Chapter 7
Federated Learning-Enabled Secure Blockchain-Based Sharing Framework for Vehicle Ad Hoc Network

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ABSTRACT

In this chapter, federated learning-enabled Secure Blockchain-based Sharing Framework for Vehicle Ad Hoc Networks (VANETs) coordinating federated learning (FL) and blockchain innovation to form a decentralized, privacy-preserving, and secure stage for vehicular communication and information sharing. This inventive system addresses basic challenges in VANETs, such as information protection, security, and real-time collaboration, by empowering vehicles to collaboratively prepare machine learning models locally utilizing their claim information and safely share overhauls through a tamper-resistant blockchain record. Key points of interest incorporate improved believe, versatility, flexibility to assaults, and compliance with protection controls, making it a promising arrangement for applications like collision avoidance, activity optimization, and independent driving bolster. Be that as it may, challenges such as computational complexity, communication inactivity, information heterogeneity, and security vulnerabilities pose critical hurdles to its usage.

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I. INTRODUCTION

The fast advancement of shrewdly transportation frameworks (ITS) has changed the way vehicles communicate, explore, and connected with their environment. At the heart of this change lies the Vehicle Ad Hoc Network (VANET), a decentralized and energetic communication arrange shaped by vehicles and roadside framework. VANETs empower real-time information trade among vehicles (V2V – vehicle-to-vehicle) and between vehicles and infrastructure (V2I – vehicle-to-infrastructure), encouraging applications such as activity administration, collision evasion, and independent driving. In any case, the expanding complexity and network of VANETs present noteworthy challenges, especially in terms of information protection, security, and productive asset sharing. Conventional centralized approaches to information administration and handling in VANETs regularly drop brief due to idleness, single focuses of disappointment, and defenselessness to cyberattacks. To address these restrictions, a novel framework integrating Federated Learning (FL) and Blockchain innovation has risen as a promising arrangement. This presentation investigates the conceptualization, importance, and operational standards of a Federated Learning-enabled Secure Blockchain-based Sharing System for VANETs, emphasizing its potential to revolutionize secure and proficient information sharing in vehicular systems. VANETs work in a exceedingly energetic environment where vehicles are always moving, shaping brief associations with adjacent hubs. This advertisement hoc nature makes it challenging to guarantee dependable communication and believe among members. Vehicles create gigantic sums of information, counting area arranges, speed, activity conditions, and sensor readings, which are basic for improving street security and activity productivity. Be that as it may, sharing this information with centralized servers raises protection concerns, as delicate data might be uncovered to unauthorized substances or abused by pernicious performing artists. In addition, the heterogeneity of gadgets in VANETs—ranging from high-end independent vehicles to fundamental associated cars—complicates the plan of a uniform data-sharing instrument. Centralized machine learning models, which depend on amassing information in a single area for preparing, worsen these issues by requiring steady information transmission, driving to transmission capacity over-burden and expanded idleness. In this setting, Federated Learning offers a decentralized elective that jam protection whereas empowering collaborative learning over distributed nodes. Federated Learning may be a disseminated machine learning worldview where different gadgets collaboratively prepare a shared demonstrate without trading their raw information (Agarwal et al., 2023). Instead of sending delicate information to a central server, each vehicle in a VANET performs local computations utilizing its possess dataset and offers as it were the show updates (e.g., gradients or weights) with a coordinating substance. These upgrades

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