-metric evaluation framework incorporating integrity, latency, scalability, and privacy. The findings provide both theoretical and practical insights for enhancing trust and performance in decentralized IoT environments. © The Author(s) 2025.

Author keywords

Blockchain; IoT; IoT protocol; Security; Subjective evaluation

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