Communication framework for vehicular ad-hoc networks using Blockchain: Case study of Metro Manila Electric Shuttle automation project

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Abstract

Vehicular Networks or the Vehicular Ad-hoc Networks (VANET) are experiencing revolutionary growth in research and industry, but still suffers from various breaches such as poor decentralization of communication, security vulnerabilities, scalability and trust issues in its communication as well as in its design. Major issues identified in VANET, are trust, data accuracy, and reliability of communication in the communication channel. Blockchain technology is a technology adopted by crypto currency, namely Bitcoin, which is recently used to build trust and reliability in peer-to-peer networks. This study proposes a communication framework for VANET exploring capabilities of blockchaining. Metro Manila Electric Shuttle Automation Project is used as a case study to verify the communication framework. It fulfills Vehicle-to-Vehicle (V2V) as well as Vehicle-to-Infrastructure (V2I) communication requirements of the considered project. It includes an Intelligent Toll Payment (ITP) system (V2I communication) and automated vehicular following, known as goose tracking (V2V and V2I communication), and those covering main communication requirements. Further, a simulator named SimulatorZ is implemented to model Goose Tracking which should support multi-vehicle simulation to understand data requirements of master and slave vehicles and the timing of communication. Communication framework provides trustworthiness for vehicles behavior, cashless secure transaction between two untrusted party as well as rewards and penalties for vehicles' actions. Data communication in goose tracking is done with 10ms latency between two vehicles and 1-10^{-5} reliability. Slave vehicles' movements depends on master vehicle's speed, position, angle and the timestamp.

Keywords: *BlockChain, Communication framework, Metro Manila, VANET*