Software Defined Networking Assisted Electric Vehicle Charging: Towards Smart Charge Scheduling and Management

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Recent advancements in plug-in Electric Vehicles (EV) have opened up Intelligent Transportation Systems (ITS) services to a greater extent. However, charging rechargeable batteries for EV remains a major concern among researchers. Moreover, EV charge management systems require optimal and personalized charging schedules that opt for a centralized controller. This article proposes a Software-Defined Network (SDN)-assisted EV Charge (SEVC) scheduling and management strategy for effective charge scheduling and providing personalized charging services. The SEVC framework has SDN as a centralized controller that receives the charging requests from Vehicular Edge Computing (VEC) servers. The proposed Federated Support Vector Machine (FS) algorithm in SEVC trains the local model available in VEC nodes and updates the SDN global model. The FS algorithm estimates EV charging demand and schedules EV to charge from optimal Recharging Terminals (RT). Moreover, based on the historical charging requirements of EV, the SEVC framework predicts future charging demands of EV, which helps in scheduling and managing EV charging. Since model parameters alone are transmitted to SDN via VEC nodes, the overhead of the SEVC framework is reduced drastically. Our experimental analysis shows that the proposed SEVC framework is 17.32% more efficient than existing algorithms in terms of accuracy, latency in processing charging requests, waiting time of EV, and total running time of algorithms.

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A key to modern transportation systems is the introduction of Electric Vehicles (EV), which are eco-friendly and do not produce harmful emissions. Each EV is equipped with a rechargeable battery, which can be charged with electricity. As fossil fuels are non-renewable energy resources, re-usage of such fuels is impractical [1], and this situation makes EV an essential component in the future development of Intelligent Transportation Systems (ITS). However, due to rechargeable batteries, EV undergo certain challenges such as finding Recharging Terminals (RT), limited driving range, higher charging times, and expensive replacement of batteries. With the prevalence of green EV, the way to develop an efficient charge scheduling method to recharge while driving has become a significant problem [2].