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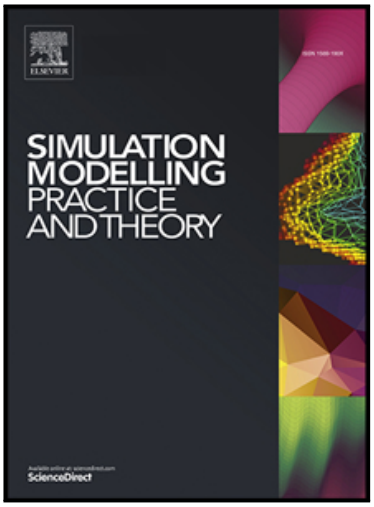

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An Agent-based Negotiation Scheme for the Distribution of Electric Vehicles Across a Set of Charging Stations

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Abstract

We consider the problem of scheduling Electric Vehicle (EV) charging within a set of multiple charging stations. Each station aims to maximize the amount of charged energy and the number of charged EVs. We propose an agent-based simulation scheme, where the EVs announce their requests to the stations and each station computes an optimal solution using Integer Linear Programming (ILP) techniques. We propose two variations of the problem, namely the Offline Mode and the Online Mode. In the first one, all the EVs send their charging requests simultaneously at the beginning of the simulation and the stations compute their charging schedules at once, while in the second one each EV may send a charging request at whichever time point and the stations compute their charging schedules incrementally. Moreover, we apply agent-based negotiation techniques between the stations and the EVs to service EVs when the ILP problem is initially unsolvable due to insufficient resources at some stations. Finally, we insert delays in the Online Mode, meaning that an EV that came to an agreement with a station may cancel this agreement and request charging anew. We test our scheme for both variations, Offline and Online, for a diverse set of stations and EVs and show the outcomes of the different scenarios in the system.

Keywords: electric vehicle, charging station, optimal charging schedule, negotiation, intelligent agents, agent-based simulation