

Chapter 16

Policy and Regulatory Considerations for Blockchain and Federated Learning in IoV


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ABSTRACT

The union of Blockchain and Federated Learning (FL) technologies in the Internet of Vehicles (IoV) domain has ushered in new possibilities for privacy-preserving, decentralized, and cyber-resilient financial use cases. As autonomous and connected vehicles (CAVs) are integrated with edge computing and 5G/6G networks, these smart nodes increasingly engage in real-time financial transactions spanning from usage-based insurance, automated tolls, electric vehicle charging fee payments, to intelligent vehicle leasing and decentralized vehicular identity management. Such a dynamic scenario is best addressed by Blockchain technology, which provides a

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decentralized ledger system that promises immutability, transparency, and trust, which are perfect for authenticating transactions like insurance claims, micropayments, and contractual fulfilment in mobility finance. This enables IoV stakeholders to build predictive systems with data sovereignty and low latency. Even so, the joint employment of blockchain and FL in financial environments poses important regulatory and ethical challenges.

1.INTRODUCTION

The Internet of Vehicles (IoV) is quickly transforming from a networked automotive communications platform into a hi-tech cypher-physical system (Lin et al., 2017). Cars can now compute and network, allowing them to perceive, process, and respond to huge volumes of data. However, in the effort of making the automobile safe, more navigational, and fun, IoV systems are now changing the financial interaction paradigm of vehicles giving much softer IoV systems automated and real-time functions from use-based insurance to tolling, vehicle micropayments, leasing, and even autonomous energy trading (Xu et al., 2021). Cars are increasingly becoming financial agents that complete transactions, execute, contracts, and interact with digital infrastructure. This shift from being passive carrier objects to active autonomous financial nodes creates new challenges, most importantly, data privacy issues, regulatory compliance, transparency, security, and managing boundaries liability (Mishra et al., 2022). The financial system architecture centralized, highly regulated and audit-based contrasts with the mobile, decentralized, and privacy-driven nature of IoV operations.

To address these challenges, two enabling technologies emerged: Blockchain and Federated Learning (FL). The decentralized system of Blockchain can offer financial trust by enforcing obligation without being mutable or transparent.

Federated learning provides decentralized machine learning between edge devices such as vehicles without sharing raw data to a central point, maintaining user privacy and respecting present data privacy paradigms.

Based on this, this chapter formulates three closely related goals:

- To explore how blockchain and FL can be integrated together to enable autonomous financial decision-making in vehicles.
- To look at the policy and regulatory implications of this integration, with a focus on privacy, accountability, and cross-border compliance.
- To design a Federated Governance Framework that implements hybrid on-chain/off-chain monitoring for financial IoV ecosystems.

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