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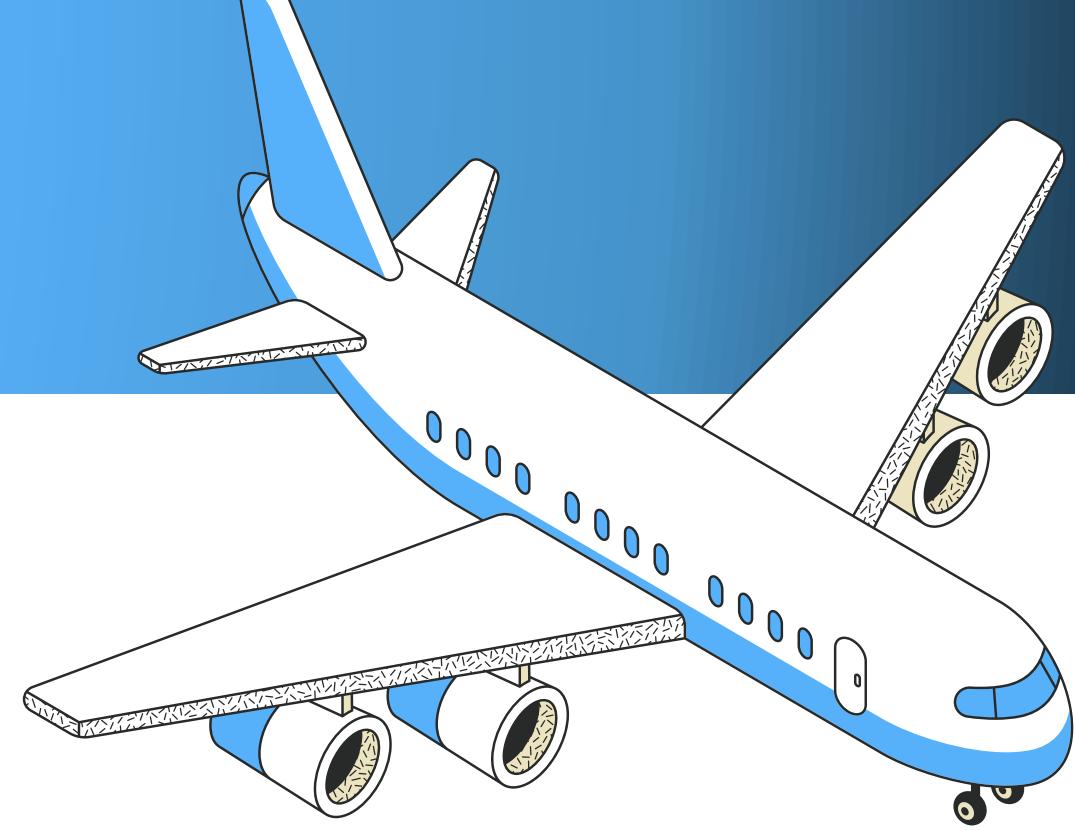


AIRBUS

Team : ByteBusters

Theme: Enhancing Flight Navigation Mechanism for Optimal  
Route Planning and Risk Mitigation

# Introduction



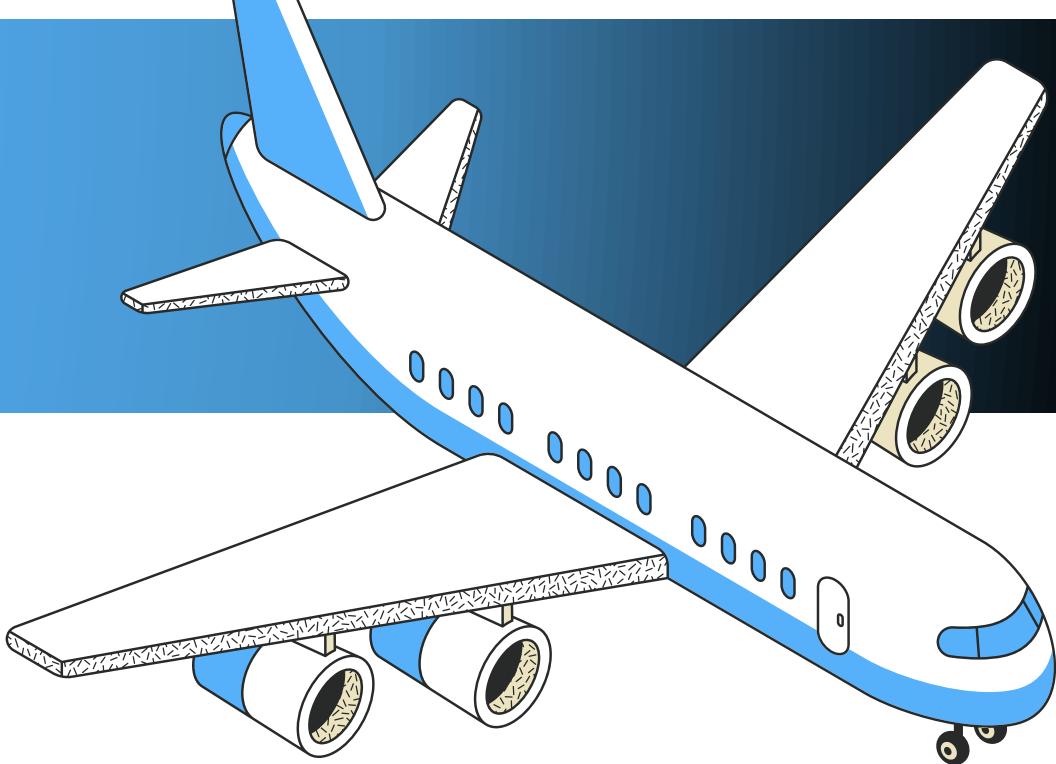
## Overview:

The aviation industry prioritizes safe and efficient flight navigation. Challenges include unavailable GPS signals, adverse weather conditions, electronic failures, noise, and varying pressures.

## Context:

Addressing these challenges requires minimizing human errors and enhancing automated navigation mechanisms.

# Objective



## Primary Goal:

Create an application for optimal path detection between two airports based on various factors like weather, distance, fuel consumption and also enable a health-check dashboard for the flight monitoring status which informs the user about the aircraft details.



## Key Objectives:

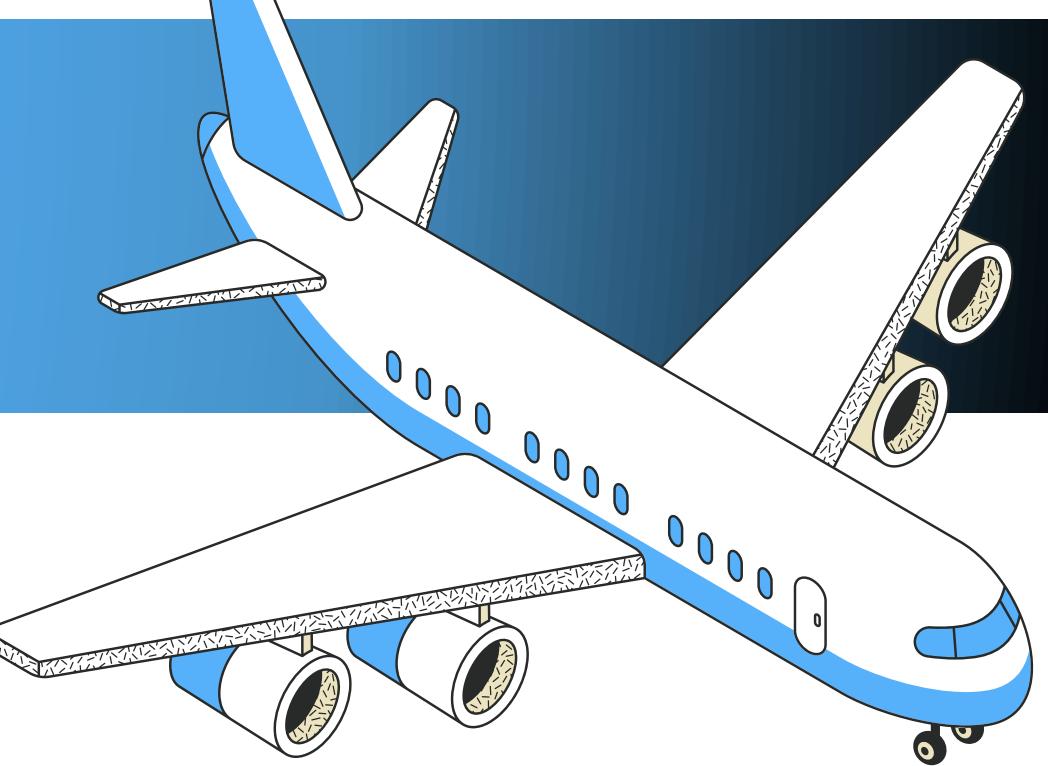
Provide real-time risk assessment.

Suggest alternative routes for pilots, airlines, and airport authorities.

Integrate real-time health metrics tracker based aircraft information for monitoring aircraft health.



# Components

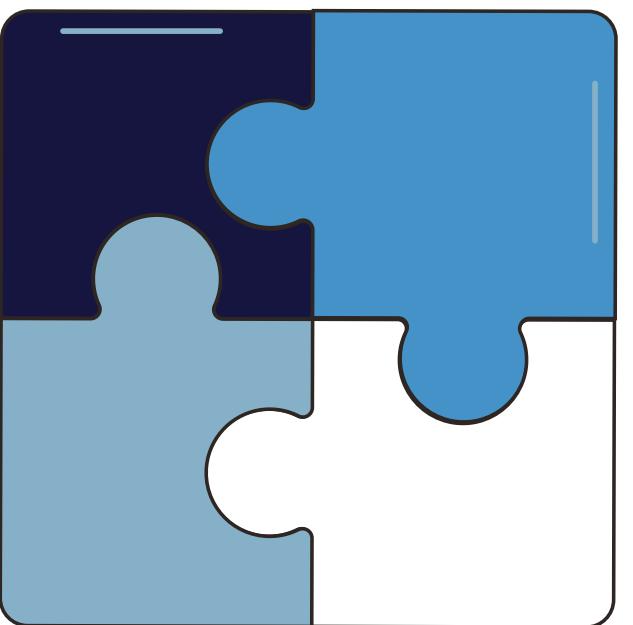


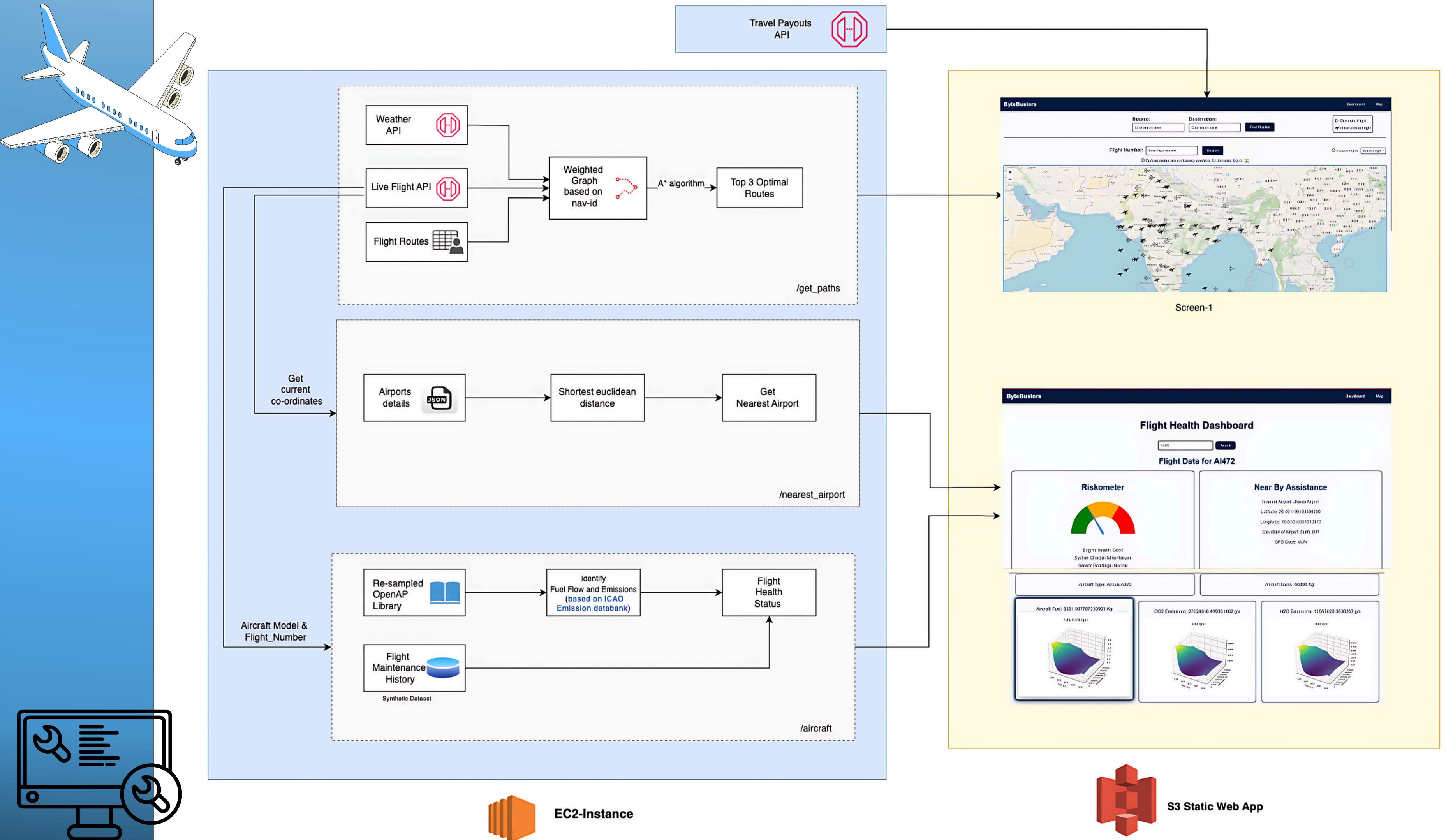
**Frontend:** User interface for searching routes and viewing health metrics.

**Backend:** API services to process data, perform calculations, and interact with external data sources.

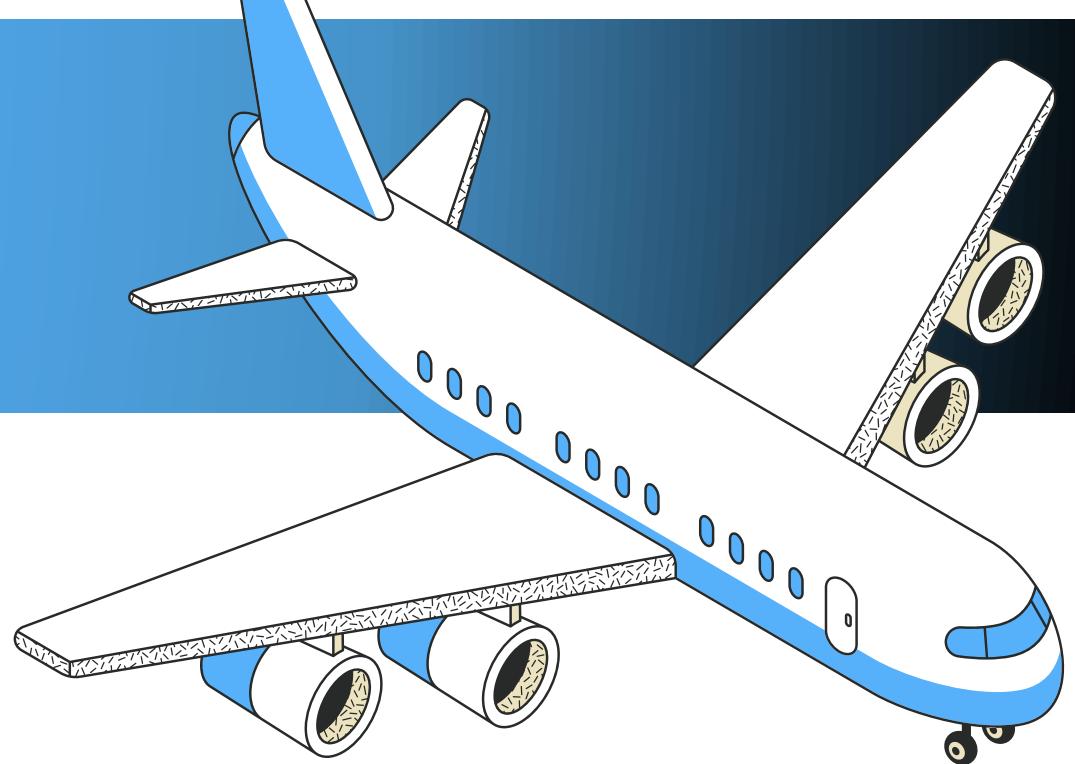
**Data Sources:** Live flight status, weather data, sensor data.

**Algorithms:** Optimal path calculation, risk assessment.





# Technical Details



**Frontend:** React JS

**Backend:** Python FastAPI based microservices

**Deployment:** AWS EC2

**Data Store:** S3

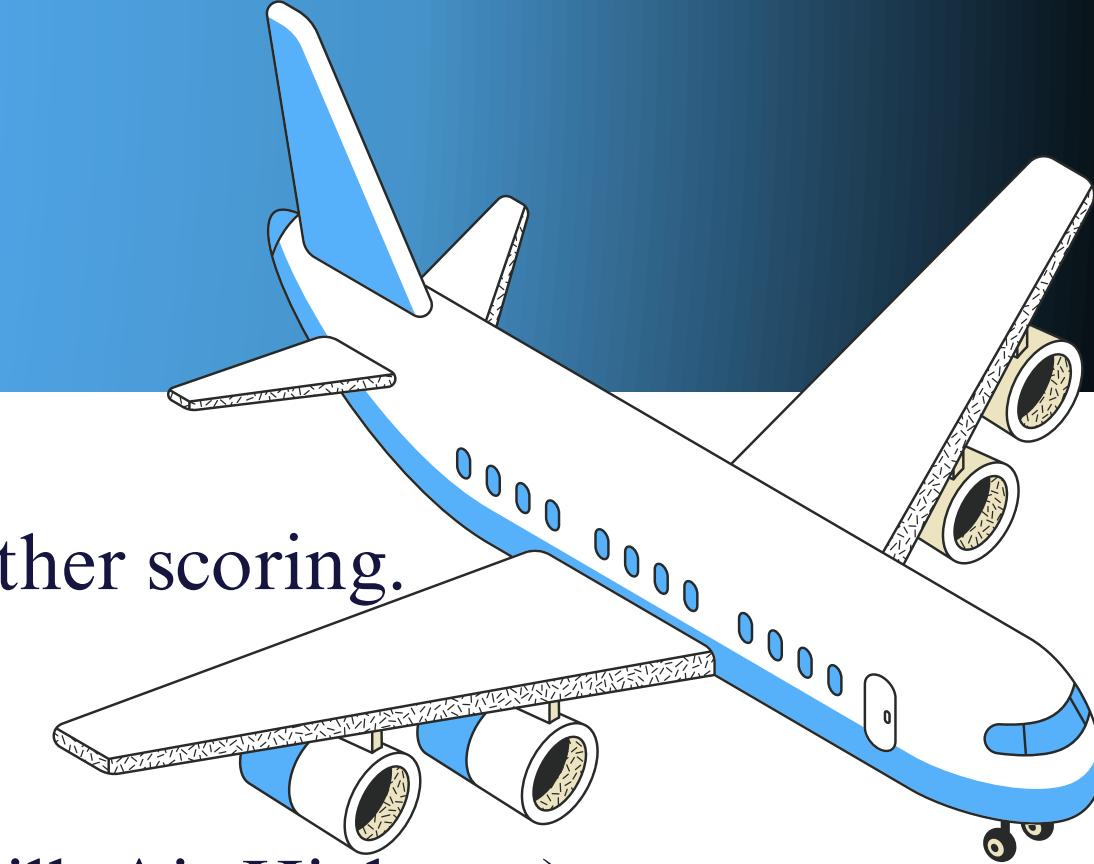


# Algorithm Used

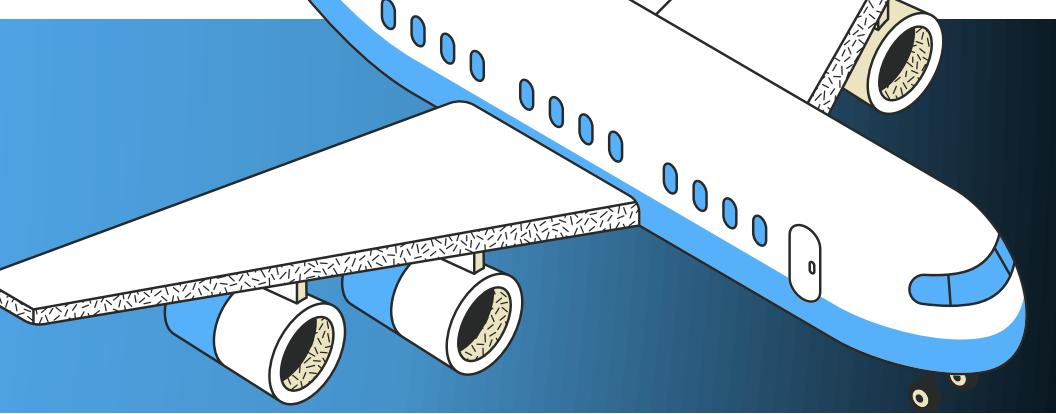
- **Customized A Algorithm:** \* Utilizes distance heuristic and weighted weather scoring.
- **Data Structure:**
  - **Graph Representation:**
    - **Nodes:** Navigational IDs in air highways (e.g., L888 - Chinese Silk Air Highway).
    - **Edges:** Paths of the air highways.
  - **Clustering:** Merges nearby air highways using a clustering algorithm.

## Heuristic and Route Identification

- **Distance-Based Heuristic:** Uses Euclidean distance for efficient path identification.
- **Route Identification:** A\* algorithm finds potential routes from source to destination.



# Algorithm Used



## Weighted Weather Score

- **Criteria:**
  - Snowfall
  - Rainfall
  - Cloud Coverage
  - Visibility
- **Bias:** High bias for unsafe weather conditions.

## Path Thresholding and Safe Paths

- Thresholding: Paths with weather scores above a threshold are discarded.
- Safe Paths: Only routes below the threshold are considered viable, ensuring safety.

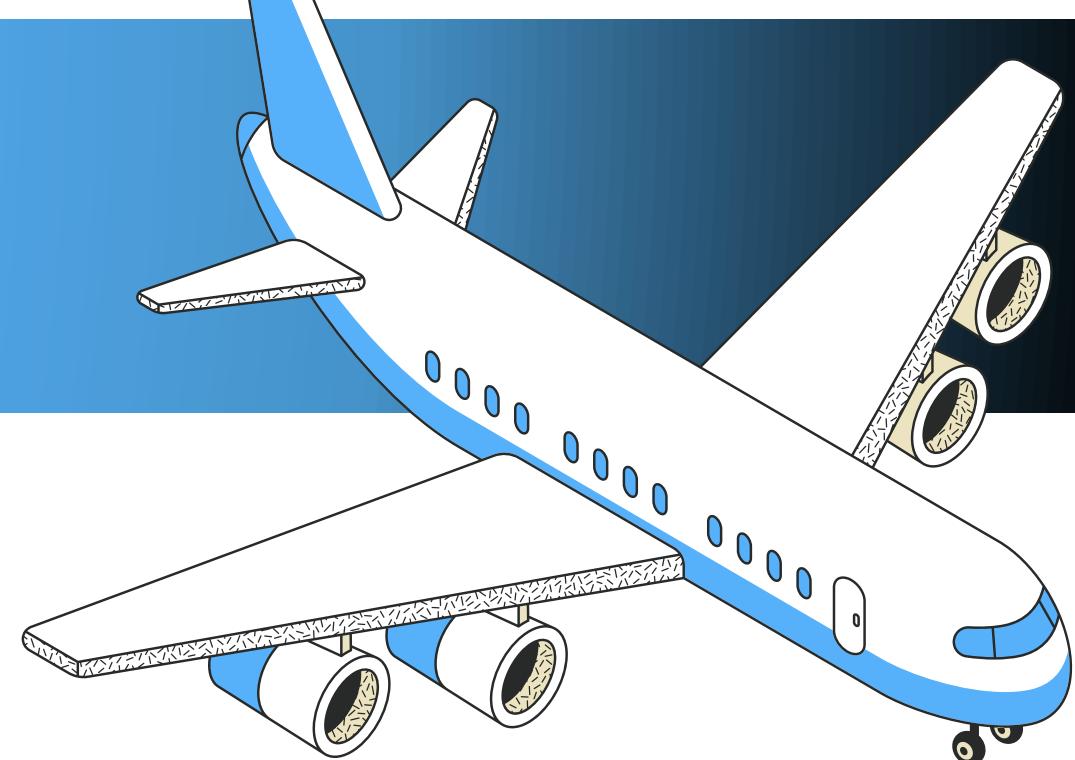
# Features

Optimal Route Finder



Live Weather Tracking

Health Metrics Dashboard



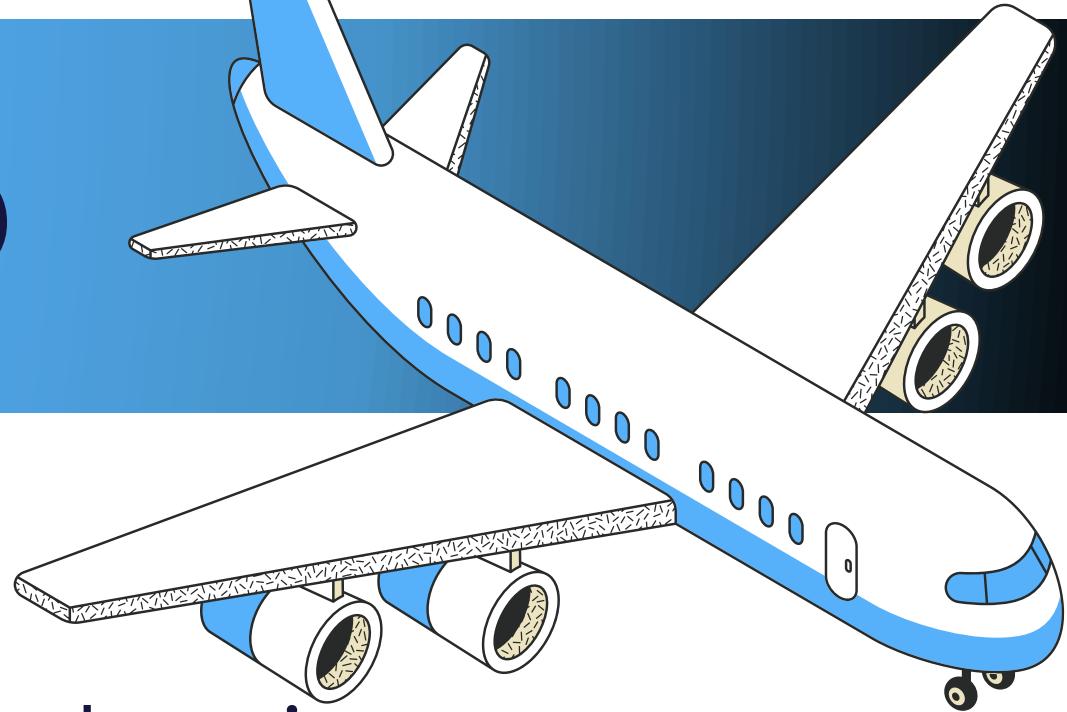
## Challenges Faced

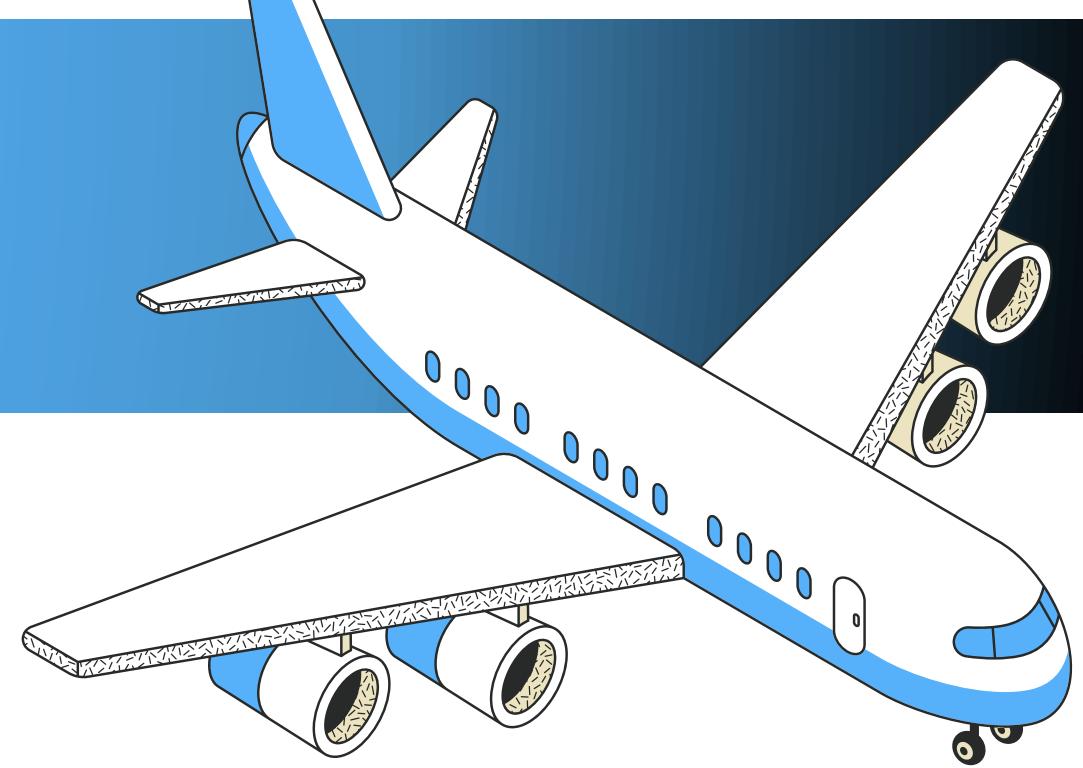
- Opensky API got deprecated on which the application was developed
- Had to curate data from multiple API end-points for fetching route, aircraft and weather information.
- API limitations for fetching data restricting the number of API calls
- Lack of free historical data on planes and their routes to train machine learning models
- Faced issues with EC2 instance setup to ensure the session runs until disabled.



# Future RoadMap

- Retrain openap library to support more aircraft models and engine types
- Integrate application with actual aircraft maintenance history
- Improved UI functionality with 3d modelling
- Enable live tracking for the flights provided we get unlimited access to the Api.
- Enhance Optimal Route Finding Algorithm to take into consideration multiple factors.





**[https://github.com/mahita-panga/byte\\_busters](https://github.com/mahita-panga/byte_busters)**



**<http://airbushack.s3-website.ap-south-1.amazonaws.com/>**



**Team: ByteBusters**