Quadcopters Package Delivery System

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Abstract

Abstract of the project goes here

Figure 1: Figure caption

Introduction

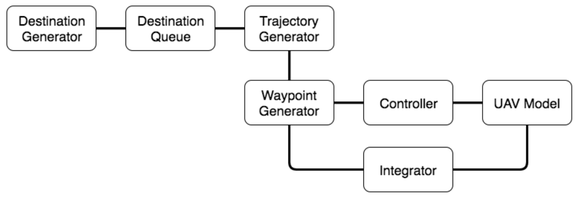
One of the main economic and environmental concerns for package delivery arises within the last mile of transit. Often times deliveries are delayed at the warehouse so they may be grouped together to fill a truck's capacity. The truck is then responsible for delivering its entire payload by exhaustively traversing to each customer's house. This is not always the most efficient method and does not guarantee deliveries to be made in the least amount of time. Companies are exploring the use of small unmanned aerial systems (UAS) for local package deliveries in an attempt to minimize these inefficiencies and to offer rapid delivery services [1]. However, the effect this would have on the National Airspace (NAS) is mostly unstudied. In an attempt to study the traffic that would be produced, we aim to build a simulation that uses UAS vehicles flying at low altitude to deliver packages from local warehouses when requests are made. As we build this simulation we must assume certain parameters especially since this type of service is not yet offered. For the purposes of analyzing the air traffic on a larger scale, we will assume that the warehouse will manage ground level traffic for takeoff and landing purposes at the warehouse. When using small UAS vehicles, it is safe to assume this will not cause much change in the overall traffic of the simulation. Another assumption

Approach

- Data Collection - In order to simulate a more realistic data we collected San Jose terrain, population, Walmart, and K-12 school location. The data was provided from the United States Geological Survey (USGS), United States Census Bureau, Walmart.com, and Schooldigger.com, respectively.
- Initial Framework - The structure of the simulation focused around which warehouses were chosen to have a delivery fleet.
- Single Package Delivery - UAS vehicles reponded to one one request traversing to the destination and following the same path back to the warehouse.
- Multiple Package Delivery - UAS vehicles carrying multiple packages optimize which destinations to delivery to based on proximity to the first destination.

System Model

Upon a package request, the location of who placed the order is added to a queue. The queue is read whenever there is an available vehicle at the warehouse. Trajectories are then built from the warehouse to the destination, from the first destination to the second, and back to the warehouse. Once assigned a trajectory, the vehicle follows the reference points along the trajectory until returning to the warehouse to recharge. When in transit to the destination, the trajectory will keep the vehicle awway from the no-fly-zones defined around airports and above schools.



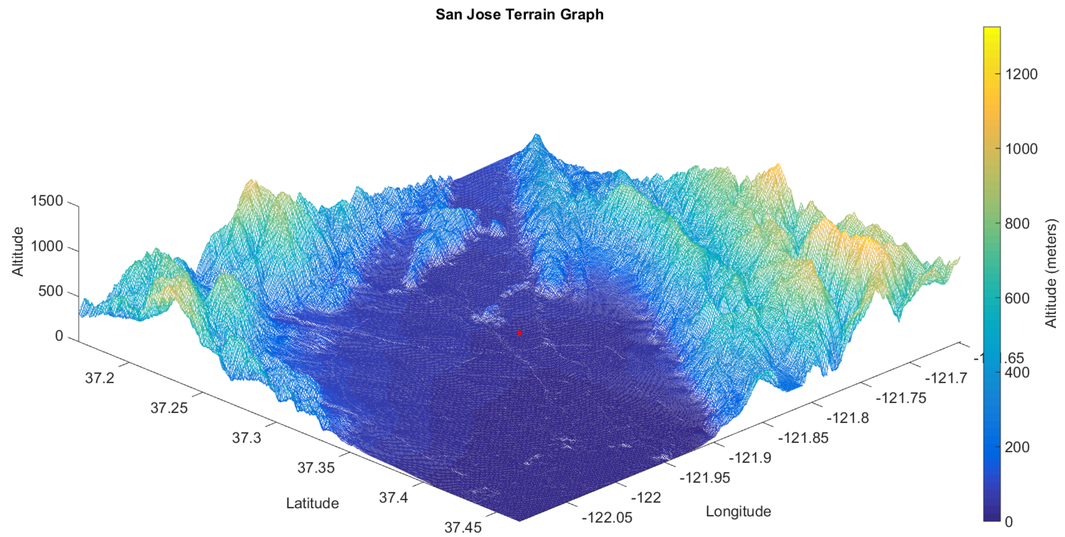


Figure 3: Figure caption

Results

Conclusion

Based off the simulations performed in the framework for multiple package delivery service using UAS vehicles, we have defined a functioning set of requirements in order to implement such a system.

References

[1] A. B. Dacidson Helen and J. M. Smith. Dronedelivery service aims for take-off in november. *Journal title*, 2013.

[2]

[3]

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