Simulating and Scheduling Last Mile Package Delivery by Autonomous Drones

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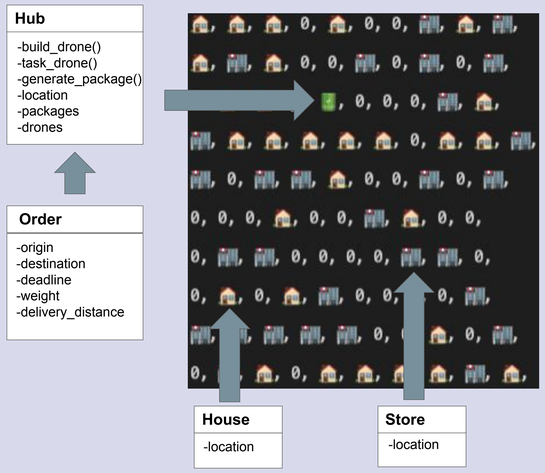
Objective

- To find the most optimal scheduling algorithm for picking up and delivering packages via simulated drones

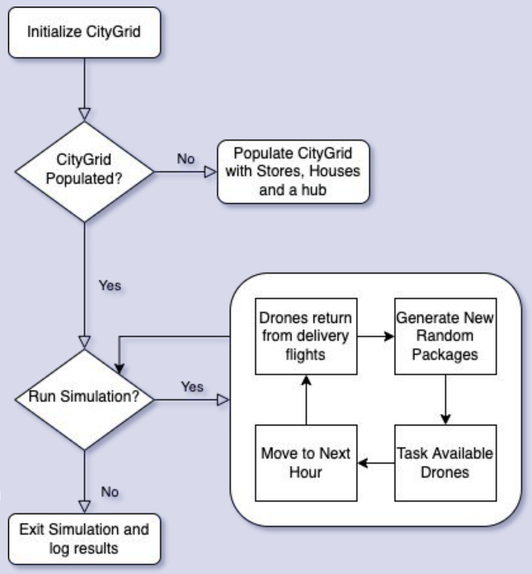
Motivation

- Schedule Optimization is an important consideration for high-volume, last-mile autonomous cargo operations
- Utilizing autonomous aerial systems for last-mile package delivery could lower delivery costs while burgeoning the field of air cargo.
- Effectively scheduling when and which packages are to be picked up is important for ensuring on time delivery.

Simulation



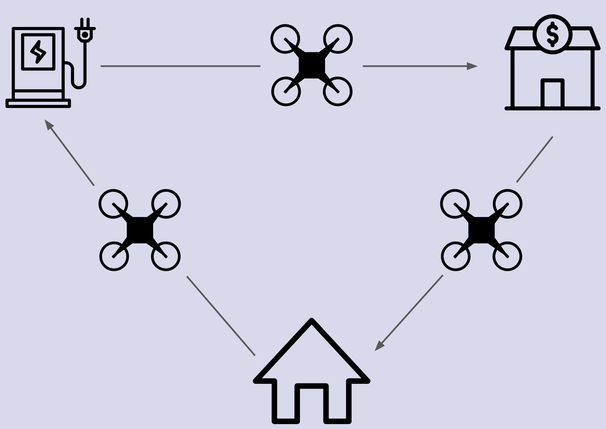
- Each block is 1 mile. Drones in simulation travel 30 miles per hour



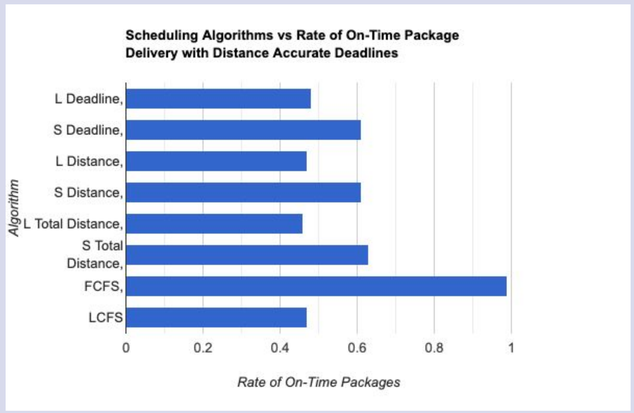
Future Work

- Test more types of scheduling algorithms
- Investigate why FCFS outperforms other algorithms
- Test different types of randomization seeds, the results shown in the Initial Results section were tested all on the same seed, which may cause data to be misleading
- Use reinforcement learning to train a scheduling algorithm
- Expand simulation to take into account weight of packages, drone energy/range, time needed to charge drones
- Analyze data further: how close missed packages were to being delivered, how close late packages were to being on time, time placed vs time picked up, etc.
- Implement drones that can carry multiple packages

Visual Example



Preliminary Findings



L = Longest
S = Shortest
FCFS = First Come First Served
LCFS = Last Come First Served

Each Scheduling Algorithm prioritizes packages based on a predetermined metric. For Example, L Deadline takes the Longest Deadlines and prioritizes them to be picked up first

"Rate of On-Time Packages" is calculated by dividing the amount of On-Time Packages by the total number of packages.

Simulation ran for 100000 hours with 3 packages generated per hour and 10 drones. All Simulations are run on the seed 2.

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