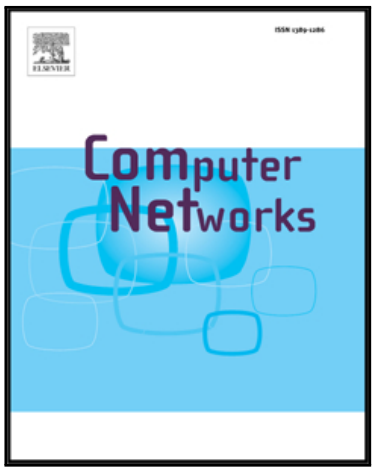

Branch Based Blockchain Technology in Intelligent Vehicle

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Branch Based Blockchain Technology in Intelligent Vehicle

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Abstract

Intelligent vehicle (IV) is an internet-enabled vehicle, commonly referred to as a self-driving car, which enables vehicles-to-everything communications. This communication environment is not secure and has several vulnerabilities. The major issues in IV communication are trustworthiness, accuracy, and security of received and broadcasted data in the communication channel. In this article, we introduce blockchain technology to build trust and reliability in peer-to-peer networks with topologies similar to IV communication. Further, we propose a blockchain-technology-enabled IV communication use case. Blockchain technology is used to build a secure, trusted environment for IV communication. This trusted environment provides a secure, distributed, and decentralized mechanism for communication between IVs, without sharing their personal information in the intelligent transportation system. Our proposed method comprises of a local dynamic blockchain (LDB) and main blockchain, enabled with a secure and unique crypto ID called intelligent vehicle trust point (IVTP). The IVTP ensures trustworthiness among vehicles. Vehicles use and verify the IVTP with the LDB to communicate with other vehicles. For evaluation, we simulated our proposed blockchain technology-based IV communication in a common intersection deadlock use case. The performance of the traditional blockchain is evaluated with emphasis on real-time traffic scenarios. We also introduce LDB branching, along with a branching and un-branching algorithm for automating the branching process for IV communication.

Index Terms—**Blockchain technology; Intelligent Vehicles; Communication; Privacy; Trust; Security.**

1. Introduction

Nowadays, vehicles are faster, more sophisticated, and more efficient. These advancements result from dozens of electronic control units (ECUs) and a vast communication network interconnecting them and enabling a whole new driving experience from vehicles that can be remotely locked or unlocked, to vehicles that can be driven without the key in the ignition, and vehicles that can drive or park themselves. Recently, vehicle manufacturers have been competing not only in the field of physical vehicle design or the engine's force and performance, but also the new functionalities that are offered to the driver. Similarly, you can find Google's driverless vehicles driving themselves in Nevada, which are also allowed in Florida and California. Therefore, it is just a matter of time until we see more autonomous vehicles around, which will probably raise driving safety. Not only are the new vehicles being equipped with this new technology, but even the older vehicles share some of these features and architecture. This new driving experience functionality is achieved with hundreds of megabytes of code contained in the vehicle's ECUs. However, what about the security aspects? We are in the 21st century and are no longer surrounded by mechanical vehicles; instead, there are computers on wheels owing of the recent advances in technology. Currently, it is possible to deploy these technologies to create numerous safety devices and protocols for vehicles, such as forward-collision warning, automatic emergency braking, vehicle-to-vehicle technologies, and in the future, we may witness fully automated vehicles. Intelligent Transportation System (ITS) uses ad-hoc networks for vehicle communication such as Dedicated Short Range Communication (DSRC), Wireless Access Vehicular Environment (WAVE), and cellular network, which does not guarantee secure data transmission [1]. Currently, vehicle communication application security protocols are based on cellular and IT standard security mechanism, which are not up-to-date and unsuitable for ITS applications. Still, many researchers are working to provide a standard security mechanism for ITS [2].

We propose blockchain technology for secure, intelligent vehicles communication, which can be used to keep track of the data generated by vehicles and verify it using the blockchain [3]. We also introduce branching and un-branching of the local dynamic blockchain for intelligent vehicle communication. Every message that a vehicle sends is used by other vehicles for generating proof-of-work and for mining a block. After that, the block may be added to the blockchain. We have evaluated our proposed mechanism through an intelligent vehicle intersection use-case scenario. This scenario involves four vehicles reaching the intersection at nearly the same time, which leads to a deadlock because the