

Drone Operations Dashboard

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1 Overview

For my Informatics Large Practical Coursework 3 I have decided to implement a user interface targeted towards managers and supervisors of the drone-based medication delivery system. It visualises dispatches and service points on a map and incorporates a heatmap to easily visualise busy areas. The coding languages used were Java, HTML, CSS and JavaScript with the key tools used in this coursework are Spring Boot, geojson.io, Leaflet, and ChatGPT.

2 The Goal

While working on my coursework 2, I quickly discovered that trying to read JSON data, especially when there was a lot of it, was very inconvenient and thus, I wanted to create an easier and clearer way to be able to visualise all of that data at once. Therefore, I decided that for my coursework 3 implementation, I would try to solve this issue by placing the necessary data onto a map. Doing so would allow drone supervisors the ease of reading and visualising the drone system's data, and for them to be able to make decisions based on the patterns seen. I wanted there to be an easy way to visualise which areas were busier, which service points required more attention, and potentially more drones and resources deployed at in order to keep up with the demand. I also figured that plotting all the dispatches onto a map would also help supervisors decide where new drone service points should be established, particularly in areas where dispatches are located far from the existing service points.

3 Features

- Map of all service points and dispatches
- Service point overview (accessed by clicking on a service point on the map and viewable on a sidebar)
 - Shows total drones assigned to service point
 - Shows total dispatches assigned to service point
 - Shows average dispatch per drone
 - Shows workload status - derived from the average dispatch per drone

- List of drones at service point
- Drone overview
 - Shows capabilities of the drone
 - Shows list of dispatches assigned to the drone (clicking on the dispatch will direct the user to the location of the dispatch on the map)
- Clickable dispatches on the map - shows dispatch's requirements and which drone and service point is assigned to the dispatch

4 Implementation & Tools

My coursework 3 implementation was built on top of my already existing coursework 2 project. In order to simulate a busy drone delivery system, I created a mock database from scratch, as the existing data from the external ILP Rest Service provided for coursework 2 was too small. My database is comprised of hard coded data transfer objects (DTOs) written directly into my project. Using geojson.io, I placed markers at different areas around Edinburgh for where I wanted drone service points. Figure 1 shows the service points I marked out in geojson.io. After I was satisfied with the service points, I took the coordinates of those service points, and added them to my database.

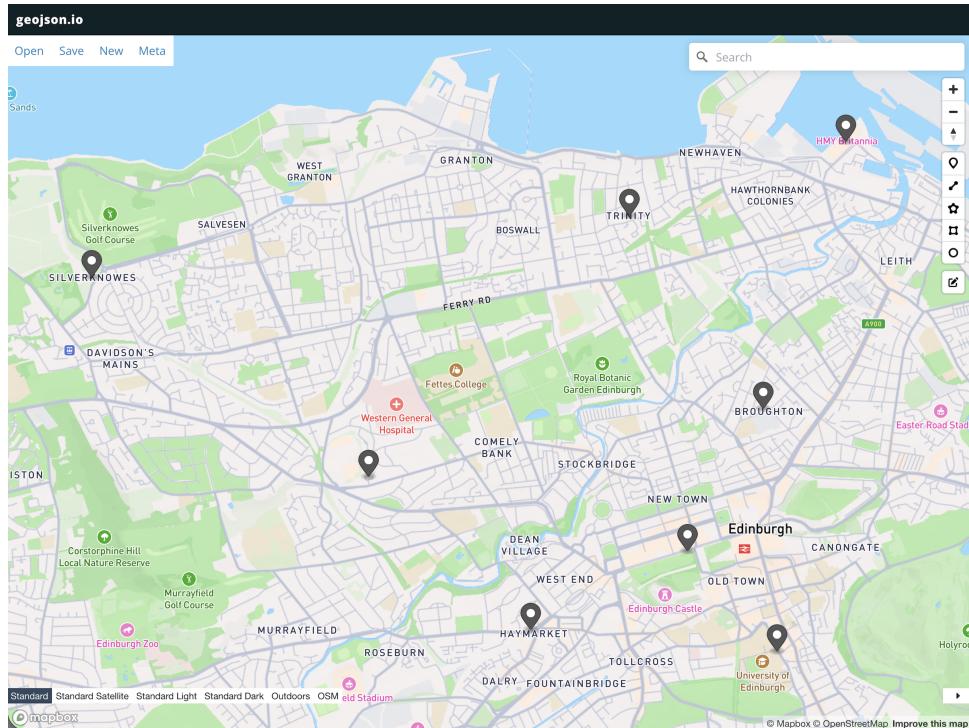


Figure 1: Service points in geojson.io

Next, I used ChatGPT to randomly generate a list of drones and I assigned 5 drones to each service point. After that, I used geojson.io again to place down markers to represent dispatches. The locations for the dispatches were mostly random however I tried to place more points around hospitals in order to best simulate what I assume would be the busier areas for the system. I then sent those points to ChatGPT to generate the corresponding MedDispatchRec objects with randomized requirements.

I chose to use ChatGPT to automate this part of the process as there were hundreds of dispatch points and manually assigning randomized data for each one myself would have been inefficient. Aside from

that, I chose to use geojson.io for selecting the location for service points and dispatches as I was already familiar with it from coursework 2 and its map interface allowed for me to visualise the points before integrating my own map.

With the mock database created, I used the same logic I had made for coursework 2 for assigning dispatches to drones to assign all the mock dispatches to a drone. Next, I moved on to the UI, using HTML, CSS and JavaScript for the functionality. I first gathered some inspiration from several other websites that involved maps in their UI, like DeepState's war map [1], EMSC's earthquake map [2], and IQAir's air quality map [3]. Eventually, I made the decision to incorporate a heatmap into my own map as it provides a clear visual representation of the concentration of dispatches. And since I decided to use a heatmap, I thought Leaflet was the most suitable choice since it has many built in functionality including a heatmap. Furthermore, Leaflet also provides many different map styles which greatly helps with styling [4]

Finally, I plotted all the service points and dispatches onto the map along with the additional features like the service point and drone details into the sidebar. Figure 2 shows a picture of my drones operation dashboard with the Appleton Tower service point selected. The service points are indicated by the blue markers while dispatches are indicated by the small red points around the map, with areas with more intense heatmap colouring indicating more dispatches.

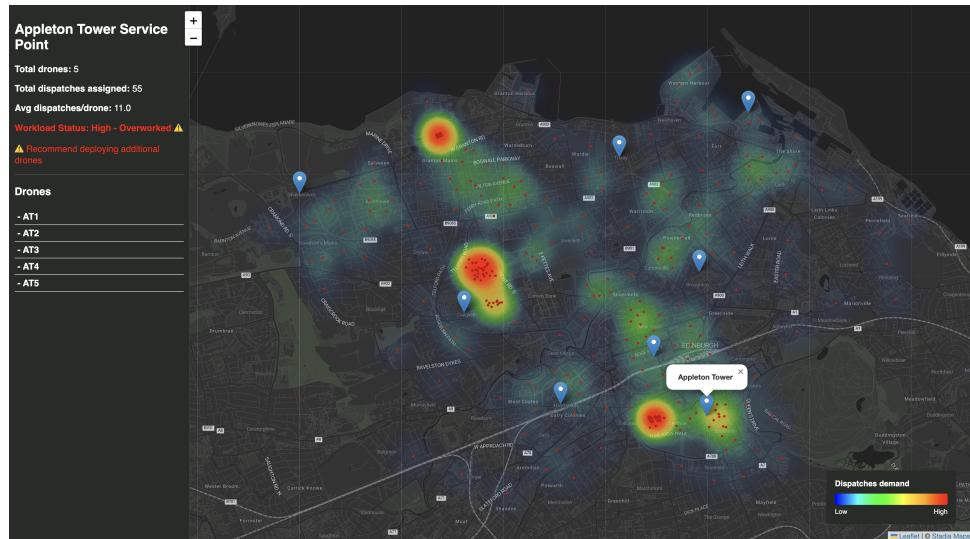


Figure 2: Drone Operations Dashboard with a busy service point selected

References

- [1] *DeepStateMAP — Map of the war in Ukraine*. URL: <https://deepstatemap.live/en#6/48.1147666/33.9697266>.
- [2] *EMSC-CSEM Earthquake Map*. URL: https://www.emsc-csem.org/Earthquake_map/.
- [3] *IQAir Air Quality Map*. URL: <https://www.iqair.com/gb/air-quality-map>.
- [4] *Leaflet Providers Preview*. URL: <https://leaflet-extras.github.io/leaflet-providers/preview/>.