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A Lightweight Blockchain: Enhancing Internet of Things Driven Smart Buildings Scalability and Access Control Using Intelligent Direct Acyclic Graph Architecture and Smart Contracts

Authors : Syed Irfan Raza Naqvi, Zheng Jiangbin, Ahmad Moshin, Pervez Akhter

Abstract : Currently, the IoT system depends on a centralized client-servant architecture that causes various scalability and privacy vulnerabilities. Distributed ledger technology (DLT) introduces a set of opportunities for the IoT, which leads to practical ideas for existing components at all levels of existing architectures. Blockchain Technology (BCT) appears to be one approach to solving several IoT problems, like Bitcoin (BTC) and Ethereum, which offer multiple possibilities. Besides, IoTs are resource-constrained devices with insufficient capacity and computational overhead to process blockchain consensus mechanisms; the traditional BCT existing challenge for IoTs is poor scalability, energy efficiency, and transaction fees. IOTA is a distributed ledger based on Direct Acyclic Graph (DAG) that ensures M2M micro-transactions are free of charge. IOTA has the potential to address existing IoT-related difficulties such as infrastructure scalability, privacy and access control mechanisms. We proposed an architecture, SLDBI: A Scalable, lightweight DAG-based Blockchain Design for Intelligent IoT Systems, which adapts the DAG base Tangle and implements a lightweight message data model to address the IoT limitations. It enables the smooth integration of new IoT devices into a variety of apps. SLDBI enables comprehensive access control, energy efficiency, and scalability in IoT ecosystems by utilizing the Masked Authentication Message (MAM) protocol and the IOTA Smart Contract Protocol (ISCP). Furthermore, we suggest proof-of-work (PoW) computation on the full node in an energy-efficient way. Experiments have been carried out to show the capability of a tangle to achieve better scalability while maintaining energy efficiency. The findings show user access control management at granularity levels and ensure scale up to massive networks with thousands of IoT nodes, such as Smart Connected Buildings (SCBDs).

Keywords : blockchain, IOT, direct acyclic graphy, scalability, access control, architecture, smart contract, smart connected buildings
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