A New Distribution Paradigm: Delivery of Medicines by Drone

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Abstract

This work analyses a new paradigm imposed by the integration of unmanned aerial vehicles (UAV), commonly referred to as drones, in logistics and distribution processes. This work is motivated by a real case-study, where the company Connect Robotics, the first drone delivery provider in Portugal, wants to implement drone deliveries in a pharmacy located at a rural region. This pharmacy delivers medicines to five nursing homes every day. However, this is a service that causes some problems in the drugstore's daily operations considering it requires an available vehicle, as well as an employee leaving their station. Moreover, rural road networks do not always enable a fast delivery and, unfortunately, car accidents are not unprecedented either. Therefore, drone deliveries came as a potential answer to these issues, but it requires tackling some logistics challenges brought by the drones' characteristics. From the literature, the parallel drone scheduling travelling salesman problem (PDSTSP) was considered the most similar to the problem at hand since its formulation considers the drone integration concurrently with a road vehicle. Therefore, this work proposes the parallel drone scheduling vehicle routing problem (PDSVRP), which is based on the PDSTSP but allows for multiple road vehicle routes. Two variants of this problem were modelled: (1) the daily delivery operations and (2) single delivery operation, with two objectives: cost and time minimization. The MILP models were implemented with real data and the results obtained suggest that it is possible to obtain savings in the cost and transportation time of the pharmacy's deliveries.

Keywords: drone deliveries, unmanned aerial vehicles, drones, last mile deliveries, vehicle routing problem

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