

AD Project Proposal

Project Title: Flight Prediction based on Machine Learning

Team: 2

Team Members

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Problem Statement

Every year, millions of flights take off around the world. Prior to 2020, the aviation industry experienced steady growth annually. However, the COVID-19 pandemic had a significant negative impact on the industry in 2020 and the subsequent two years. By 2023, with the end of the pandemic, the aviation industry has essentially recovered. It is anticipated that in 2024, the number of flights will surpass the record set in 2019.¹

Air travel has become an indispensable mode of transportation for millions of people worldwide, with increasingly diversified ticket purchase channels. However, a major challenge that travellers face is flight delays. Choosing flights with lower delay risks has become a critical consideration for passengers who prioritise punctuality.¹

Data indicates that the average on-time arrival rate for global flights ranges between 70% and 90%. For instance, Singapore Airlines had an on-time arrival rate of 78.57%² for the entire year of 2023. This implies a delay rate of 21.43%, meaning that on average, one out of every five flights are delayed.

In addition to the challenges brought by flight delays, flight prices are also a factor that passengers should focus on. Prices can fluctuate widely due to various factors such as demand, seasonality, special

¹ <https://www.statista.com/statistics/564769/airline-industry-number-of-flights/>

events, economic conditions, and changes in fuel costs. This volatility makes it difficult² for passengers to determine the optimal time to purchase tickets, often leading to higher expenses or missed opportunities for better deals.

The lack of transparency and unpredictability in ticket pricing places travellers in a dilemma, causing stress and financial strain. While various online travel agencies and fare aggregators provide some level of guidance, they often fall short in offering accurate and personalized price predictions. Consequently, travellers are left to navigate an overwhelming amount of information and the complex dynamics that influence flight prices.

Our goal is to develop an advanced flight ticket price prediction and delay risk assessment application that empowers travellers to make informed booking decisions. By analysing historical price data and identifying patterns and trends through machine learning, this application will provide users with accurate and personalized price forecasts. Additionally, it will assess flight delay risks, helping travellers choose flights with higher punctuality. This dual approach will aid in minimising expenses, reducing the stress associated with booking flights and enhancing overall travel planning experiences.

Application Overview

Our application is designed to provide users with advanced functionality related to commercial airline flights. This application offers predictive capabilities for estimating the arrival time, future ticket price fluctuations, and cancellation rates of commercial flights. In addition to these predictive features, the app includes flight optimisation tools to help users find the most cost-effective flight options based on their input criteria.

Key Features:

Prediction Functions:

1. Estimate arrival times of commercial airline flights.
2. Predict future ticket price fluctuations.
3. Forecast cancellation rates of commercial airline flights.

Flight Optimisation:

Users can input their departure point, destination (including any waypoints), and date to receive recommendations for the best flight combinations based on cost-effectiveness. Options for displaying flights with the lowest price or shortest travel time are available.

Basic Information Retrieval:

1. Users can access weather forecasts for future dates.
2. Browse information about specific flights.
3. Look up ticket details for flights.

² <https://assets.fta.cirium.com/wp-content/uploads/2024/01/02221218/Cirium-OTP-2023-Annual-Report3-prmc.pdf>

User Categories:

- Unregistered Users: Visitors who have not created an account.
- Registered Users: Individuals with basic accounts.
- Premium Members: Users with subscription-based access to premium features.
- Administrators: Admin users with access to manage the application.

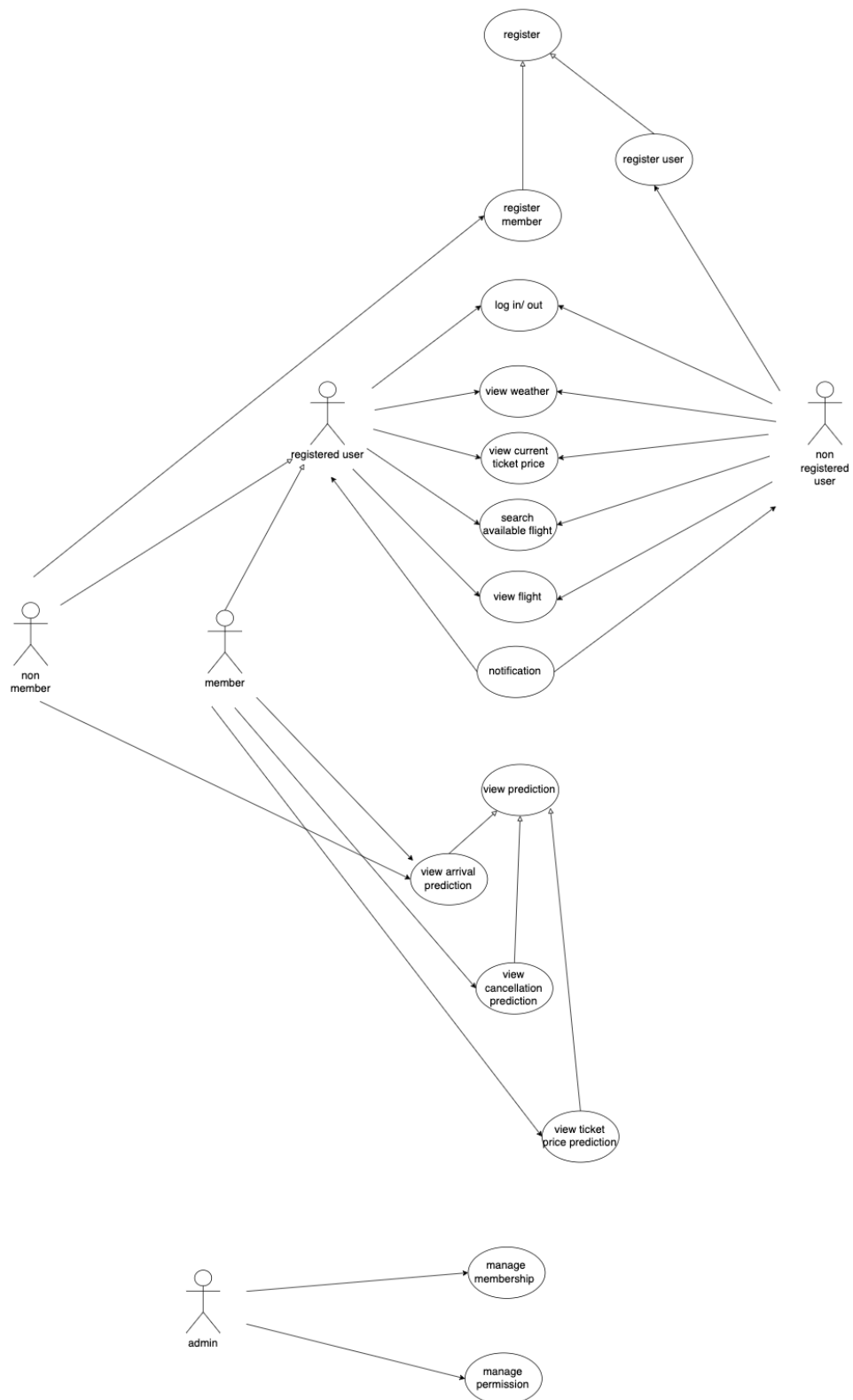
Development Details:

Web Development: Java Spring Boot will be utilized for the web version of the application.

Mobile Development: The Android platform will be used for the mobile version.

This application aims to enhance the user experience by providing accurate predictions, optimizing flight choices, and offering convenient access to essential flight-related information.

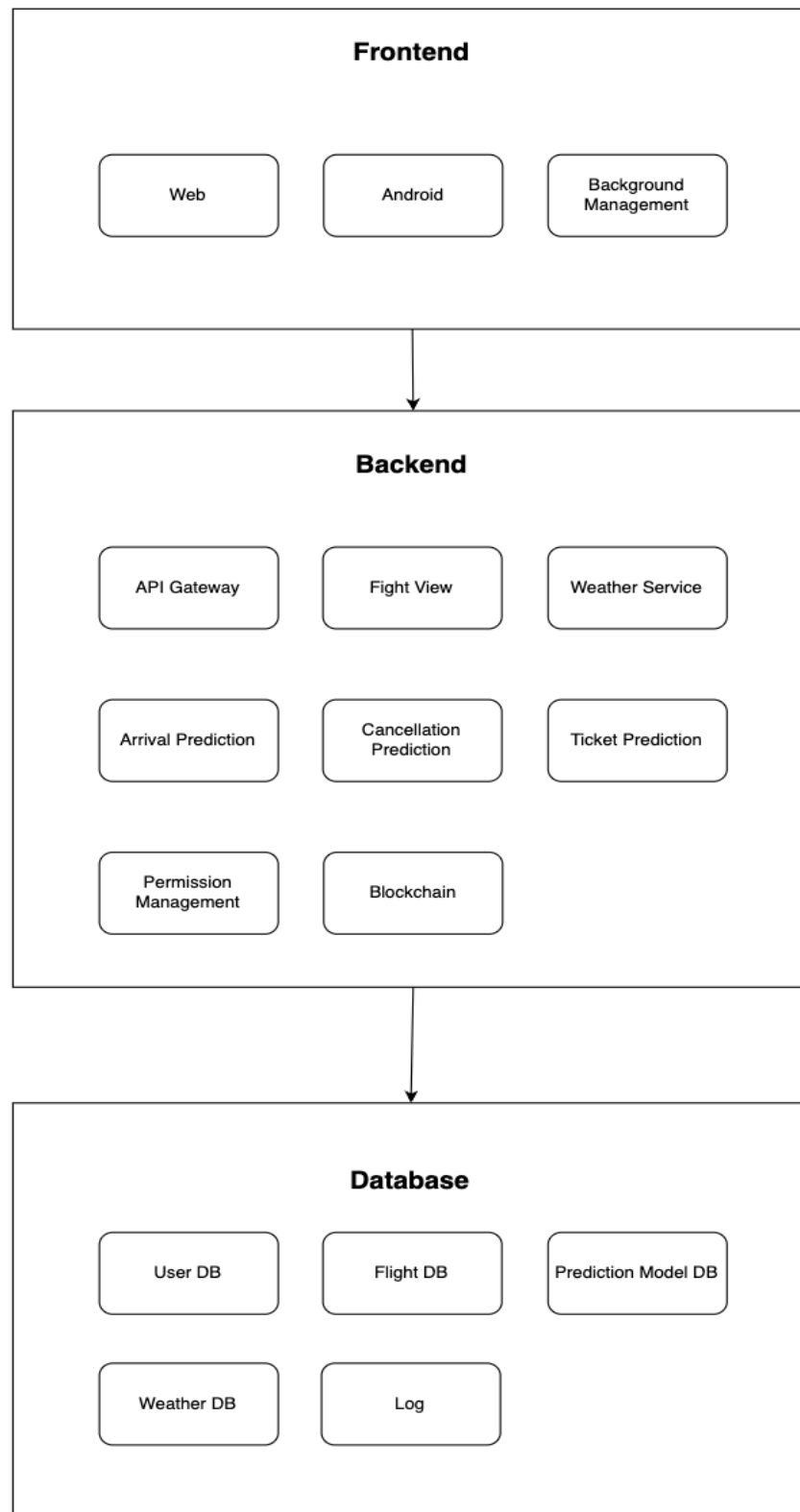
Use Case Diagram



Explanation of Use Cases

S/N	Use Case	Actor	Description	Technology
1	Register member	Non-member	Unregistered users can sign up for a membership account to access additional features and benefits.	Java Spring/Android
2	Register user	Non-registered user	Users without an account can register to create a basic account, allowing access to basic features.	Java Spring/Android
3	Log in/out	Registered user/Non-registered user/Admin	Registered users and administrators can log in to access their accounts and log out to secure sessions.	Java Spring/Android
4	View weather	Registered user/Non-registered user	Users can access weather forecasts for their desired locations and dates of travel.	Java Spring/Android
5	View the current ticket price	Registered user/Non-registered user	Users can view the current prices of available flight tickets to make informed booking decisions.	Java Spring/Android
6	Search available flight	Registered user/Non-registered user	Users can search for available flights based on their departure point, destination, and travel dates.	Java Spring/Android
7	View Flight	Registered user/Non-registered user	Users can view details of flights they are interested to find out more about.	Java Spring/Android
8	Notification	Registered user/Non-registered user	If there are changes to the flight, a notification will be sent to the user.	Java Spring/Android
9	View arrival prediction	Member/Non-member	Users can view predictions for the arrival times of their selected flights based on historical data.	Machine Learning
10	View cancellation prediction	Member	Users can access predictions for the likelihood of flight cancellations based on historical data.	Machine Learning
11	View ticket price prediction	Member	Users can receive predictions for future ticket price fluctuations to plan their bookings accordingly.	Machine Learning
12	Manage membership	Admin	Administrators can manage user memberships, including approving new registrations and handling account upgrades.	Java Spring/Android
13	Manage permission	Admin	Administrators can manage user permissions within the system, controlling access to different features and functionalities.	Java Spring/Android

Architecture Diagram



The frontend layer includes web and mobile applications for regular users and members, as well as an admin panel for administrators. These interfaces allow users to access flight information and various prediction features based on their access level.

The backend layer consists of a flight information module that provides detailed flight data and machine learning modules for predicting flight delays, cancellations, and ticket prices. These predictions help users make informed decisions about their travel plans.

For data, we utilise APIs to fetch historical and real-time flight data from flight information websites. Additionally, we use a dataset of flight data from the past ten years to train our prediction models, ensuring accurate and reliable predictions.

Extra Technology (optional)

➤ Weather System

The weather system provides real-time and forecasted weather data directly within the application, allowing users to conveniently check weather conditions that may impact their flights. This system integrates data from reliable weather APIs, ensuring up-to-date and accurate weather information.

➤ Permissions Management System

The permissions management system enables admins to efficiently manage and assign data access permissions for different user roles, such as members and non-members. The system provides a user-friendly interface for defining and modifying permissions, ensuring that users only have access to features and data appropriate to their role. Admins can easily add or remove users, assign roles, and monitor access logs to maintain security and compliance. Additionally, the system supports granular permissions, allowing fine-tuned control over specific data sets and features.

➤ Blockchain

Smart Contracts automatically trigger flight purchases based on user-defined parameters. When the predicted price falls below a user's set limit, the smart contract automatically purchases the ticket. Users can specify their acceptable delay risk, and the smart contract can filter flights accordingly.

Reward System implements a reward system where users earn tokens for contributing data to the blockchain network. These tokens can be used for discounts on flights, airport lounge access, or other travel-related benefits.