The pickup and delivery problem with online transfers, for the next generation of public transport

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Abstract

We introduce and study a new variant of the vehicle routing problem, which we call the pickup and delivery problem with online transfers (PDPOT), motivated by an innovative passenger transportation concept involving self-driving vehicles. These vehicles are designed in a way that they can couple/decouple while en-route and transfer passengers seamlessly towards more efficient capacity utilization and traffic management. Due to the potential reduction in fuel/energy consumption and travel costs, there are studies in the vehicle routing literature taking transfer opportunities into account within their framework. The most closely related vehicle routing problem to the one we consider in this study is the pick-up and delivery problem with transfers. However, the main difference and perhaps the most challenging aspect of the PDPOT is that when two or more vehicles couple, the passengers may transfer from one vehicle to another during the time the vehicles are traveling together as a single vehicle. Among the major contributions of our study are: (1) the development of an optimization based approach to solve a complex vehicle routing problem arising in an on-demand transportation system involving autonomous shared vehicles, (2) investigating the economic, social, and environmental benefits of the door-to-door shared mobility service with online transfers compared to private door-to-door rides and compared to shared mobility services with outside transfer possibilities.

Keywords: On demand shared mobility, pick up and delivery with online transfers, autonomous vehicles

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