Optimizing Real Time Operations of One-way Electric Carsharing Systems

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Abstract

Carsharing is a mode of transportation which allows its users to rent cars for short periods of times. Although one-way systems are more attractive to their users, operators prefer to implement easy-to-operate and implement round-trip systems. Furthermore, round-trip systems provide the flexibility of early reservation which is not an option in most of the operating one-way systems. In these systems, users are usually allowed to reserve vehicles which are available at the time of reservation shortly (not longer than 30 minutes) before the pick-up time. With an additional feature of early reservations, one-way systems can attract more customers and increase their efficiency without requiring additional investment. In this research, our ultimate aim is to combine early and last-minute reservations for one-way non-floating electric carsharing systems. For this purpose, we developed a simulation framework which takes the demand and other system information as input. This simulator replicates a generic carsharing system including rental requests, movements of vehicles and relocation personnel. Furthermore, it allows developing different algorithms to decide on operational decisions that include vehicle (and personnel) relocation and rental decisions. We also developed a mathematical model which maximises the number of rentals served with minimum relocation cost without violating operational constraints. This mathematical model is integrated to this simulation framework to test the system performance in real time with the data from carsharing system in Nice, France.

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