Summary

In order to support the Puerto Rico hurricane disaster scenario, we need to develop a DroneGo disaster response system to be able to conduct both medical supply delivery and video reconnaissance of road networks.

After initial analysis, we start with identifying the best locations of cargo containers and then address the whole problem. When selecting the best locations, we take transportation cost and reconnaissance area into account. Through establishing transportation cost function to solve the optimal solution and calculate the reachable area of each candidate position, we get the best three locations are Fajardo, Bayamon and Arecibo.

Once the locations are determined, we can calculate the quantity of each medicine package in each cargo container and how they are delivered to other places. Next, we develop a comprehensive indicator to evaluate the performance of each drone type, and select the best transport and reconnaissance drones. Then we use EasyCargo to load medicine packages and drones to container to maximize space utilization. For example, the container at Bayamon is loaded with 18 F, 12 G, 1 H, 300 Med1, 120 MED2 and 180 Med3. More results are shown in paper.

Given the drone fleet at each location, we then develop delivery and scouting plan.

Drones at Fajardo and Arecibo only need to perform scouting mission. For drones at Bayamon, we first load drones to deliver medicine and optimize their drone payload packing configurations. We establish a delay time function to arrange their schedule.

Afterwards, we use the grid method to abstract the major highways, and then we use cellular automaton to get the optimal scouting plan. Greedy algorithm is used to give primary transfer rules and weight functions.

Finally, we apply sensitivity analysis of the parameters used in the model to verify the sensitivity and rationality of the parameters. And then we provide some simple and feasible trade-offs in case of insufficient delivery or reconnaissance ability.

Key Words: Multi-objective optimization, Three-Dimension Knapsack Problem, Cellular Automaton, Greedy Algorithm