**Redo of Research 1 - Drone:**

When it comes to the drone model that we will use, it will be from a company called DJI. If we are able to get an enterprise contract with DJI, the model we will choose is the DJI Mavic 2 Enterprise. If we are unable to get a contract with DJI, the model we will choose is the DJI Air 2S. The technical specifications of the DJI Air 2S include a camera that can shoot 4k video at 60fps and a 5.4k video at 30fps. Having good camera quality is a feature we wanted when we view livestreams and this drone gives us that. This drone can fly for a maximum of 31 minutes according to their website and it has a distance of 18.5km (roughly 11.5 miles). According to *dronethusiast.com*, they say that 20 minutes is a very common flying time for drones (dronethusiast.com). Therefore with the DJI Air 2S, it exceeds this common flying time, which shows how good the flying time is for this drone. This is another reason why we chose this model because we wanted a drone that will give good flying time since it is going all over Seattle.

With the DJI Mavic 2 Enterprise, it also has a 4k camera and a maximum flying time of 31 minutes. Other notable features include 24 Gigabytes of storage, which could be useful when trying to store data such as video streams on the drone. It also has an optical zoom that is 2x and a digital zoom that is 3x. This could be useful when trying to get a closer view of a road/highway.

One of the most significant reasons why we chose DJI as the drone company is because their drones have autonomous features. For example the DJI Air 2S has a software called APAS 4.0 (Advanced Pilot Assistance System, which is used for autonomous flying (Murphy 2021). Also with the DJI Mavic 2 Enterprise, it also has a software called DJI GS Pro (DJI Ground Station Pro). WIth this software, the Mavic 2 Enterprise can have pre planned routes of where it can go. Therefore since these two DJI drone have autonomous features, we do not have to rely on manually controlling each drone in Seattle.

The way we will use the live streaming footage in order to show data on traffic conditions on our app is for the first year, we will use a team that will monitor the live footage and make judgements on the traffic conditions, which will be displayed on the app’s map. During this time we will collect data on this, after a few years of collecting data on Seattle’s traffic conditions, we will create an AI program that will make judgments on the traffic based on the live footage.

Links:

<https://www.dji.com/air-2s?site=brandsite&from=nav>

<https://www.dji.com/air-2s/specs>

<https://www.dronethusiast.com/best-drones-with-longest-flight-times/>

<https://www.dji.com/mavic-2-enterprise/specs>

<https://www.dpreview.com/reviews/review-dji-s-air-2s-is-the-ultimate-consumer-drone>

<https://www.dji.com/ground-station-pro?site=brandsite&from=landing_page>

<https://www.dji.com/mavic-2-enterprise>

<https://dronedj.com/2018/10/30/mavic-2-enterprise-specifications/>

**Research 2 - Funding:**

Possible challenges- The initial money will be our first challenge. We hope Seattle city would give our initial funding to purchase the drones. If not, we will be asking for investors for our seed money. Once we get the initial funding we will get our second round of funding through our in-app ads and our monthly subscription plan.

Since Seattle is a large city, we will be deploying our drones in the most populated and traffic areas. Upon feedback, we will decide whether to expand to other parts of the city.

Spending- We will need about $200,000 to buy 72 drones( that is if we want to fly our drones 24 hours a day). This will include 24 hour support for our drones. Each drone has a flight time of 20 minutes. We do need to spend more money on support.

Advertising- We will be spending around $50,000 on advertising our app. We will hire a marketing agency to advertise our app.

Income- Our app has two versions, free with ads and a monthly subscription without ads. The free version will have at least one ad upon opening the app. Based on the user time the ads will increase.

Free version:

For the base case, we will consider one ad per user and users opening our app once in a day. We will earn around $1.6 per ad. This includes banner ads and interstitial ads. If 0.1% of the population uses our app, that is around 724 people, our revenue would be around $1158 per day if the user opens the app once a day.

Monthly subscription:

We will charge $4.99 per month after a 30 days free trial. Our revenue would be $3612 per month if 0.1% of the population are using the app.

Links:

<https://www.creative.onl/how-much-money-do-mobile-apps-make/>

**Research 3 - Traffic Index:**

Population + traffic index, how can we improve the traffic index? Barriers?

* Area of seattle : 83.78 sq miles

Population of seattle in 2019, 2020 and 2021 can be found below

|  | Washington State | Seattle | Population Density in seattle | % of population in seattle |
| --- | --- | --- | --- | --- |
| 2019 | 7,614,839 | 753,675 | 8,995 | 9.89% |
| 2020 | 7,705,281 | 737, 105 | 8,798 | 9.56% |
| 2021 |  |  |  |  |

* We see that even though the population of Washington state has increased from 2019 to 2020, the population of Seattle has decreased from 2019 to 2020.
* This could possibly be the effect of the COVID-19 pandemic making people move out of the city and into the outskirts
* Traffic Index : composite index of time consumed in traffic due to job commute

|  | Rank | Traffic Index | Traffic Index(minutes) |
| --- | --- | --- | --- |
| 2019 | 8 | 199.72 | 42.99 |
| 2020 | 11 | 193.87 | 42.17 |
| 2021 | 12 | 189.29 | 41.57 |

* Possibily due to the decrease of population in Seattle and the effect of the pandemic, the traffic index is also reducing over the years.
* How can we improve the traffic Index
  + Congestion Pricing - Charging a fee for single occupancy vehicles
* Barriers
  + Expensive to Administer. The costs of collecting a congestion charge are much higher than petrol tax. It requires sophisticated technology and chasing up drivers who don’t pay or try to avoid it. For smaller cities, the administration costs may be prohibitive.
  + Inequality. A congestion charge is regressive as it takes a higher % of income in tax from the poor.
* Links
  + <https://www.tomtom.com/en_gb/traffic-index/seattle-traffic/>
  + <https://www.numbeo.com/traffic/region_rankings.jsp?title=2021&region=021>
  + <https://www.census.gov/quickfacts/fact/table/seattlecitywashington,US/POP010220>
  + <https://sdotblog.seattle.gov/2019/05/23/lets-talk-about-managing-seattle-congestion-in-a-fair-and-equitable-way/>
  + <https://www.its.ucla.edu/for-the-press/traffic-congestion/>
  + <https://www.economicshelp.org/blog/143/transport/how-effective-is-a-congestion-charge/>
  + <https://www.economicshelp.org/blog/143/transport/how-effective-is-a-congestion-charge/>

**Research 4 - Privacy:**

Laws and regulations can be different depending on state and if the drone is meant for recreational or commercial use. A big common rule for drone flying is line-of-sight, meaning drone operators must be within line of sight of their drones. This obviously presents a problem in that if we’re collecting data from all Seattle, having drones in line-of-sight at all times could make things difficult. Some places also have laws preventing drones from being flown too closely to people, yet there are also maximum height limitations that can make balancing the two rules a challenge. The Federal Aviation Administration has a process for acquiring a waiver (BVLOS) to allow for beyond line-of-sight activity. These mainly apply for first-responders, but there are cases of companies acquiring waivers, so it is possible to have exceptions. Recently, the FAA made rules to allow for flying over people for autonomous commercial drones, so this can help address the challenge the other rules presented. Drones, even if unmanned, must still be identifiable with a remote ID, and drones must be checked for safety purposes routinely.

Drones are a relatively new technology, and as such the FAA is still designing laws and regulations for them. Privacy is not addressed much by the FAA. However, there are laws in different states. For Seattle specifically, aerial recording of video requires a permit from the city of Seattle. This applies to drones flying over city property, and since our drones would be doing just that to capture traffic activity, a permit is required. Traffic control is listed as something that requires a film permit from Seattle, and may require notifying citizens which could bring challenges if concerns are brought up. There are also different privacy issues regarding video and audio. If audio is involved, privacy concerns are higher as the potential for eavesdropping increases and may not be approved. However, with video in public places, there is no expectation of privacy. Recording is not limited by privacy issues, so as long as drone requirements and permissions are met, recording sky-view video will not present privacy issues.

Sources:

<https://www.businessinsider.com/drone-license-laws-regulations>

<https://www.govtech.com/public-safety/faa-announces-drone-line-of-sight-waiver-for-public-safety.html>

<https://www.businessinsider.com/faa-says-it-will-allow-commercial-drones-fly-over-people-2021-1>

<https://www.seattle.gov/filmandmusic/film/film-permits/uas-(drone)-use#:~:text=Hobbyist%20drone%20use%20can%20operate,Municipal%20Code%20(SMC)%2012A>.

<https://www.seattle.gov/filmandmusic/film/film-permits>

<https://www.wvxu.org/local-news/2020-10-12/as-drones-become-more-common-privacy-concerns-arise>

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where do you want to go

live streaming - the drone view of the traffic(The most recent)

1. What makes our map unique?

- predict future traffic (ex: accident - estimate the traffic based on the live streaming based on the several factors, such as how big the accident is or if there are any authorities on the scene)

- showing road condition in real time without user input

- animal

- construction

- all of possible road condition

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1. Keep the paid version or remove it?
   1. Remove the paid version for the first 5 years then depending on our revenue/user feedback, etc, then we might add the paid version
2. Funding plan:
   1. Drone (Seattle: 90 miles - we want to cover the most populated/traffic areas - 30 miles)
      1. DJI - Contract with Seattle or if we don’t get approved to work together with the local government, we will have our own contract with DJI or buy consumer level drones (needs research)
      2. Dji air 2s RTS: $1200 - 7.5 miles - 31 minutes/battery
      3. 24 x 60 = 1440 minutes, 47x4 drones (to cover the whole 30 miles of Seattle for each session)

Estimated drone spending: $56,400 (without any partnership/contract with Skydio)

* + 1. Estimated life time: 1 year (half of the average Skydio 2 Lifetime)
  1. Wages
  2. Other expenses
  3. Revenue:
     1. Total expected users for the first year:
        1. 154,400,000/mo (Google)
        2. 154,400/mo (Team 2)
        3. 77,200/mo - active users
     2. Total estimated revenue from ads:

$/ads = $1.6 x 77,200 = $123,520/mo