CSC207 PROJECT REPORT

FINAL Project Report
Created 2023.11.11

Flight Explorer
Vlad
Youssef
Alvin
Nikita

SECTION 1: REPORT SUMMARY

This is a comprehensive report on the work process and the work done for the FlightExplorer project. Two major differences from the proposed implementation are: switching from a static map image to the Leaflet library to graph flight paths, and the abandonment of the historic flight functionality due to API subscription limitations. The Agile software development process was followed when working on the project. The report includes details about each sprint. Note that due to the nature of the project, some sprints may not include commits from some group members, as they were researching and experimenting with third party libraries, which were decided to not be used in the final version of the project.

SECTION 2: PROCESS DOCUMENTATION

2.1. SPRINT 1 OVERVIEW

2.1.1 Sprint Overview:

The goal is, by the end of Sprint, to have a program with GUI that displays the minimal flight data, and a backend that queries and formats that data.

Start of the sprint is Friday, Nov 10.
End of the sprint is Friday, Nov 17.

2.1.2 Stories Selected for this Sprint:

	Feature	ID	User story
Vlad	*MVC API Model*	1.1	*As a developer I want to have an MVC model that separates aviationstack API logic from the app logic.*
Youssef	*Fetch Airport Coordinates*	1.3	*As a developer I want to collect flight departure airport and arrival airport coordinates so that I can display the flight route on the map.*
Nikita	*Research GoogleMaps API*	0.2	*As a developer I want to have an understanding of how the Google Maps API works so that I can incorporate the google map into the project.*
Alvin	*Set-up initial scene and frontend interface*	0.1	*As a developer I want to have a UI including search bar, map, and dashboard, so that I can display flight data to the user.*

2.1.3 Team Capacity:

We expect to have a graphical UI with minimal event handling and a backend that can respond to those events by supplying structured data.

2.1.4 Participants:

Vlad: Set up FlightExplorer model directory structure. Transfer the UML 1 into code (classes with methods that need implementation). Implement the RealTimeFlightAPI class.

Youssef: Configure the AirportAPI class. Determine the interface of the class. Make a synonyms map of country codes to country codes for smoother user experience when searching flights from country A to country B. Look for a dataset of City Names to Airport names, so that users can search flights by City.

Nikita: Created the starting page of the Frontend interface with a search bar. Determined the location and implementation of the map using a google maps api.

Alvin: Initialized frontend interface with javaFX. Created dashboard to store flights in a scrollable fashion. Added search bar to search for flights and main map VBox.

2.1.5 Tasks Completed:

- Project directory structure was set up.
- Backend was mostly finished, including FlightExplorer.buildFlight() method, the AirportsAPI and RealTimeFlightsAPIEndpoint classes.
- Basic front-end was set up.
- Superficial google-maps overview was conducted.

2.2. SPRINT 1 PRODUCT BACKLOG

Feature	*ID*	*Owner*	*Description (User Story)*	*Acceptance Criteria*	*Implementation Detail*	*P*
Set-up initial scene and frontend interface	*0.1*	*Alvin*	*As a developer I want to have a UI including search bar, map, and dashboard, so that I can display flight data to the user.*	*The UI must fit in the screen/window of the user, with a tab that can be changed in size. The Search bar has to usable to type and submit info for search. The dashboard must display all flights that are found after the search . The map must display the current flights found with the airports and flight lines.*	*Utilize the view class where this UI will be initialized and styled for best user usability. This includes create methods to perform eahc of the Ui's functionality properly such as performing search of flight with some certain parameter, where in turn the dashboard and map are updated.*	*1*
Research GoogleMaps API	*0.2*	*Nikita*	*As a developer I want to have an understanding of how the Google Maps API works so that I can incorporate the google map into the project.*	*Given that I am a developer, I must read code documentation of the google maps API to clearly understand if it is usable in our project. This depends on the complexity of it within the time frame available as well as its functionality within a Java and Javafx based framework.*	*Have a method within the view class to create a map in the view UI of our project. This includes utilizing HTML, CSS and JavaScript files to render the google map realtime in a webview class. Hence, introducing a possible Bridge class to bridge those files to communicate with Java methods and variables.*	*1*
MVC API Model	*1.1*	*Vlad*	*As a developer I want to have an MVC model that separates aviationstack API logic from the app logic.*	*Given that I'm a developer, when I design an object that uses AviationStack data my expectations are to be able to retrieve that data by making one method call, without having to know what the HTTP request looks like.*	*Make one class for every API endpoint used. Add public methods for that class responsible for fetching different kinds of data. If needed pass additional HTTP parameters as method arguments.*	*1*
Map Navigation		*Vlad*		*Given that I am a curious user, when I*		

	1.2		*As a user I want to be able to zoom in, zoom out and navigate over a map to better see the flights displayed.*	*click the plus/minus button on the map my expectations are that the map will zoom in/out. Moreover when I click and drag my cursor over a map my expectation is that the visible map will move with my cursor.*	*Figure out how to manipulate images with JavaFX. Research how I can drag an image background. Make buttons for zooming in and out. This could be done with simple scaling.*	*1*
Fetch Airport Coordinates	*1.3*	*Yousse f*	*As a developer I want to collect flight departure airport and arrival airport coordinates so that I can display the flight route on the map.*	*Given that I am a developer when I graph a flight route my expectations are that I will have airports' latitude and longitude accessible in the Flight object.*	*Will have to use a local file airport dataset and find airport latitude and longitude by `iata` identification. Implement Airport class to store data, along with an AirportAPI class to retrieve data from a file.*	*1*
View Plane Information	*1.4*	*Vlad*	*As a user, I want to be able to see detailed information about the plane's model, age, status, owner and most recent flight.*	*Given the icon or flight path of a plane, I want to be able to interact with said flight path/ plane and a textbox will appear which displays the information of the plane.*	*There will be two methods to view plane information.*	*3*

Feature	*ID*	*Owner*	*Description (User Story)*	*Acceptance Criteria*	*Implementation Detail*	*P*
Filter Flight History	*2.1*	*Nikita*	*As a user I want to search historial flights by departure airport, arrival airport and flight date.*	*Given that I am a user, I want to be able to input a specific arrival and departure airport during a certain time period and be able to search all possible flights with those parameters, while having the ability to see my results.*	*Create 3 input text boxes where a user can input/select the arrival and departure and the specific time period. From this a user presses a button to search. An event handler in the view logic will send the data to the model logic, search for the data in the api and update the flights shown by sending those flights to be displayed in the view.*	*1*
Filter Real-Time Flights	*2.2*		*As a user I want to search real time flights by departure airport, arrival airport, flight date, and flight status, so that I can see a list of the kind of flights I am interested in.*	*Given that I am a user, I want to be able to input a specific arrival and departure airport during a certain time period and be able to filter my flight status to be able to see the options available at the current point in time.*	*Given the parameters through input fields for arrival, departure and time period, and an additional dropdown menu for the filter options such as status. An eventhandler will send the data to the model which calls the api and receive data for the flights by the filters imputed. The model will update the flights to display and update the view accordingly*	*1*
Flight Visualizer Updater	*2.3*		*As a user I want to be able to display, and update the flight route on a map, so that I can*	*Given that I am a user I want to be able to see the flights searched by a certain filter displayed as route lines on a map and as*	*Create a map using a world map image corresponding to the world altitude:longitude ratio. Map flight routes according to the*	*1*

			visually see it.	*a list of flights with the name of the airline and the scheduled time of the flight.*	*destination, arrival airport altitude & longitude.*	
Flight Visualizer Interaction	*2.4*		*As a user I want to be able to access details from the list of the flights I am currently displaying on a map and the list.*	*Given that I am a user, I want to be able to click on the displayed route lines on the map and list of flights available to be able to see the flight details for the specific flight clicked as a card(popup) that can be dismissed. I want to be able to repeat this task for any given flight displayed on the screen.*	*Track clicks using an event handler onto objects being displayed on the users screen and if that object happens to be a flight object, have method called to the view where that flights details are shown on the display as a card(popup) on a screen that can be closed later on.*	*1*

Feature	*ID*	*Owner*	*Description (User Story)*	*Acceptance Criteria*	*Implementation Detail*	*P*
Bulk Graph	*3.1*	*Alvin*	*As a data scientist I want to be able to graph all flights produced by the search results at once.*	*Given that I am a data analyst, when I receive multiple search results my expectations are that I will be able to correctly map all of them with one button click.*	*Make a button that will map all of the search results by looping through the List of flights. Make sure to record every flight to the `displayedFlights ` list.*	*2*
Details from graph	*3.2*		*As a visually oriented user I want to explore flight details by clicking on a graphed flight route.*	*Given that I have a visually graphed route on the map, when I click on it my expectations are that a window with flight details for that route will open.*	*Add an on-click event to the route graph. The event will trigger the creation of a FlightView related to the flight route and display long flight data to the user.*	*2*
View Airport Information	*3.3*		*As a user, I want to be able to view information on the coordinates, view all flights leaving from said airport.*	*Given a plotted airport on the map, I want to be able to interact with the icon and expand at the press of a button. This expansion should bring out a textbox to display the desired/given information on the specified airport*	*Make the airport that is plotted a dot(disguised as a button) on the map. Have an event handler that can click on the airport which will give a small box under the airport that will summarize and simplify any information of said airport. There will be another button that can be pressed to expand this info box to bring out the more detailed information on the airport. This information will be taken from the API by searching in the hashmap given by the API.*	*3*

Plot or View Airports	*3.4*		*As a user, I want to be able to:*	*Given a button, I want to be able to:*		*3*

Feature	*ID*	*Owner*	*Description (User Story)*	*Acceptance Criteria*	*Implementation Detail*	*P*
Line Thickness	*4.1*	*Youssef*	*As a low vision user I want to make the flight path lines on the map thicker, so that I can better see them.*	*Given that I am a low vision user, I want to have a button that when I click it turns up the contrast of the app.*	*Find out how to make a slider UI component with JavaFX. Go through the list of graphed routes and scale the line component.*	*1*
Contrast Mode	*4.2*		*As a low vision user I want to make the app high contrast, so that I can see it better.*	*Given that I have a visually graphed route on the map, when I click on it my expectations are that a window with flight details for that route will open.*	*Figure out how to manipulate contrast with JavaFX. Make a button in the corner of the screen. On and off feature.*	*2*
Focus on Route	*4.3*		*As a user I want to be able to quickly focus on a graphed route.*	*Given that I have a Flight route mapped, I expect to have a button in that Flight's details tab that will shift my map so that the route is centered and that the map is zoomed to contain the route.*	*Make a button with an event handler that when triggered will search through all graphed routes looking for the one matching the Flight ID. Then shift and scale the map so that the plot point of departure and arrival airports are within*	*2*

					centered in the user's view.	
Search Planes	*4.4*		*As a user, I want to be able to search planes by it's status, production line, owner, registration date, and first flight*	*Given a search box dedicated to planes, I want to search all planes with certain parameters and view their information or highlight their flight on the map.*	*There will be a search box with a drop down to search by certain features (sort). This will return any object that is similar to the string inputted.*	*3*

2.3. SPRINT 1 CODE REVIEWS

Story Reviewed	Name of Reviewer	Pull Request Link
[DEV-1.1]: As a developer I want to have an MVC model that separates aviationstack API logic from the app logic.	Alvin	https://mcsscm.utm.utoronto.ca/csc207_20239/group_94/-/merge_requests/1
[DEV-0.1]: As a developer I want to have a UI including search bar, map, and dashboard, so that I can display flight data to the user.	Vlad	https://mcsscm.utm.utoronto.ca/csc207_20239/group_94/-/merge_requests/2
[DEV-1.3]: As a developer I want to collect flight departure airport and arrival airport coordinates so that I can display the flight route on the map.	Nikita	https://mcsscm.utm.utoronto.ca/csc207_20239/group_94/-/merge_requests/4

2.4 SPRINT 1 RETROSPECTIVE

Participants in the meeting: Alvin, Vlad, Nikita.

Summary of the meeting:

One of the main topics of discussion during the meeting was the implementation of the map. Participants voiced their opinions on how the map should be implemented. Advantages of different solutions were discussed, that is simple map image over google maps API maps. It was decided to let Nikita further research google maps API. Unfortunately clear tasks were *not* assigned during the meeting and participants left with a sense of confusion as to what they should work on next.

Unfinished tasks:

- Implementing map into front end.
- Implement a working dashboard with flight highlights.

Practices that went well:

- Communicating over discord.

Revised practices:

- Replaces frequent group calls with frequent individual calls. Not everyone has a chance to attend every group call. It is much faster for people who work on similar features (backend/frontend) to communicate via direct calls.

Bad practices:

- No bad practices were identified.

Best\worst experience:

- Such experiences were not identified.

2.1. SPRINT 2 OVERVIEW

2.1.1 Sprint Overview:

The goal is, by the end of Sprint, to have a program with GUI that displays the minimal flight data, and a backend that queries and formats that data.

Start of the sprint is Friday, Nov 20.
End of the sprint is Friday, Nov 30.

2.1.2 Stories Selected for this Sprint:

	Feature	ID	User story
Vlad	*View Plane Information*	1.4	*As a user, I want to be able to see detailed information about the flight displayed in a popup window.*
Youssef	*Map Navigation*	1.2	*As a user I want to be able to zoom in, zoom out and navigate over a map to better see the flights displayed.*
Nikita	*Map Navigation*	1.2	*As a user I want to be able to zoom in, zoom out and navigate over a map to better see the flights displayed.*
Alvin	*View Plane Information*	1.4	*As a user, I want to be able to see detailed information about the flight displayed in a popup window.*

2.1.3 Team Capacity:

We expect to have a working map with navigation. We expect this to be achieved via Leaflet library.

2.1.4 Participants:

Vlad: Assist other group members with setting up frontend. Help connect frontend with backend to display queried data.

Youssef: Research leaflet and how could it be implemented into the project.

Nikita: Setup leaflet. Full integration and functionality implemented in cohesion with java.

Alvin: Continued working on dashboard and displaying flight data.

2.1.5 Tasks Completed:

- Detailed, interactive map was successfully integrated into the project.
- Short flight details are now displayed.

2.2. SPRINT 2 PRODUCT BACKLOG

Feature	*ID*	*Owner*	*Description (User Story)*	*Acceptance Criteria*	*Implementation Detail*	*P*
Map Navigation	*1.2*	*Nikita*	*As a user I want to be able to zoom in, zoom out and navigate over a map to better see the flights displayed.*	*Given that I am a curious user, when I click the plus/minus button on the map my expectations are that the map will zoom in/out. Moreover when I click and drag my cursor over a map my expectation is that the visible map will move with my cursor.*	*Figure out how to manipulate images with JavaFX. Research how I can drag an image background. Make buttons for zooming in and out. This could be done with simple scaling.*	*1*
View Flight Information	*1.4*	*Alvin*	*As a user, I want to be able to see detailed information about the flight displayed in a popup window.*	*Given that I am a user who wants to access detailed information about a specific flight, my expectations are that when I click on a flight icon I will see a new window popup displaying the detailed flight information.*	*Make an event handler that on click will open a new window and pass the detailed data about the flight to be rendered.*	*3*

Feature	*ID*	*Owner*	*Description (User Story)*	*Acceptance Criteria*	*Implementation Detail*	*P*
Filter Flight History	*2.1*	*Nikita*	*As a user I want to search historial flights by departure airport, arrival airport and flight date.*	*Given that I am a user, I want to be able to input a specific arrival and departure airport during a certain time period and be able to search all possible flights with those parameters, while having the ability to see my results.*	*Create 3 input text boxes where a user can input/select the arrival and departure and the specific time period. From this a user presses a button to search. An event handler in the view logic will send the data to the model logic, search for the data in the api and update the flights shown by sending those flights to be displayed in the view.*	*1*
Filter Real-Time Flights	*2.2*		*As a user I want to search real time flights by departure airport, arrival airport, flight date, and flight status, so that I can see a list of the kind of flights I am interested in.*	*Given that I am a user, I want to be able to input a specific arrival and departure airport during a certain time period and be able to filter my flight status to be able to see the options available at the current point in time.*	*Given the parameters through input fields for arrival, departure and time period, and an additional dropdown menu for the filter options such as status. An eventhandler will send the data to the model which calls the api and receive data for the flights by the filters imputed. The model will update the flights to display and update the view accordingly*	*1*
Flight Visualizer Updater	*2.3*		*As a user I want to be able to display, and update the flight route on a map, so that I can*	*Given that I am a user I want to be able to see the flights searched by a certain filter displayed as route lines on a map and as*	*Create a map using a world map image corresponding to the world altitude:longitude ratio. Map flight routes according to the*	*1*

			visually see it.	*a list of flights with the name of the airline and the scheduled time of the flight.*	*destination, arrival airport altitude & longitude.*	
Flight Visualizer Interaction	*2.4*		*As a user I want to be able to access details from the list of the flights I am currently displaying on a map and the list.*	*Given that I am a user, I want to be able to click on the displayed route lines on the map and list of flights available to be able to see the flight details for the specific flight clicked as a card(popup) that can be dismissed. I want to be able to repeat this task for any given flight displayed on the screen.*	*Track clicks using an event handler onto objects being displayed on the users screen and if that object happens to be a flight object, have method called to the view where that flights details are shown on the display as a card(popup) on a screen that can be closed later on.*	*1*

Feature	*ID*	*Owner*	*Description (User Story)*	*Acceptance Criteria*	*Implementation Detail*	*P*
Bulk Graph	*3.1*	*Alvin*	*As a data scientist I want to be able to graph all flights produced by the search results at once.*	*Given that I am a data analyst, when I receive multiple search results my expectations are that I will be able to correctly map all of them with one button click.*	*Make a button that will map all of the search results by looping through the List of flights. Make sure to record every flight to the `displayedFlights ` list.*	*2*
Details from graph	*3.2*		*As a visually oriented user I want to explore flight details by clicking on a graphed flight route.*	*Given that I have a visually graphed route on the map, when I click on it my expectations are that a window with flight details for that route will open.*	*Add an on-click event to the route graph. The event will trigger the creation of a FlightView related to the flight route and display long flight data to the user.*	*2*
View Airport Information	*3.3*		*As a user, I want to be able to view information on the coordinates, view all flights leaving from said airport.*	*Given a plotted airport on the map, I want to be able to interact with the icon and expand at the press of a button. This expansion should bring out a textbox to display the desired/given information on the specified airport*	*Make the airport that is plotted a dot(disguised as a button) on the map. Have an event handler that can click on the airport which will give a small box under the airport that will summarize and simplify any information of said airport. There will be another button that can be pressed to expand this info box to bring out the more detailed information on the airport. This information will be taken from the API by searching in the hashmap given by the API.*	*3*

Plot or View Airports	*3.4*		*As a user, I want to be able to:*	*Given a button, I want to be able to:*		*3*

Feature	*ID*	*Owner*	*Description (User Story)*	*Acceptance Criteria*	*Implementation Detail*	*P*
Line Thickness	*4.1*	*Youssef*	*As a low vision user I want to make the flight path lines on the map thicker, so that I can better see them.*	*Given that I am a low vision user, I want to have a button that when I click it turns up the contrast of the app.*	*Find out how to make a slider UI component with JavaFX. Go through the list of graphed routes and scale the line component.*	*1*
Contrast Mode	*4.2*		*As a low vision user I want to make the app high contrast, so that I can see it better.*	*Given that I have a visually graphed route on the map, when I click on it my expectations are that a window with flight details for that route will open.*	*Figure out how to manipulate contrast with JavaFX. Make a button in the corner of the screen. On and off feature.*	*2*
Focus on Route	*4.3*		*As a user I want to be able to quickly focus on a graphed route.*	*Given that I have a Flight route mapped, I expect to have a button in that Flight's details tab that will shift my map so that the route is centered and that the map is zoomed to contain the route.*	*Make a button with an event handler that when triggered will search through all graphed routes looking for the one matching the Flight ID. Then shift and scale the map so that the plot point of departure and arrival airports are within*	*2*

					centered in the user's view.	
Search Planes	*4.4*		*As a user, I want to be able to search planes by it's status, production line, owner, registration date, and first flight*	*Given a search box dedicated to planes, I want to search all planes with certain parameters and view their information or highlight their flight on the map.*	*There will be a search box with a drop down to search by certain features (sort). This will return any object that is similar to the string inputted.*	*3*

2.3. SPRINT 2 CODE REVIEWS

Story Reviewed	Name of Reviewer	Pull Request Link
[DEV-1.2]: As a user I want to be able to zoom in, zoom out and navigate over a map to better see the flights displayed.	Alvin	https://mcsscm.utm.utoronto.ca/csc207_20239/group_94/-/merge_requests/9
[DEV-1.2]: As a user I want to be able to zoom in, zoom out and navigate over a map to better see the flights displayed.	Alvin	https://mcsscm.utm.utoronto.ca/csc207_20239/group_94/-/merge_requests/6
[DEV-1.4]: As a user, I want to be able to see detailed information about the flight displayed in a popup window.	Nikita	https://mcsscm.utm.utoronto.ca/csc207_20239/group_94/-/merge_requests/10

2.4 SPRINT 2 RETROSPECTIVE

Participants in the meeting: Alvin, Vlad, Nikita, Youssef

Summary of the meeting:

The work done was summarized. Further instructions were given to the group members.

Unfinished tasks:

- Displaying long flight details.

Practices that went well:

- Working in pairs, with one person being the “driver” and the other the “navigator”.

Revised practices:

- Not identified.

Bad practices:

- Not identified.

Best\worst experience:

- Not identified.

2.1. SPRINT 3 OVERVIEW

2.1.1 Sprint Overview:

The goal is, by the end of Sprint, to have a product with the core functionality implemented. That is to have a program that allows users to search flights, pin flights, graph flights and adjust the display settings to accommodate accessibility users.

Start of the sprint is Friday, Nov 30.
End of the sprint is Friday, Dec 5.

2.1.2 Stories Selected for this Sprint:

	Feature	ID	User story
Vlad	*Working with other group members & coordinating. Making sure the features merge smoothly. Helping debug.*	5.1 & 2.2 & 3.4	
Youssef	*Search flights by city*	5.1	*As a user who does not have access to airport codes I want to be able to search flights based on city name, rather than iata codes.*
Nikita	*Line Thickness*	4.1	*As a low vision user I want to make the flight path lines on the map thicker, so that I can better see them.*
Nikita	*Contrast Mode*	4.2	*As a low vision user I want to make the*

			app high contrast, so that I can see it better.
Nikita	*Flight Visualizer Interaction*	2.4	*As a user I want to be able to access details from the list of the flights I am currently displaying on a map and the list.*
Alvin	*Pin flights to dashboard*	3.4	*As a user, I want to be able to pin my favorite flights so that I can easily access them*
Alvin	*Filter Real-Time Flights*	2.2	*As a user I want to search real time flights by departure airport, arrival airport, flight date, and flight status, so that I can see a list of the kind of flights I am interested in.*

2.1.3 Team Capacity:

We expect to have completed the core features of the project and have it ready to present on Tuesday.

2.1.4 Participants:

Vlad: Help debug multiple user stories. Assist group members with working on their specific user stories. Help connect frontend with backend.

Youssef: Extend the AirportsAPI class to cover broader functionality.

Nikita: Implement the graphing of flight routes. Implement accessibility features.

Alvin: Implement flight pin functionality. Finish the dashboard. Finish flight long details popup.

2.1.5 Tasks Completed:

- The core functionality was successfully implemented, even though with minor bugs regarding some edge cases.
- Accessibility features were implemented.
- Flight mapping, flight long details, and dashboard were implemented.

2.2. SPRINT 3 PRODUCT BACKLOG

Feature	*ID*	*Owner*	*Description (User Story)*	*Acceptance Criteria*	*Implementation Detail*	*P*
Filter Flight History	*2.1*	*Nikita*	*As a user I want to search historial flights by departure airport, arrival airport and flight date.*	*Given that I am a user, I want to be able to input a specific arrival and departure airport during a certain time period and be able to search all possible flights with those parameters, while having the ability to see my results.*	*Create 3 input text boxes where a user can input/select the arrival and departure and the specific time period. From this a user presses a button to search. An event handler in the view logic will send the data to the model logic, search for the data in the api and update the flights shown by sending those flights to be displayed in the view.*	*1*
Filter Real-Time Flights	*2.2*		*As a user I want to search real time flights by departure airport, arrival airport, flight date, and flight status, so that I can see a list of the kind of flights I am interested in.*	*Given that I am a user, I want to be able to input a specific arrival and departure airport during a certain time period and be able to filter my flight status to be able to see the options available at the current point in time.*	*Given the parameters through input fields for arrival, departure and time period, and an additional dropdown menu for the filter options such as status. An eventhandler will send the data to the model which calls the api and receive data for the flights by the filters imputed. The model will update the flights to display and update the view accordingly*	*1*
Flight Visualizer Updater	*2.3*		*As a user I want to be able to display, and update the flight route on a map, so that I can*	*Given that I am a user I want to be able to see the flights searched by a certain filter displayed as route lines on a map and as*	*Create a map using a world map image corresponding to the world altitude:longitude ratio. Map flight routes according to the*	*1*

			visually see it.	*a list of flights with the name of the airline and the scheduled time of the flight.*	*destination, arrival airport altitude & longitude.*	
Flight Visualizer Interaction	*2.4*		*As a user I want to be able to access details from the list of the flights I am currently displaying on a map and the list.*	*Given that I am a user, I want to be able to click on the displayed route lines on the map and list of flights available to be able to see the flight details for the specific flight clicked as a card(popup) that can be dismissed. I want to be able to repeat this task for any given flight displayed on the screen.*	*Track clicks using an event handler onto objects being displayed on the users screen and if that object happens to be a flight object, have method called to the view where that flights details are shown on the display as a card(popup) on a screen that can be closed later on.*	*1*

Feature	*ID*	*Owner*	*Description (User Story)*	*Acceptance Criteria*	*Implementation Detail*	*P*
Bulk Graph	*3.1*	*Alvin*	*As a data scientist I want to be able to graph all flights produced by the search results at once.*	*Given that I am a data analyst, when I receive multiple search results my expectations are that I will be able to correctly map all of them with one button click.*	*Make a button that will map all of the search results by looping through the List of flights. Make sure to record every flight to the `displayedFlights ` list.*	*2*
Details from graph	*3.2*		*As a visually oriented user I want to explore flight details by clicking on a graphed flight route.*	*Given that I have a visually graphed route on the map, when I click on it my expectations are that a window with flight details for that route will open.*	*Add an on-click event to the route graph. The event will trigger the creation of a FlightView related to the flight route and display long flight data to the user.*	*2*
View Airport Information	*3.3*		*As a user, I want to be able to view information on the coordinates, view all flights leaving from said airport.*	*Given a plotted airport on the map, I want to be able to interact with the icon and expand at the press of a button. This expansion should bring out a textbox to display the desired/given information on the specified airport*	*Make the airport that is plotted a dot(disguised as a button) on the map. Have an event handler that can click on the airport which will give a small box under the airport that will summarize and simplify any information of said airport. There will be another button that can be pressed to expand this info box to bring out the more detailed information on the airport. This information will be taken from the API by searching in the hashmap given by the API.*	*3*

Pin flights to dashboard	*3.4*		*As a user, I want to be able to pin my favorite flights so that I can easily access them*	*Given that I have interest in a specific flight, my expectations are that there will be a "pin" button so that I can save the flight to the dashboard.*	*Make a list that will keep track of pinned flights. Add buttons and even handler that will modify the list accordingly.*	*3*

Feature	*ID*	*Owner*	*Description (User Story)*	*Acceptance Criteria*	*Implementation Detail*	*P*
Line Thickness	*4.1*	*Youssef*	*As a low vision user I want to make the flight path lines on the map thicker, so that I can better see them.*	*Given that I am a low vision user, I want to have a button that when I click it turns up the contrast of the app.*	*Find out how to make a slider UI component with JavaFX. Go through the list of graphed routes and scale the line component.*	*1*
Contrast Mode	*4.2*		*As a low vision user I want to make the app high contrast, so that I can see it better.*	*Given that I have a visually graphed route on the map, when I click on it my expectations are that a window with flight details for that route will open.*	*Figure out how to manipulate contrast with JavaFX. Make a button in the corner of the screen. On and off feature.*	*2*
Focus on Route	*4.3*		*As a user I want to be able to quickly focus on a graphed route.*	*Given that I have a Flight route mapped, I expect to have a button in that Flight's details tab that will shift my map so that the route is centered and that the map is zoomed to contain the route.*	*Make a button with an event handler that when triggered will search through all graphed routes looking for the one matching the Flight ID. Then shift and scale the map so that the plot point of departure and arrival airports are within centered in the user's view.*	*2*

Search Planes	*4.4*		*As a user, I want to be able to search planes by it's status, production line, owner, registration date, and first flight*	*Given a search box dedicated to planes, I want to search all planes with certain parameters and view their information or highlight their flight on the map.*	*There will be a search box with a drop down to search by certain features (sort). This will return any object that is similar to the string inputted.*	*3*
Search flights by city	*5.1*	*Youssef*	*As a user who does not have access to airport codes I want to be able to search flights based on city name, rather than iata codes.*	*Given a search box, my expectations are that if I type in a city name, I will have access to flights that depart/arrive from that city.*	*Make a hashmap of city names to airport codes. When the user searches a city, return the flights from the airports that are mapped to that city.*	

2.3. SPRINT 3 CODE REVIEWS

Story Reviewed	Name of Reviewer	Pull Request Link
[DEV-1.4]: As a developer I want to have an MVC model that separates aviationstack API logic from the app logic.	Youssef	https://mcsscm.utm.utoronto.ca/csc207_20239/group_94/-/merge_requests/10
[DEV-3.4]: As a user, I want to be able to pin my favorite flights so that I can easily access them	Vlad	https://mcsscm.utm.utoronto.ca/csc207_20239/group_94/-/merge_requests/13
[DEV-4.1]: As a low vision user I want to make the flight path lines on the map thicker, so that I can better see them.	Alvin	https://mcsscm.utm.utoronto.ca/csc207_20239/group_94/-/merge_requests/14
[DEV-2.2]: As a user I want to search real time flights by departure airport, arrival airport, flight date, and flight status, so that I can see a list of the kind of flights I am interested in	Vlad	https://mcsscm.utm.utoronto.ca/csc207_20239/group_94/-/merge_requests/15
[DEV-2.2]: As a user I want to search real time flights by departure airport, arrival airport, flight date, and flight status, so that I can see a list of the kind of flights I am interested in	Youssef & Nikita	https://mcsscm.utm.utoronto.ca/csc207_20239/group_94/-/merge_requests/19

2.4 SPRINT 3 RETROSPECTIVE

Participants in the meeting: Alvin, Vlad, Nikita, Youssef.

Summary of the meeting:

The final meeting was conducted before the presentation. Code reviews were conducted along with final branch merges. Discussion of the presentation took place. Possibilities for further development and project maintenance were discussed.

Unfinished tasks:

- Some user stories were left behind. These include: bulk graph, airport details, airplane details.

Practices that went well:

- It helped to have one person orchestrate the work of others. Make sure no one is duplicating work or overwriting other people’s work. This is especially important considering the large number of features being completed over such a short period of time.

Revised practices:

- Not identified.

Bad practices:

- Not identified.

Best\worst experience:

- Not identified.

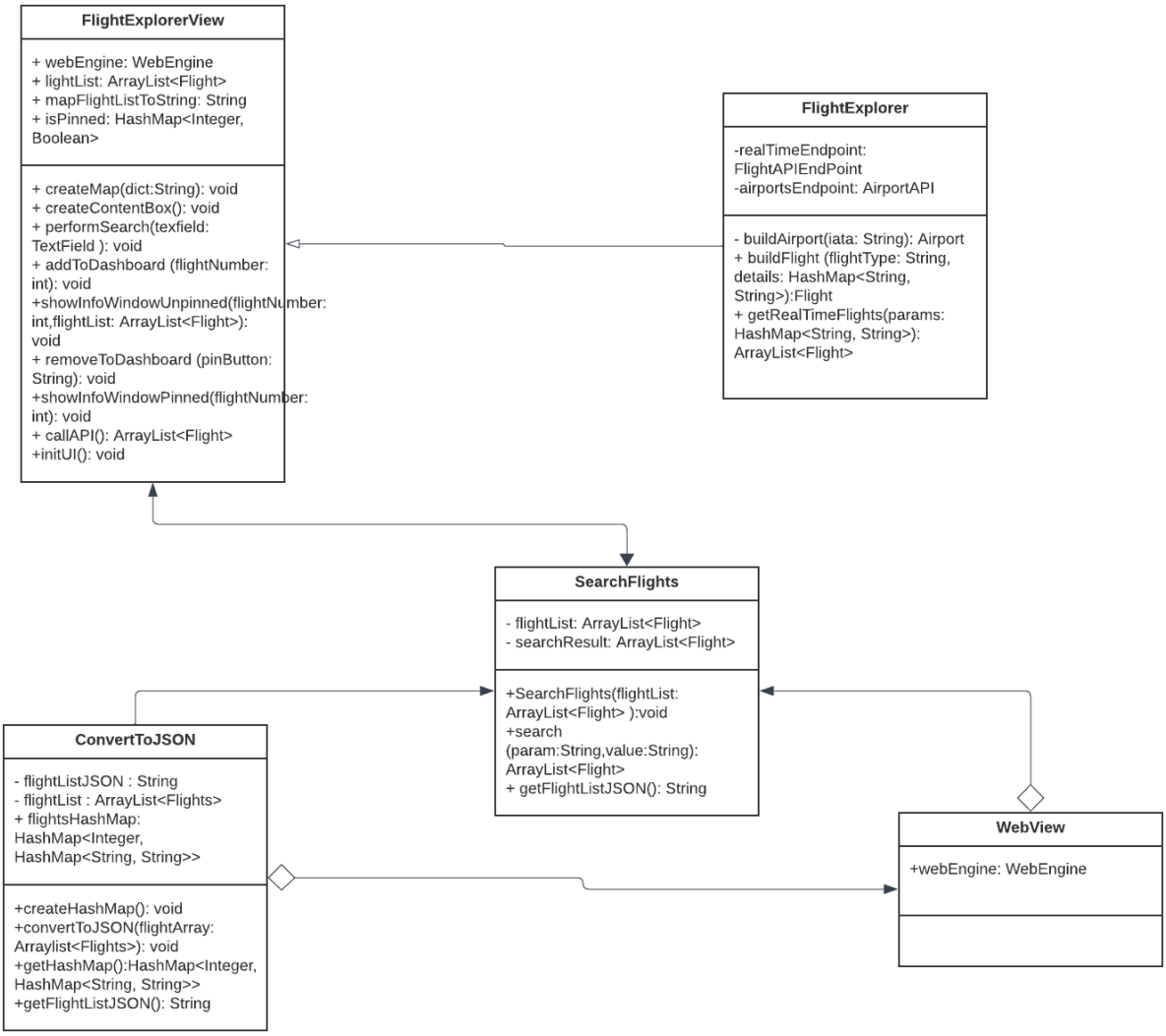
SECTION 3: SUMMARY

The Flight Explorer app was completed with ~80% accuracy as to what it was intended to be. Some things worked out better than expected. For example the map API ended up looking better than expected. Although the frontend could use some styling work to look more appealing. We were unable to include historic flights in the project due to API limitations. Also the detailed airport information along with detailed airplane information were not implemented. Everything else, including searching, graphing and exploring flight details was implemented successfully. Overall project can be declared a success. The project will likely be further developed and maintained. The Agile process did not go extremely smoothly, but it was a valuable learning experience. We plan to continue implementing agile, incremental development practices when continuing to work on this project as well as other future projects.

Updated UML diagram can be found below 👇

UML Design Patterns:

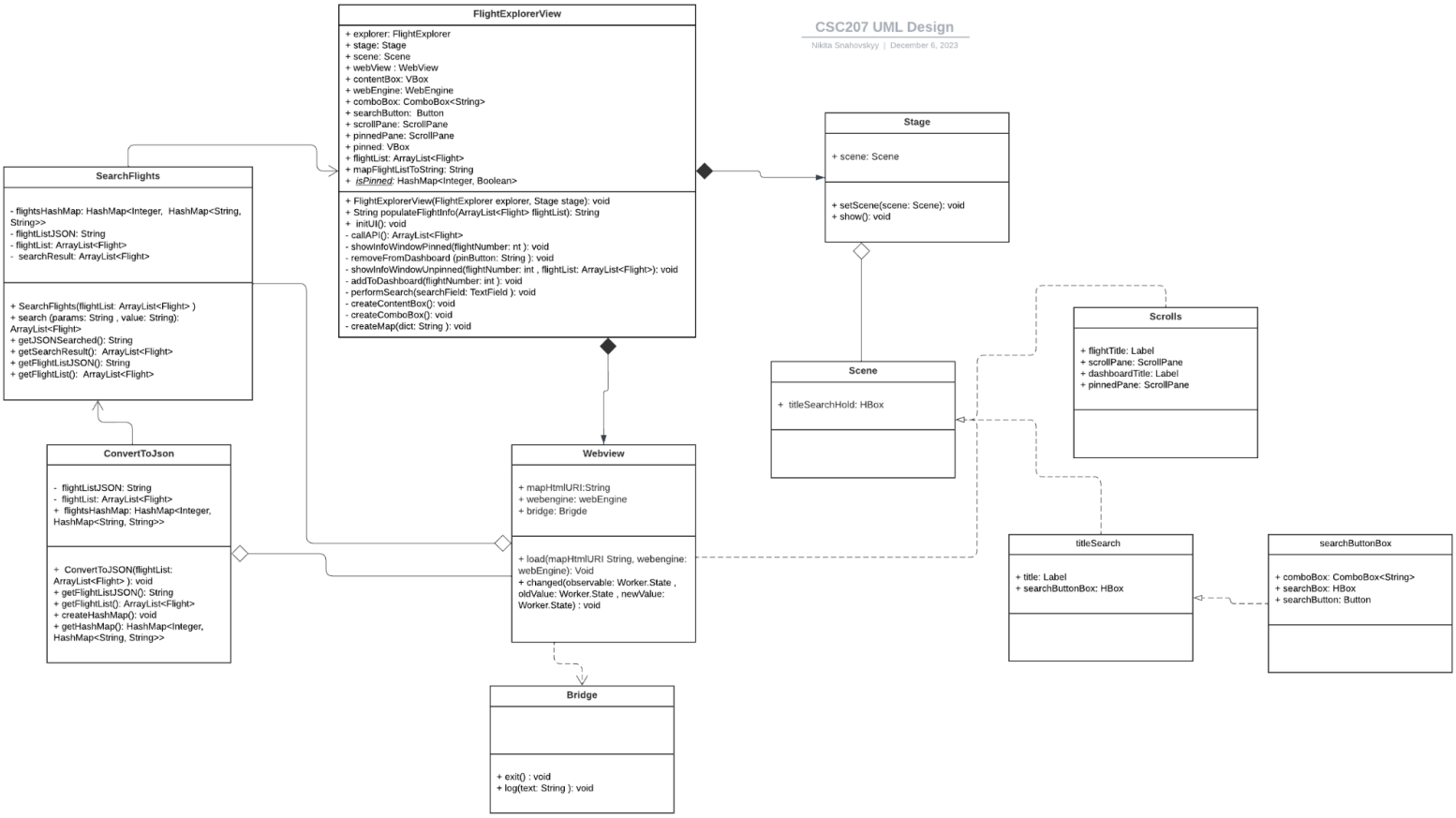
Mediator:



The Mediator design pattern promotes loose coupling by introducing a central Mediator object that manages communication between a set of objects, known as Colleagues. Instead of direct communication between Colleagues, they communicate through the Mediator, reducing dependencies and simplifying the overall system structure. This pattern is particularly useful in scenarios where a complex interaction exists between multiple objects, such as in GUI systems or applications with numerous components. The Mediator pattern enhances

maintainability, promotes reusability, and provides a centralized control point for communication logic. In our case, the project used the mediator pattern to allow for direct communication from our front end to our back end, as seen in the UML above. The webview, which contains the map and displays all the flights searched by the user, needs to have an aggregate relationship with the searchFlights and ConvertToJson. These classes communicate specifically with the AviationStackAPI in the FlightExplorer and provide the results of the API calls that depend on the search parameters imputed by the user in the FlightExplorerView. These results are then given as input for the webview to process and display on the map. Hence you can see the necessity of using such a design pattern, as no application without a mediator to connect the frontend and backend together would allow for the project to function as intended.

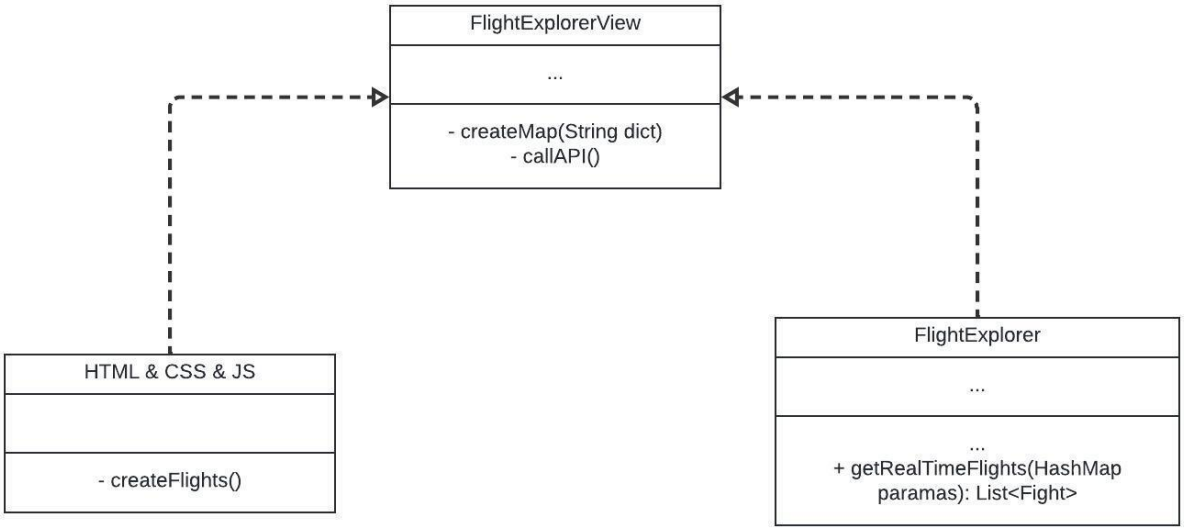
Composite:



The Composite design pattern is a structural pattern that enables clients to treat individual objects and compositions of objects uniformly. It forms a tree-like structure where components, represented by an interface or abstract class, can be either leaf objects or composite objects. Leaf objects represent individual elements, while composite objects group elements together. Clients can interact with both types of objects using a common interface, allowing for a seamless and uniform approach to handling complex hierarchies of objects. This pattern is particularly useful in scenarios where a part-whole hierarchy needs to be represented, such as in graphical systems or organizational structures. Hence, such a design pattern would be useful within our project that utilizes Javafx GUI which functions in a tree like structure as can be seen in the UML above. The Stage is at the top of the tree, following the Scene, and after the children nodes of Scene which display the specific parts of the UI window used in the frontend. Webview for the map, scrollables for the dashboard and pinned flights, as well as the title search holding the search box,

filters, and searchbutton. Therefore our frontend depends on this composite design pattern as it helps develop the proper UI for the best user experience.

Model-View-Controller



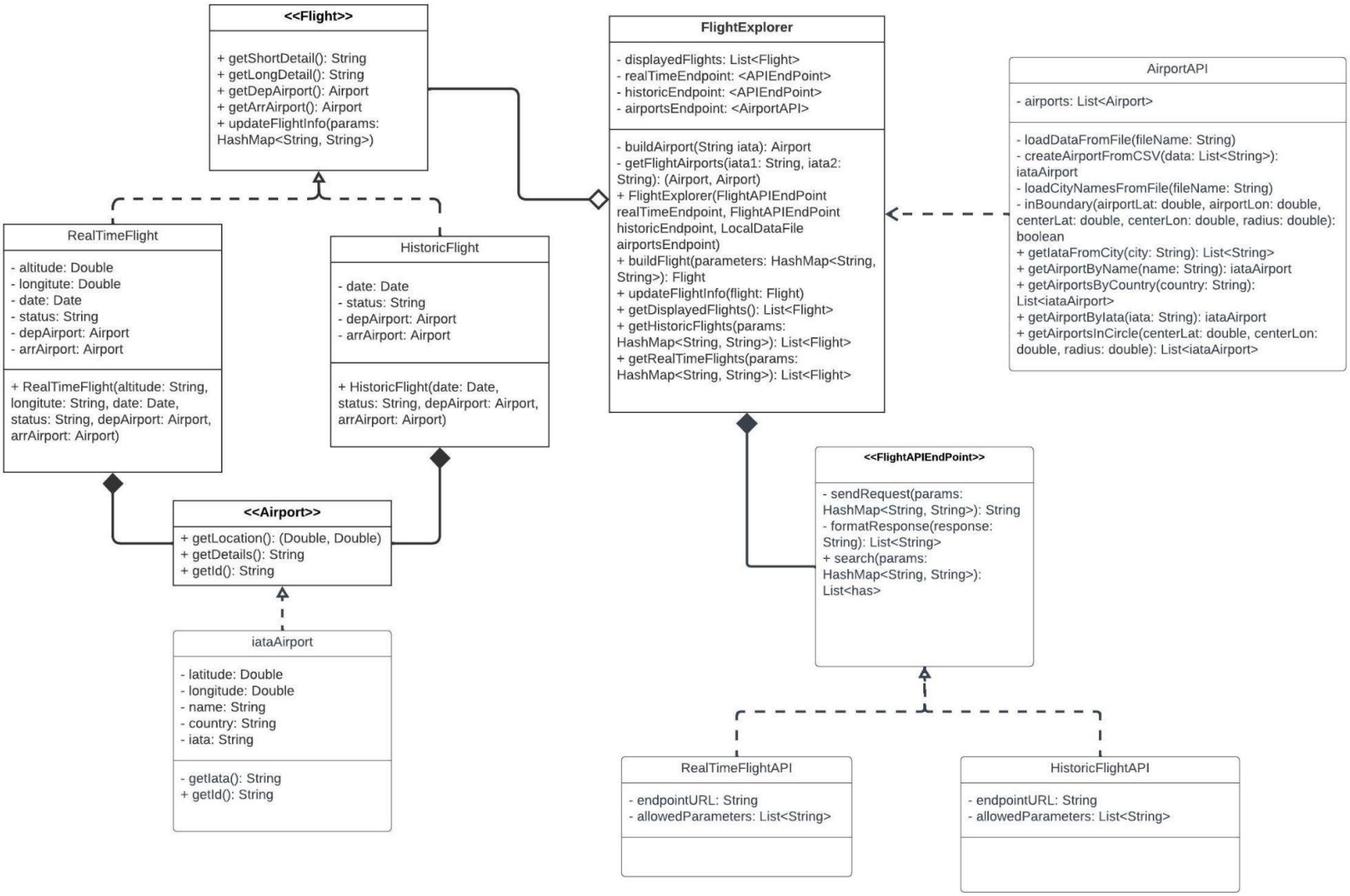
Here we have FlightExplorerView control the logic and update the map view. The map is updated with the createMap() private method. This method takes flight parameters and updates the map by calling createFlights() JavaScript method.

The FlightExplorerView also queries data from FlightExplorer using the callAPI method. The FlightExplorer handles all the logic regarding the flight data retrieval and processing and returns Flight objects.

Finally, the map is displayed via an HTML file. The logic for displaying the map is in the FlightExplorerView and the FlightExplorerView gets its data from the FlightExplorer.

Note* Some implementation details were omitted, as the classes are described in detail in other UMLs.

Factory Method



The flightExplorer's primary job is to build and store Flight objects. The getHistoricFlights() and getRealTimeFlights will query the corresponding FlightAPIEndPoint with the parameters provided. It will then create a flight object via buildFlight() method for each flight in the response. The buildFlight method will getFlightAirports() for itself based on the airport IDs of the flight . The getFlightAirports will query the AirportAPI and construct Airport objects based on the return of the AirportAPI. Finally when getFlightAirports() returns the Airports, a Flight object is created and returned by buildFlight(). The getHistoricFlights() and getRealTimeFlights() then return a list of flight objects. Note that buildFlight() may be used by itself to just query one flight (e.g. the user wants to refresh data about a live flight).