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Grant Access Protocol for Consortium Blockchain in Vehicle Maintenance System

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Abstract

A vehicle undergoes various lifecycles, spanning from the manufacturing process to its end-of-life phase. One of the essential life cycles is the ownership period, which involves maintaining the car. The services performed on a vehicle must be properly recorded to ensure that its maintenance and historical records are available and accurate, which is a challenge in the current practice. By leveraging decentralised ledger systems, specifically a consortium blockchain, this work builds upon an existing framework to address current challenges associated with traditional record-keeping methods, such as data silos, fraudulent or tampered entries, and a lack of interoperability between various stakeholders. All stakeholders are considered in the framework to ensure secure and trusted operations. A secure grant access protocol is introduced during the stakeholders' inception phase, specifically for the new vehicle owner. The protocol is formally analysed using the Scyther tool to ensure the security requirements (confidentiality, integrity, and authentication) are met. The security requirements, which include integrity, availability, and non-repudiation, are also analysed

informally. The analyses verify that the proposed protocol is secure and can be applied for logging vehicle service maintenance within the consortium blockchain framework. © 2025 IEEE.

Author keywords

blockchain; formal analysis; secure protocol; vehicle maintenance system

Indexed keywords

Engineering controlled terms

Authentication; Interoperability; Knowledge based systems; Life cycle; Maintenance; Network protocols; Network security; Records management; Vehicles

Engineering uncontrolled terms

Access protocols; Block-chain; End of lives; Formal analysis; Maintenance systems; Manufacturing process; Secure protocols; Security requirements; Vehicle maintenance; Vehicle maintenance system

Engineering main heading

Blockchain

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