Obstacle Clustering and Path Optimization for Drone Routing

Ang Li, Mark Hansen
Department of Civil and Environmental Engineering
University of California, Berkeley
Berkeley, CA, USA
angli@berkeley.edu, mhansen@ce.berkeley.edu

Abstract— To enable safe and efficient Unmanned Aircraft Systems (UAS) operations at low altitudes, it is necessary to conduct airspace management and operations for UAS traffic. This study focuses on deterministic clustering-based drone routing, with specific emphasis on the trade-off between horizontal and vertical travel costs. The routing problem is simplified to a 2D problem that we solve at several altitude candidates. Altitude candidates were generated based on clustered static obstacles in low urban airspace. Fast-Marching algorithm is performed to generate the shortest path at each altitude candidate. The optimal altitude is determined by weighing the vertical cost for ascent and descent over the horizontal cruising cost at certain altitude. Experiments are conducted to choose proper number of clusters and weight given to building height in the clustering procedure, and different shortest path algorithms are compared. Larger scale of Unmanned Aerial Vehicles (UAV) missions are simulated, based on which we analyze the relationship between optimal travel altitude and shortest cruise path, and estimate the UAV cost function.