ADAPTIVE Q-LEARNING FOR VEHICLE-TO-VEHICLE (V2V) CHARGING IN ELECTRIC VEHICLES FOR SMART TOURISM DESTINATIONS

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ABSTRACT
This paper investigates the application of adaptive Q-learning to optimize vehicle-to-vehicle (V2V) charging among electric vehicles (EVs) specifically within smart tourism destinations. V2V charging offers a promising solution for extending driving range and enhancing the operational flexibility of EVs in these dynamic environments by enabling direct energy transfer between vehicles. However, optimizing this process requires complex decision-making to efficiently balance energy distribution in varied and unpredictable conditions. This study develops an adaptive Q-learning algorithm tailored to the unique challenges of smart tourism destinations. The algorithm dynamically adjusts its learning parameters to improve performance in these environments. The methodology includes modeling a fleet of EVs with V2V charging capabilities and simulating their interactions within a custom-built environment that reflects the characteristics of smart tourism destinations. The algorithm learns optimal charging actions by considering the state of charge and spatial positions of each vehicle, with a reward function designed to incentivize efficient and balanced energy transfer. Simulation results demonstrate that the adaptive Q-learning algorithm significantly outperforms traditional rule-based approaches in terms of total energy transferred, average state of charge, and energy transfer efficiency, particularly in the context of smart tourism. The algorithm's ability to dynamically adapt enhances its robustness and effectiveness in these complex environments. Finally, adaptive Q-learning offers a viable and innovative approach for optimizing V2V charging in EVs within smart tourism destinations, providing substantial improvements over conventional methods. Future research should explore extending the algorithm's capabilities to manage more complex and dynamic scenarios, including real-time traffic data and vehicle mobility patterns characteristic of smart tourism destinations.
Keywords: Adaptive Q-learning, Vehicle-to-Vehicle Charging, Electric Vehicles, Optimization, Reinforcement Learning

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