Literature Review

The purpose of this review is to explore exactly what a drone delivery is, benefits of delivering via drone, and different methods of implementing a delivery scheduler. It will conclude with a recommendation on preferred techniques and environments to develop the scheduler in.

**Drone Delivery**

A drone is an small, unmanned flying vehicle. In recent years many companies have unveiled plans to begin delivering packages via drone. In 2013 Amazon announced their ‘Prime Air’ service that will deliver packages to customers (Rose, 2013). DHL have announced their ‘Parcelcopter’ project, which has successfully delivered medicine to the island of Juist in the North Sea (Hern, 2015). There are many more companies who have unveiled plans to release their own delivery drone solution (Sacramento, 2019). This sudden upsurge in use has been brought on by advancements in technology used in construction of drones. The price of manufacturing carbon fibre has dropped from $25 to $10 per kg over the last 20 years. This combined with improvements in battery technology allows drones to fly faster and further (Dorling et al, 2017).

There is great demand from customers for a faster, more reliable option for delivery. This is a driving factor in the development of drones for last-mile delivery. A study conducted on over 4700 people from China, Germany and the USA showed that 23% of customers are willing to pay extra for the benefit of same-day delivery (McKinsey, 2016).

Img1

There are several advantages to using drones for so called last-mile delivery. The primary advantage of drone’s vs trucks is the speed and timing accuracy as drones are not affected by traffic or road layout of a city. This enables them to offer fast delivery and tell the customer to the minute when the parcel will arrive (Hau L. Lee et al, 2016).

For the company deploying the delivery solution, they will likely save money. A study performed by ARK Invest suggests that Amazons drone delivery service could be charged at just $1 per delivery and still be profitable (Keeney, 2015).

Img2

It is also suggested that delivery by drones will be environmentally beneficial. As drones are battery powered, they do not directly produce any diesel pollution. Research backs this up, showing that carbon dioxide emissions produced by drones is lower than that of trucks, even taking into consideration the energy requirements of drones and the smaller service zone (Goodchild and Toy).

These are they key factors driving companies to invest in drones as a delivery solution.

Limitations

**Development Environments**

**OR-TOOLS google**

**A\***

AI

Presentation

Libraries

**Algorithm – Multitrip Vehicle Routing Problem**