Title

Multi-Objective Optimization of Hybrid RPAS–Public Transit Networks for Urban Last-Mile Delivery under Uncertainty

Abstract

This seminar presents a hybrid optimization framework for integrating Remotely Piloted Aircraft Systems (RPAS) with public transportation systems (PTS) to improve the efficiency, robustness, and sustainability of urban last-mile delivery under operational uncertainty. The proposed model adopts a two-layer decision structure that simultaneously addresses task allocation and route optimization while accounting for RPAS endurance, payload feasibility, transit schedules, and boarding constraints.

Operational uncertainties arising from stochastic travel times, synchronization delays, and system disruptions are modeled using Monte Carlo simulation and embedded within a multi-objective Non-dominated Sorting Genetic Algorithm II (NSGA-II). The framework jointly minimizes delivery time, operational cost, and energy consumption, enabling the exploration of Pareto-optimal trade-offs across multiple uncertainty scenarios, including boarding conflicts, transit unavailability, and multi-leg transfers.

Simulation results demonstrate that coordinated RPAS–PTS operations can significantly enhance delivery robustness and efficiency compared with direct aerial delivery, particularly in dense urban environments. The study highlights how uncertainty-aware optimization and multimodal coordination can support scalable and resilient aerial logistics systems and inform future deployment of intelligent urban air mobility infrastructures.

Bio

Leila Hashemi is a Ph.D. candidate in Aerospace Engineering at Carleton University. Her research focuses on hybrid RPAS–public transit delivery systems, multi-objective and robust optimization, uncertainty modeling, and quantitative risk assessment for sustainable logistics networks. She has extensive experience in metaheuristic optimization, Monte Carlo simulation, Bayesian reliability modeling, and energy and CO_2 performance analysis of aerial delivery systems.

Leila has published in high-impact journals including Cleaner Logistics and Supply Chain, Sustainable Futures, and Drone Systems and Applications, and serves as a reviewer for several international journals in transportation, optimization, and aerospace engineering. Her broader research interests include intelligent transportation systems, risk-aware decision support, and resilient urban logistics.