NEMO DEMO

Spring - 1st Sprint

THE TEAM

Taylor Sumlin	Scrum Master, Frontend Developer
Maegan Lucas	Frontend Developer
Maxwell Moolchan	Frontend Developer
Adam Fitch	Backend Developer
Darian Hopkins	Backend Developer

AGENDA

01
PROJECT OVERVIEW
A high-level description of our project.

02
SINCE LAST SPRINT
Accomplishments since last semester.

03
FRONTEND
An overview of the frontend changes.

04
BACKEND
An overview of the backend developments.

05
FUTURE SPRINTS
Planned tasks for the future.

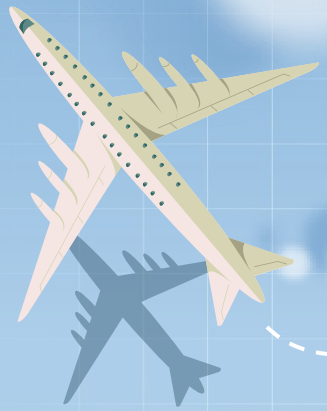
06
LESSONS LEARNED
Lessons learned throughout the sprint.

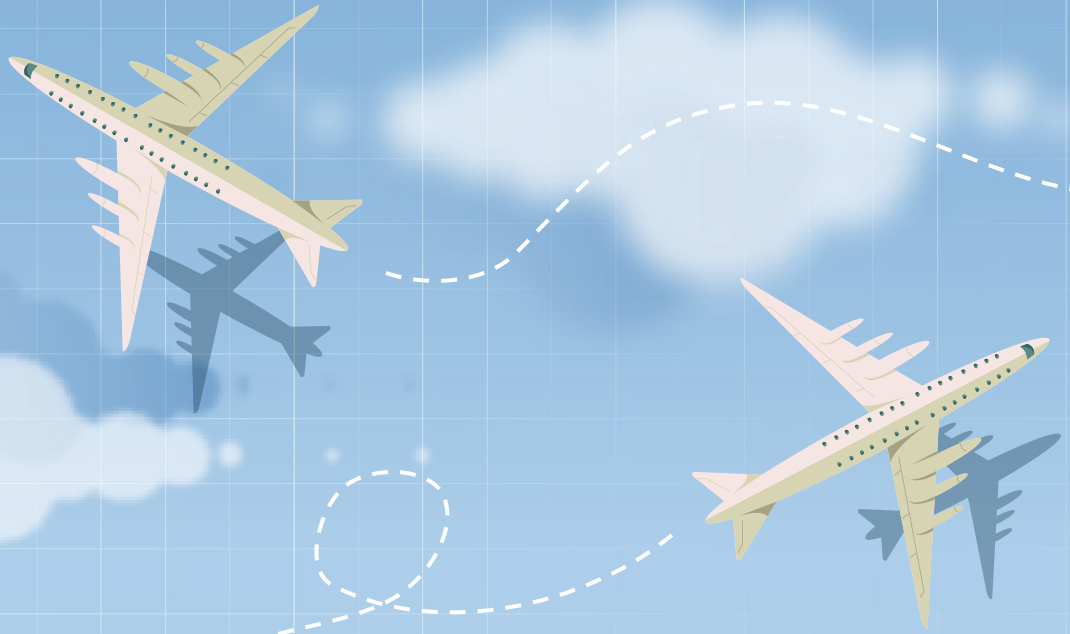
PROJECT OVERVIEW

Updating an existing Web application that allows users to select airplanes or airports and listen to Air Traffic Communication (ATC) audio. Integrates NVIDIA NeMo Automatic Speech Recognition (ASR) to transcribe ATC. Creation of a Communications database.

SINCE LAST SPRINT

- Redefined Team Roles & Organization
- Separated Workflow into Frontend & Backend Development
- Set a clear end goal for this iteration of development





03

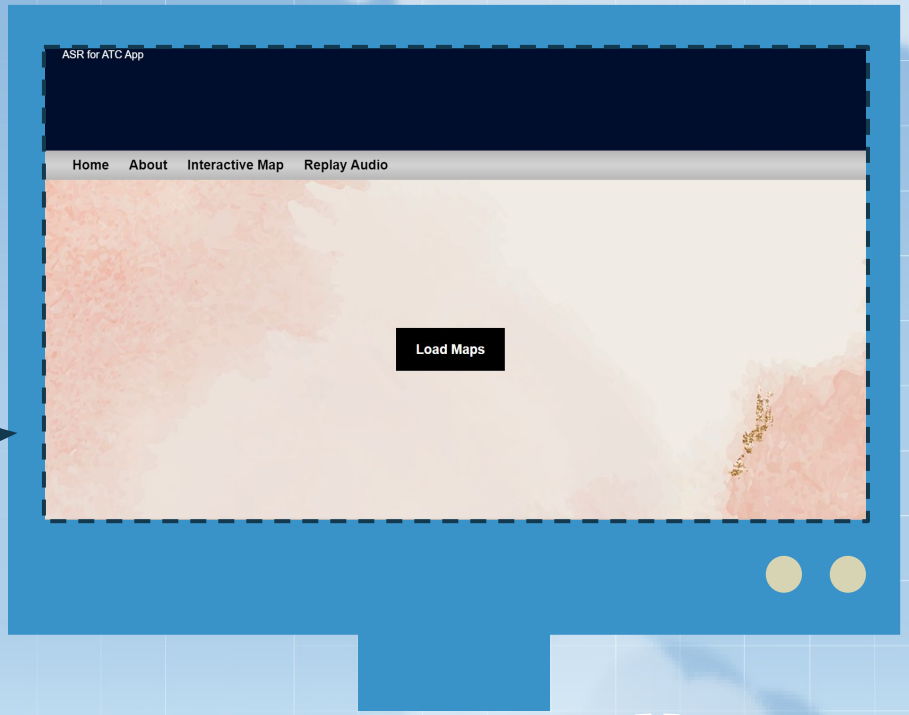
FRONTEND

User interface updates

TEMPLATE UPDATE

Update the template for each page for a cleaner look and to match the Embry-Riddle color scheme.

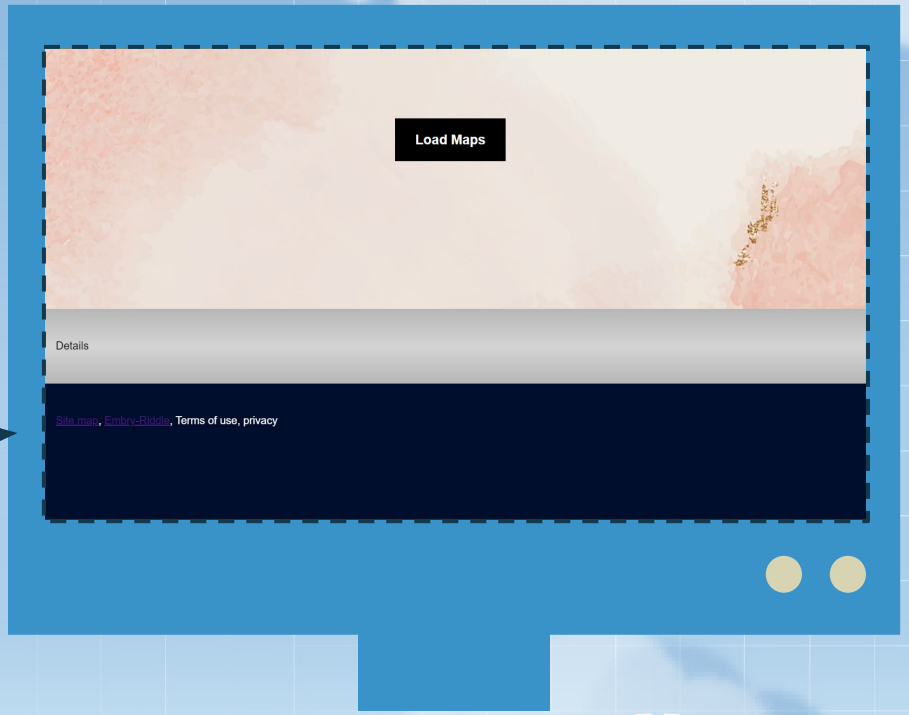
OLD TEMPLATE



TEMPLATE UPDATE

Update the template for each page for a cleaner look and to match the Embry-Riddle color scheme.

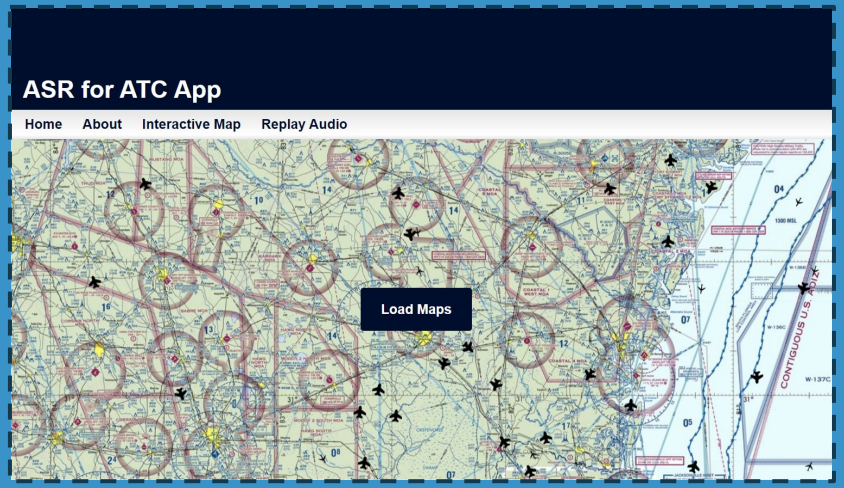
OLD TEMPLATE



TEMPLATE UPDATE

Update the template for each page for a cleaner look and to match the Embry-Riddle color scheme.

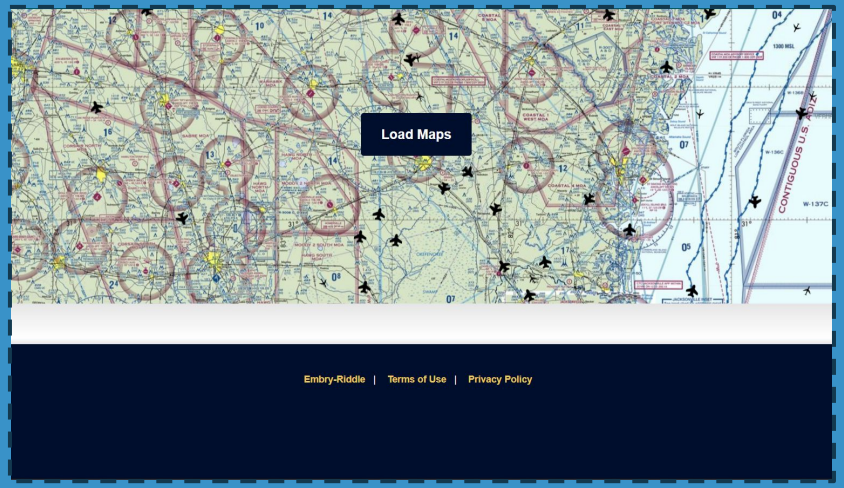
NEW TEMPLATE

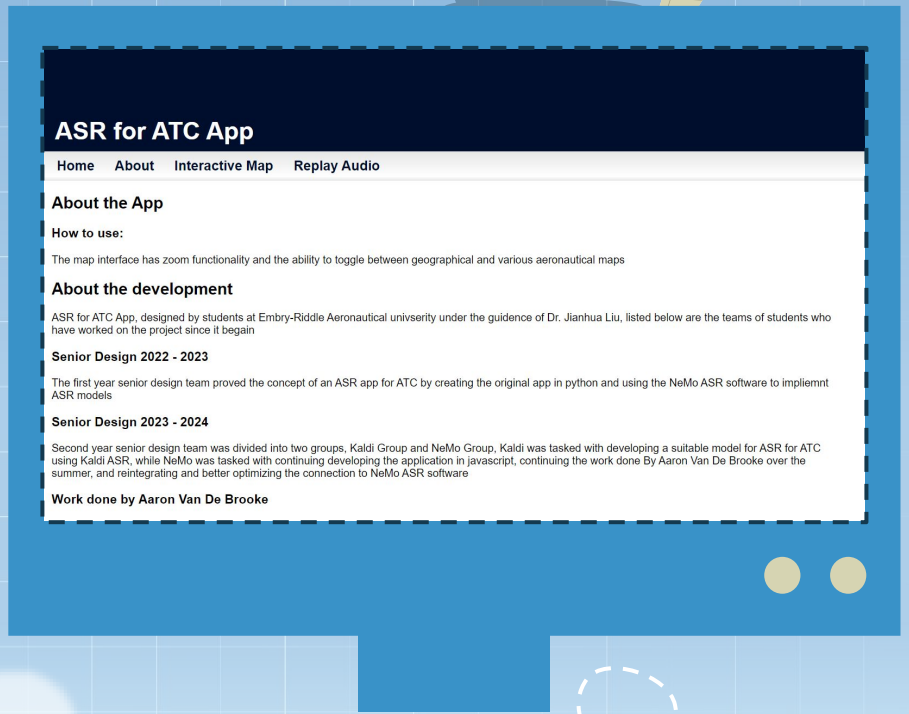


TEMPLATE UPDATE

Update the template for each page for a cleaner look and to match the Embry-Riddle color scheme.

NEW TEMPLATE

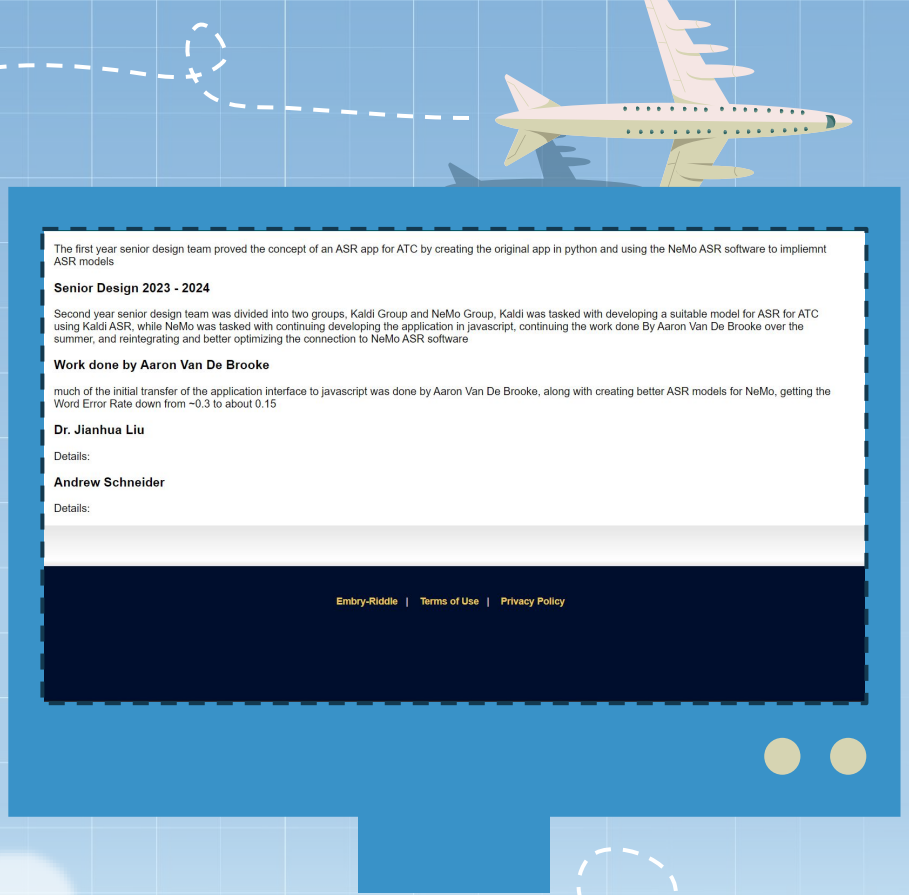




ABOUT PAGE UPDATE

Update the *About* page with more information, filling blank areas, and keeping design consistency.

OLD ABOUT PAGE



The first year senior design team proved the concept of an ASR app for ATC by creating the original app in python and using the NeMo ASR software to impliemnt ASR models

Senior Design 2023 - 2024

Second year senior design team was divided into two groups, Kaldi Group and NeMo Group, Kaldi was tasked with developing a suitable model for ASR for ATC using Kaldi ASR, while NeMo was tasked with continuing developing the application in javascript, continuing the work done By Aaron Van De Brooke over the summer, and reintegrating and better optimizing the connection to NeMo ASR software

Work done by Aaron Van De Brooke

much of the initial transfer of the application interface to javascript was done by Aaron Van De Brooke, along with creating better ASR models for NeMo, getting the Word Error Rate down from ~0.3 to about 0.15

Dr. Jianhua Liu

Details:

Andrew Schneider

Details:

Embry-Riddle | Terms of Use | Privacy Policy

ABOUT PAGE UPDATE

Update the *About* page with more information, filling blank areas, and keeping design consistency.

OLD ABOUT PAGE

ASR for ATC App

Home About Interactive Map Replay Audio

About the App

This Automatic Speech Recognition (ASR) application is designed to be a study tool for student pilots, or those who are new to aviation phraseology found withing Air Traffic Communication (ATC). With this application, you can view live aircraft data on a geographic or various aeronautical maps, including:

- Hybrid Visual Flight Rules
- Low Instrument Flight Rules
- High Instrument Flight Rules
- Sectionals
- Helicopters

You can select an aircraft icon from the map and see information about the aircraft such as callsign, coordinates, altitude, and much more. Once an aircraft is selected, audio communications can be listened to and transcribed. You can also select an airport icon from the map and see their information such as their name, identifier, coordinates and more.

How to Use:

Click the *Interactive Map* tab to view the default geographic map. To view other maps, select the + button on the left-hand side of the screen to enable the map drop-down menu. From there, select the map you desire or toggle between them.

All maps have zoom capabilities. For best viewing practices, a zoom limit is enacted. If this occurs, either zoom back in or out.

About the Development

This application is designed by students at Embry-Riddle Aeronautical University under the guidance of Dr. Jianhua Liu and in collaboration with Dr. Andrew

ABOUT PAGE UPDATE

Update the *About* page with more information, filling blank areas, and keeping design consistency.

NEW ABOUT PAGE

About the Development

This application is designed by students at Embry-Riddle Aeronautical University under the guidance of Dr. Jianhua Liu and in collaboration with Dr. Andrew Schnieder. Listed below are the teams of students who have worked on the project since its inception.

Senior Design 2022 - 2023

The first year senior design team provided the concept of an ASR app for ATC by creating the original app in Python and Plotly Dash, and using the NeMo ASR software to implement ASR models

Team Members: Braeden Burnett, Jackob Haehre, Kira McFadden, Tyler Carr

Senior Design 2023 - 2024

The second year senior design team was divided into two groups: Kaldi and NeMo. Kaldi was tasked with developing a better suited model for ASR for ATC using the Kaldi ASR. NeMo was tasked with continuing development of the application in Javascript, Python, and Flask. This is a continuation of the work done By Aaron Van De Brooke over the summer, while also reintegrating and better optimizing the connection to NeMo ASR software

Team Members: Maegan Lucas, Taylor Sumlin, Adam Fitch, Darian Hopkins, Maxwell Moolchan

Work Completed by Aaron Van De Brooke

Much of the initial transfer of the application interface to Javascript and Flask was done by Aaron Van De Brooke. Along with this, he created better ASR models for NeMo, getting the Word Error Rate down from about 0.30 to about 0.15.

Dr. Jianhua Liu

Dr. Jianhua Liu is an Associate Professor and Program Coordinator for M.S. in Electrical and Computer Engineering. He joined Embry-Riddle in 2004, and has been developing teaching expertise primarily in devices, circuits, signals, and systems. He has extensive publications in the areas of wireless communications, signal processing, embedded systems, sensor networks, and avionics.

Andrew Schneider

Andrew Schneider is an Aviation English Coordinator and Adjunct Faculty with the College of Aviation.

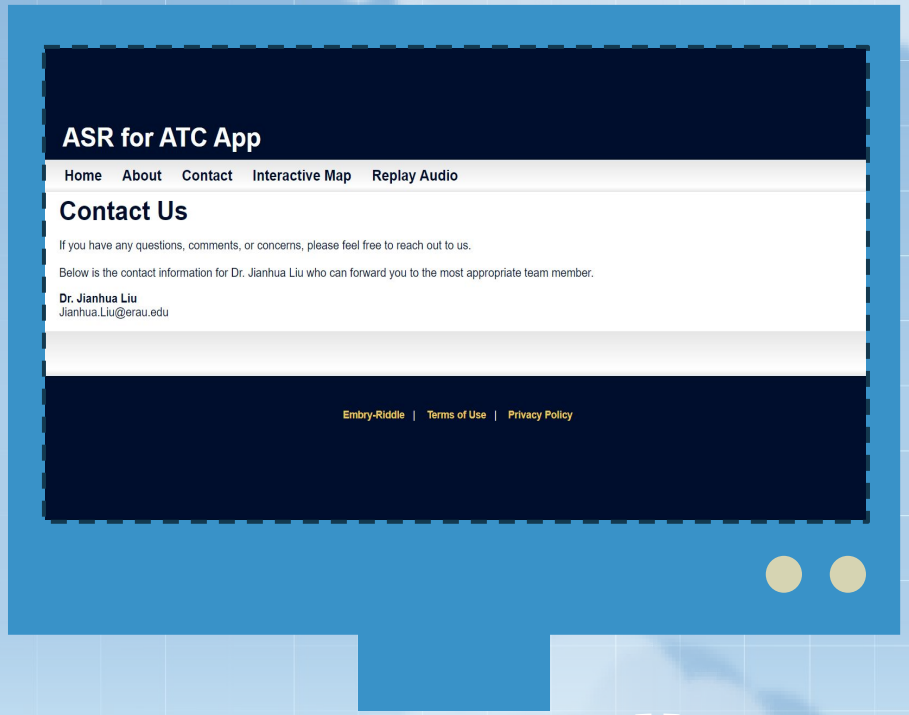
ABOUT PAGE UPDATE

Update the *About* page with more information, filling blank areas, and keeping design consistency.

NEW ABOUT PAGE

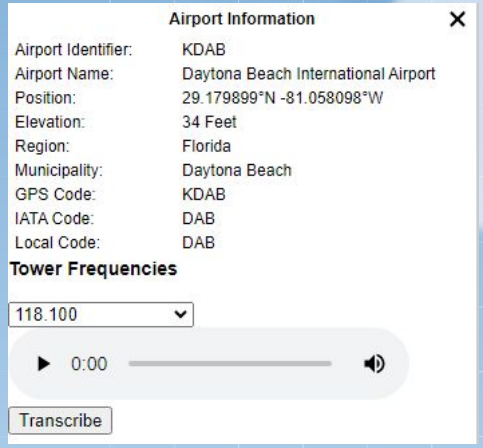
CONTACT PAGE

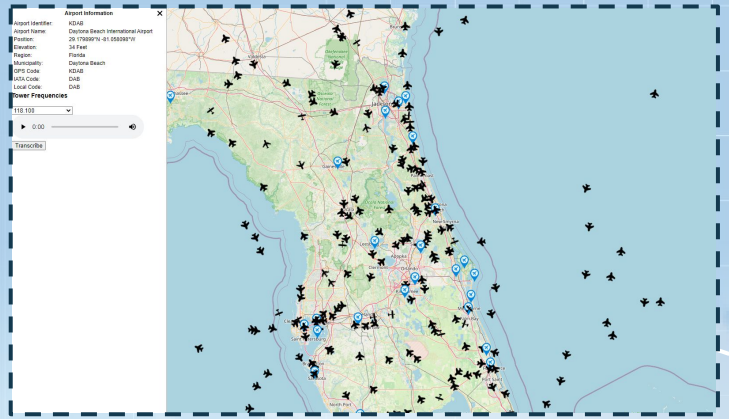
Created an initial *Contact* page for anyone who may have questions, comments, or concerns.



AIRPORT PANELS

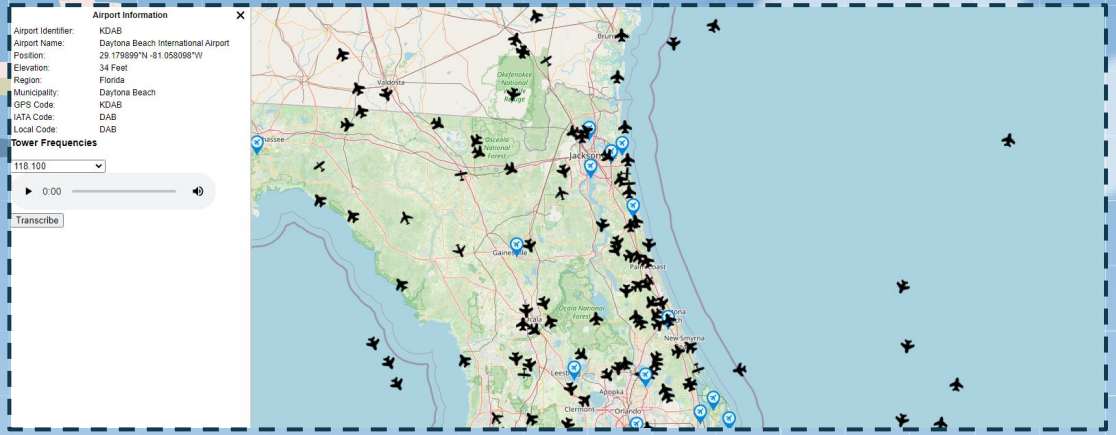
Ongoing facelift of key web application features to ensure visibility and ease of access for future users

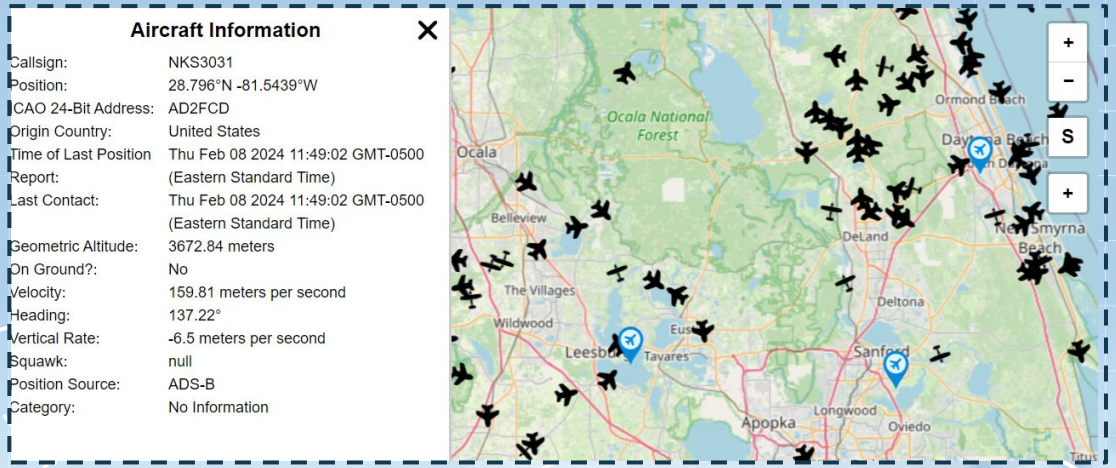


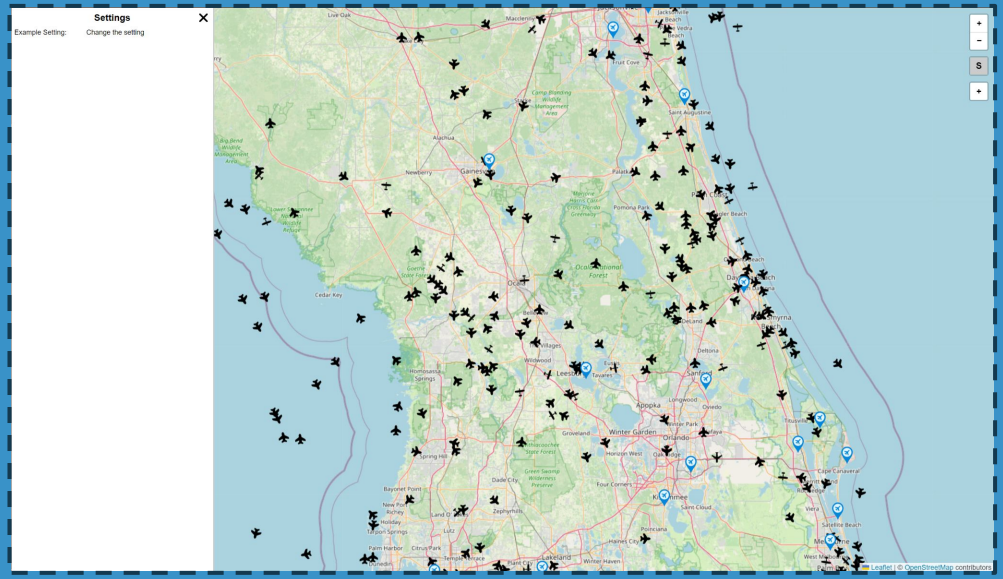


MOVED CONTROLS

Moved control locations to right side of map screen, enables user to view properties and utilize controls at the same time.







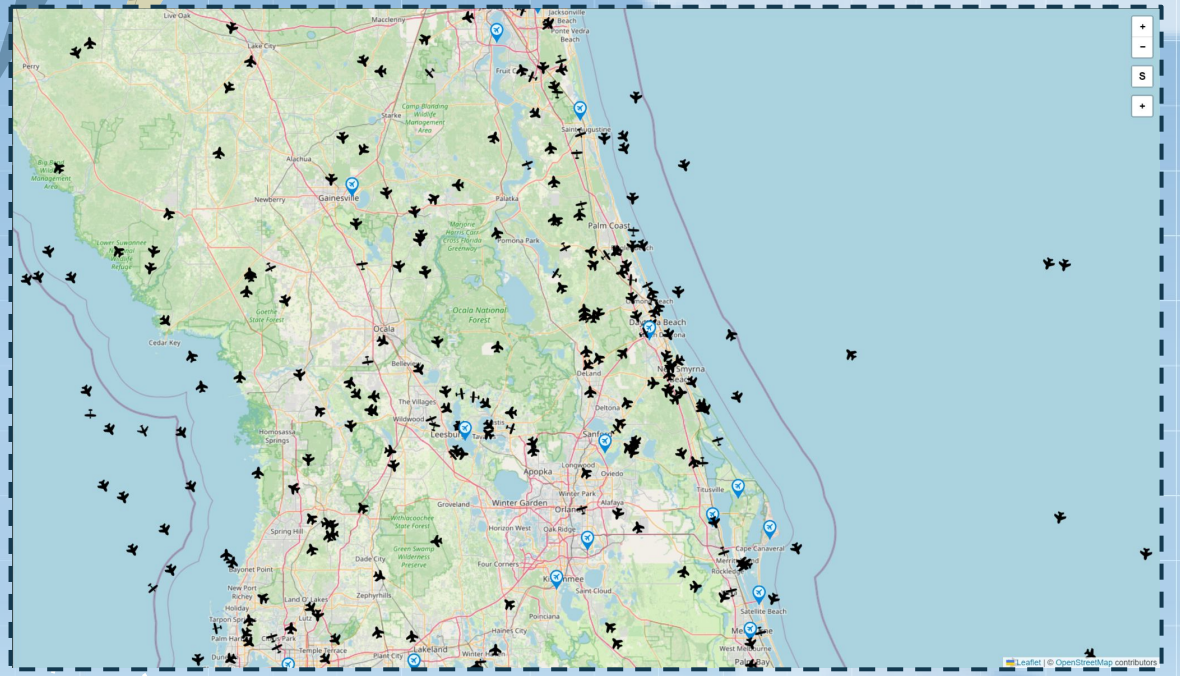
SETTINGS PANEL

Enables user to customize their experience. Future settings include aircraft color, enable/disable aircraft path, map brightness, & units.

NEW SETTINGS PANEL

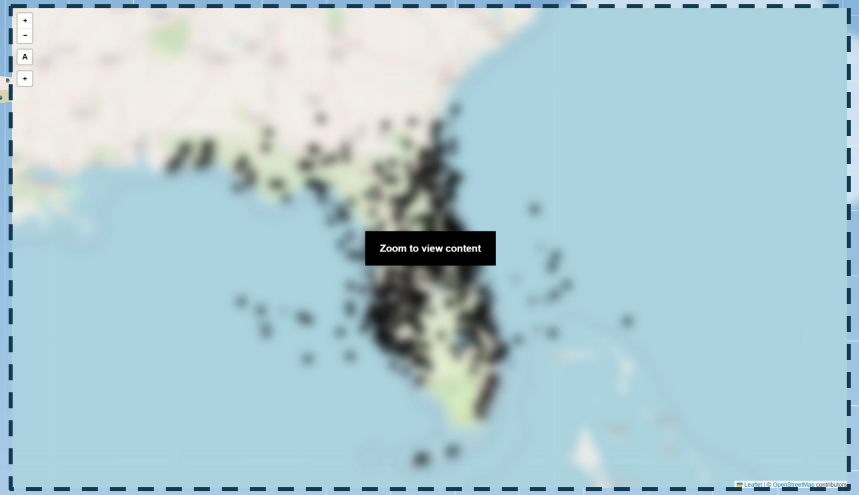
BUG FIX - INCORRECT PLANE LOCATION

Fixed planes having incorrect locations based on map zoom due to plane heading.



BUG FIX - UNLOAD PLANES ZOOM OUT

Fixed Planes still rendering when zoom out message appears.



04

BACKEND

NeMo ASR and Database

NVIDIA NEMO

GOT ACCESS TO WORKING MODEL

Got access to the most accurate model to understand how it works.

USE THE MODEL FOR MORE RESEARCH

Figure out how to implement the model, database and web application.

```
is TensorFlow binary is optimized to use available CPU instructions in performance-
critical operations.
To enable the following instructions: AVX2 AVX_VNNI FMA, in other operations, rebui
ld TensorFlow with the appropriate compiler flags.
2024-01-31 14:54:00.701160: W tensorflow/compiler/tf2tensorrt/utils/py_utils.cc:38]
 TF-TRT Warning: Could not find TensorRT
[NeMo I 2024-01-31 14:54:03 cloud:58] Found existing object /home/adamfitch/.cache/
torch/NeMo/NeMo_1.23.0rc0/QuartzNet15x5Base-En/2b066be39e9294d7100fb176ec817722/Qua
rtzNet15x5Base-En.nemo.
[NeMo I 2024-01-31 14:54:03 cloud:64] Re-using file from: /home/adamfitch/.cache/to
rch/NeMo/NeMo_1.23.0rc0/QuartzNet15x5Base-En/2b066be39e9294d7100fb176ec817722/Quart
zNet15x5Base-En.nemo
[NeMo I 2024-01-31 14:54:03 common:924] Instantiating model from pre-trained checkp
oint
[NeMo I 2024-01-31 14:54:04 features:289] PADDING: 16
[NeMo I 2024-01-31 14:54:04 save_restore_connector:249] Model EncDecCTCModel was su
ccessfully restored from /home/adamfitch/.cache/torch/NeMo/NeMo_1.23.0rc0/QuartzNet
15x5Base-En/2b066be39e9294d7100fb176ec817722/QuartzNet15x5Base-En.nemo.
Transcribing: 100%|                                        | 1/1 [00:01<00:00,  1.06s/it]
Audio in /home/adamfitch/NeMo/workingNemo/audio_files/gettysburg.wav was recognized
 as: four score and seven years ago our fathers brought forth on this continent a n
ew nation conceived in liberty and dedicated to the proposition that all men are cr
eated equal now we are engaged in a great civil war testing whether that nation or
any nation so conceived and so dedicated can long endure
adamfitch@adam-XPS-15-9520:~/NeMo/workingNemo$
```

DATABASE

Sprint 1 Database

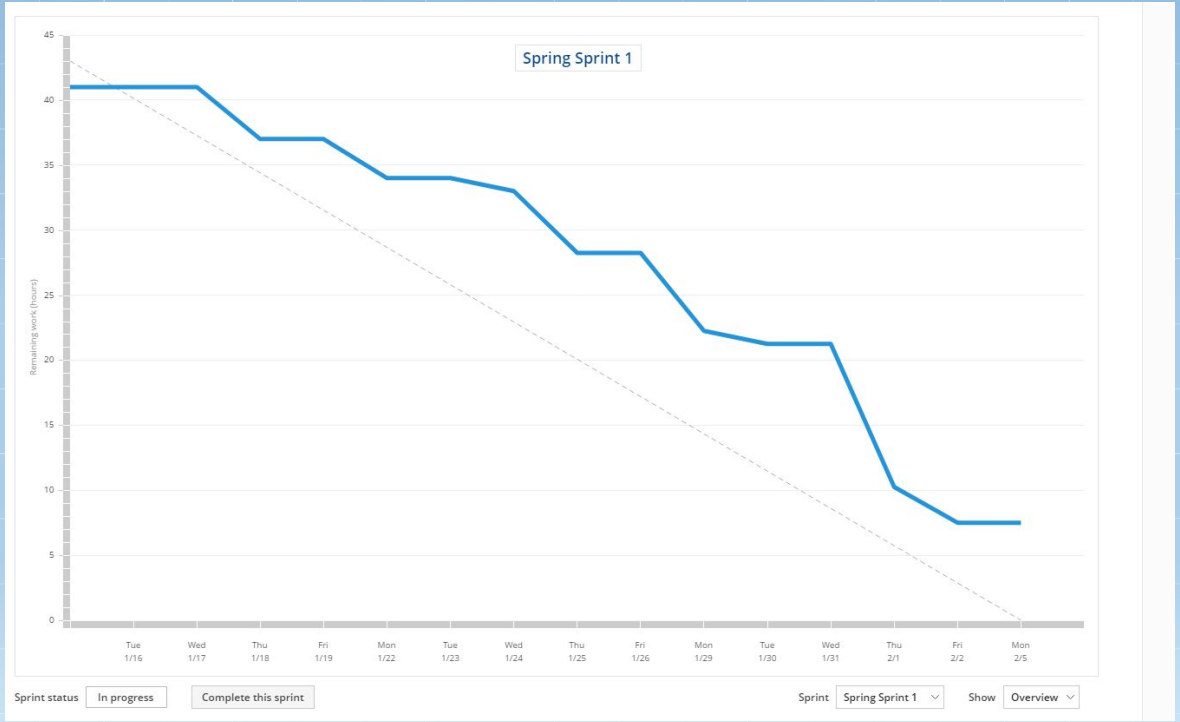
- Researched what we need to do in order to implement NeMo in the database.
- Want to implement an hour worth of data into the database.

Plans for Sprint 2 Database

- Setting up the database on our laptops.
- Implement code into the database to collect more data to come up with ideas on how to implement with the web application.

```
…/asr-webapp  main !?
❯ flask --app source shell
Python 3.11.5 (main, Sep 11 2023, 13:54:46) [GCC 11.2.0] on linux
App: source
Instance: /home/adamfitch/GitHub/asr-webapp/instance
>>> aircraft = Communication(callsign = '12345');
>>> aircraft
<Communication 12345>
>>>
```

BURNDOWN


Spring Sprint 1
Remaining work (hours)
45
40
35
30
25
20
15
10
5
0
Tue 1/16
Wed 1/17
Thu 1/18
Fri 1/19
Mon 1/22
Tue 1/23
Wed 1/24
Thu 1/25
Fri 1/26
Mon 1/29
Tue 1/30
Wed 1/31
Thu 2/1
Fri 2/2
Mon 2/5
Sprint status
In progress
Complete this sprint
Sprint
Spring Sprint 1
Show
Overview

LESSONS LEARNED

COMMUNICATION

Communication is key

DOCUMENTATION

Everything in writing helps understanding

DEFINED TASKS

Tasks broken down into smaller pieces

CLEAR GOALS

Everyone now has a finish line in sight

FUTURE SPRINTS

MAP UPDATES

Continuous development to create a polished, user-friendly product

DATABASE

Integration of database into web application to store data

NEMO

Integrating NVIDIA NeMo to transcribe ATC Audio

API

Investigating new API due to ongoing OpenSky issues

Q&A