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AI-Enhanced Route Optimization Algorithms: A Survey on Intelligent Transportation Systems

Khursheed Mohammed Hussain
Data Architect, J.B. Hunt Transport
kd.hussain811@gmail.com

Abstract: *India, possessing the world's second-largest road network, continues to experience frequent and fatal road accidents, emphasizing the critical need for effective traffic monitoring and route optimization. In order to increase road safety, alleviate traffic, and control traffic, modern technologies like cloud computing, artificial intelligence (AI), the Internet of Things (IoT), and real-time data analytics have been combined to create Intelligent Transportation Systems (ITS), which have revolutionized the industry. This paper investigates the foundational concepts of route optimization in ITS, the enabling communication technologies such as V2X, DSRC, and C-V2X, and the architecture of ITS data ecosystems. A key component of dynamic route planning is the integration of AI through machine learning (ML), deep learning (DL), reinforcement learning, swarm intelligence, traffic signal optimization, and predictive maintenance. Furthermore, the paper reviews key AI-based methodologies, real-world case studies, and emerging techniques aimed at improving efficiency, safety, and sustainability in transportation. The paper concludes by highlighting ongoing advancements and identifying future directions for research in AI-driven ITS frameworks.*

Keywords: Intelligent Transportation Systems (ITS), Route Optimization, V2X Communication, DSRC, C-V2X, Traffic Management

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