Decentralized dynamic task allocation and route planning for autonomous delivery vehicles in urban areas

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Abstract

We address the problem of assigning and executing orders for a fleet of autonomous electric delivery vehicles operating in urban areas. The vehicles are equipped with storage units, allowing them to transport several packages at the same time. Material handling equipment supports the automatic exchange of loads at mechatronic post-boxes. Together, this leads to a new form of last mile logistics, reducing traffic volume and pollution in cities. Related applications in intralogistics, where automated guided vehicles (AVG) are already widely used for material handling, often use decentral control systems for deciding on task assignment and routing. In our talk, we investigate whether these control concepts can be transferred to urban vehicle fleets in the light of changing operational factors, e.g., the ratio of driving time to service time, the fact that several orders can be transported simultaneously, and the impact of traffic and congestion. To this end, we propose a multi-agent system (MAS), where orders are allocated via sequential auctions. We evaluate this system based on a discrete-event simulation. The quality of the decentral control strategies are compared with central solution approaches to the corresponding static vehicle routing problem with pickup and deliveries.

Keywords: autonomous vehicles, dynamic vehicle routing, multi, agent system, discrete, event simulation, urban logistics

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