Distributing a Fleet of Drones over an Area with No-Fly Zones

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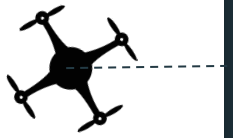


Project Overview

- Goals:
  - To be able to give a UI to users that displays their drones interacting with their points of interest for whatever reason they have given.
  - Have drones fly in a shortest path to certain events while ensuring that they get around no-fly zones.
- Importance:
  - Many drone users currently have to manually use them to respond to events, we will automate this so that drones can instantly perform the jobs needed.
  - Rather than users controlling drones one by one they can now have all of them move at the same time assuming there are multiple events happening simultaneously.

Project Management Style (Agile)

There are several reasons we chose to use the Agile Methodology for our project management style:

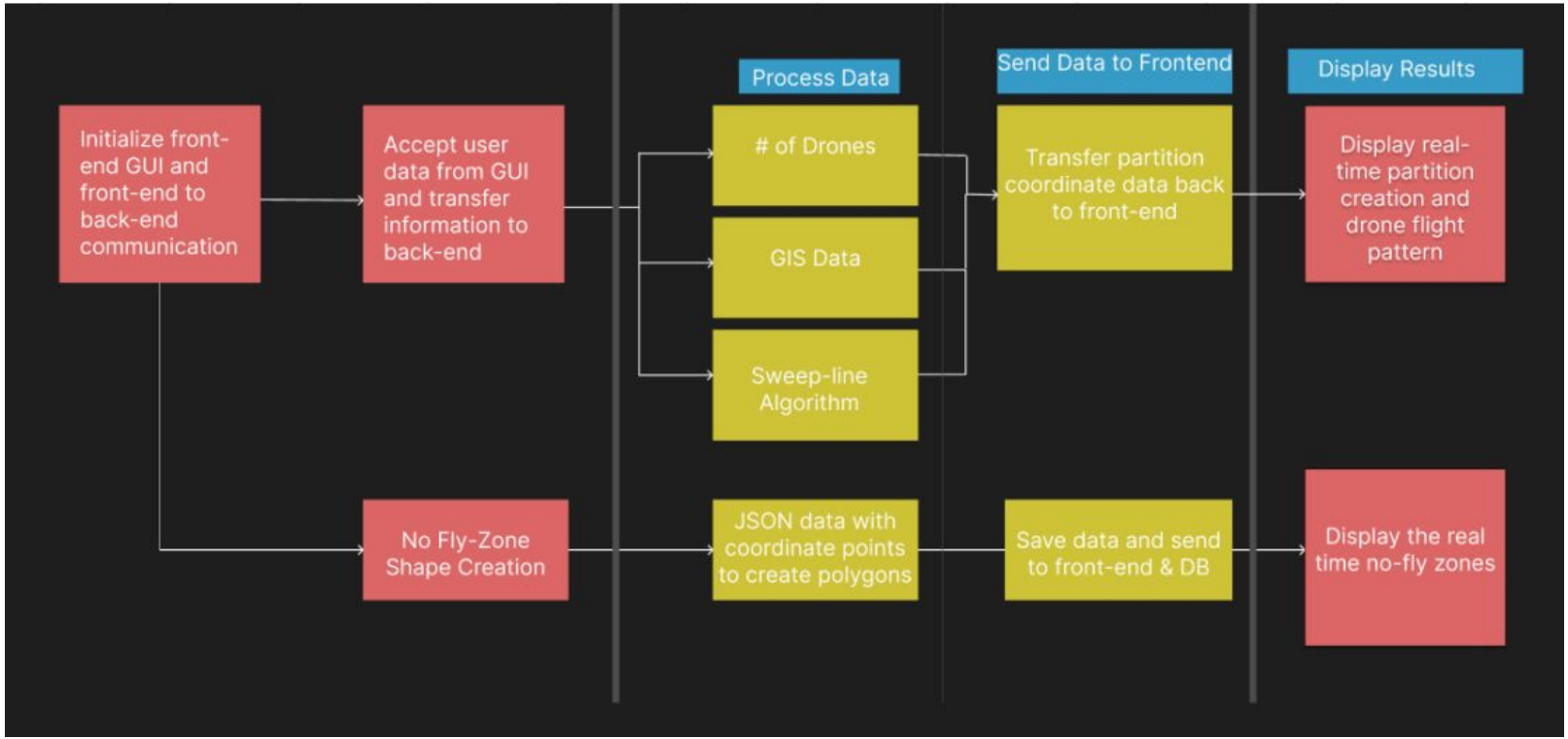
- It is super adaptable and will allow our team to adapt to changing requirements and be able to respond to our advisors feedback quickly
- We will be able to be very transparent with one another during our meetings. People will be kept in the loop and be able to make suggestions if people are stuck on a problem.
- We will be able to test and catch issues early using this style. This will allow us to communicate quickly and resolve the problem.
- This will allow for great communication and collaboration between our team members.

Task Decomposition

At a top level: Initialize and setup front end and backend communications as well as accept user data from our GUI to be used in the backend. We also need to create the no fly zones on screen

At a middle level: We need to be able to process incoming data, send data between our back and frontend, as well as display what is happening in real time.

At a low level: We need the number of drones the user wants to utilize, their map data, as well as no-fly regions they want plotted. With this information we will create partitions on screen for the user to optimize drone flight times. From here the user will be able to input events in certain regions for drones to respond to, and the drones will respond in real time on screen to these inputted events.


Initialize front-end GUI and front-end to back-end communication
Accept user data from GUI and transfer information to back-end
Process Data
# of Drones
GIS Data
Sweep-line Algorithm
Send Data to Frontend
Transfer partition coordinate data back to front-end
Display Results
Display real-time partition creation and drone flight pattern
No Fly-Zone Shape Creation
JSON data with coordinate points to create polygons
Save data and send to front-end & DB
Display the real time no-fly zones

Key Milestones

- Develop requirements and determine software to be used for frontend and backend
- Set up socket transfers between the front and backend
- Develop UI for the frontend (drone map screen, algorithm display, event management input)
- Develop backend (take in frontend data, call partitioning methods, call pathing algorithms)
- Unit test both the frontend and backend
- Make drone visualization smooth and clear

Key Risks + Mitigations

- Ensuring that our data is only held in state variables and not in a database to ensure that the user's data is safe and secured from prying eyes.
    - To do this we will create large data structures that will be able to hold things like the no-fly locations, the map location, as well as number of drones. These will be wiped upon a new user session
- Ensuring that we have a server that cannot be broken into, yet can have multiple user sessions occurring at once
    - We will be using a Linux server that runs PostgreSQL that will manual host and distribute out sessions to users in order to ensure that data cannot be overwritten or seen by other users
- Protecting frontend resources from being manipulated by non-server activities
    - We will hide the api keys well, as well as only allow communication from authenticated users utilizing the HTTPS protocol over TCP

Conclusions

In conclusion, the drone fleet management project aims to optimize drone response time for various user scenarios, including search and rescue, delivery, and infrastructure maintenance, while accounting for no-fly zones and other obstacles. By having utilizing Agile alongside our task decomposition and milestones we will be able to develop this project as well as anyone could with great speed and accuracy. Mitigating and understanding our potential risks will also allow us to develop with security in mind ahead of time, which will make it much easier to keep our users resources safe.