# Satellite Visualizer

**Team Members:** Curtis Batters, Joseph Corona, Eben Fuentes, Angel Gutierrez Sanjuan, Zhuowen Li, Dennis Martinez, Rosa Saldivar, Sanskar Thapa, Kevin Ortez
**Faculty Advisor:** Dr. Zilong Ye
**Aerospace Corporation Liaisons:** Pablo Settecase, Dearo Yam, & Denny Ly
Department of Computer Science
College of Engineering, Computer Science, and Technology
California State University, Los Angeles

## Objective

Our goal is to make a web app that visualizes satellite positions over time.
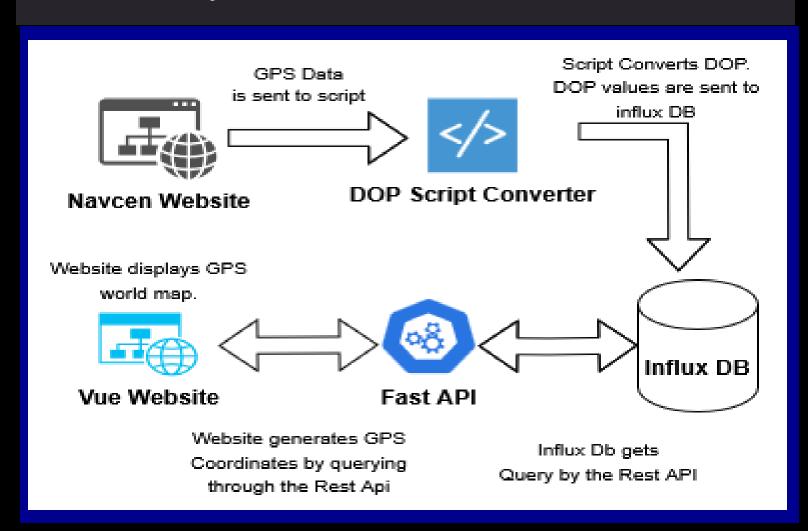Objectives are the following:

- Modernize existing project to use up-to-date web frameworks
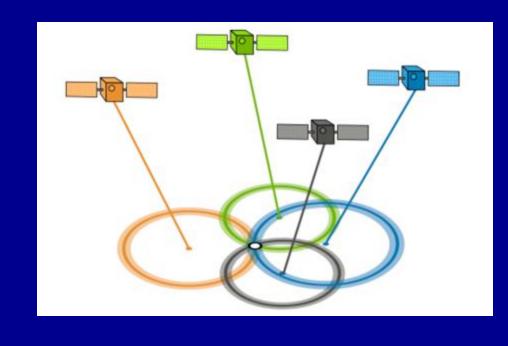- Visualize satellite data over a map of the Earth over time

## Background

- GPS accuracy is influenced by satellite positioning geometry, measured using DOP (Dilution of Precision).
- DOP is a numerical representation of satellite alignment. The lower the DOP value, the better the positioning accuracy.
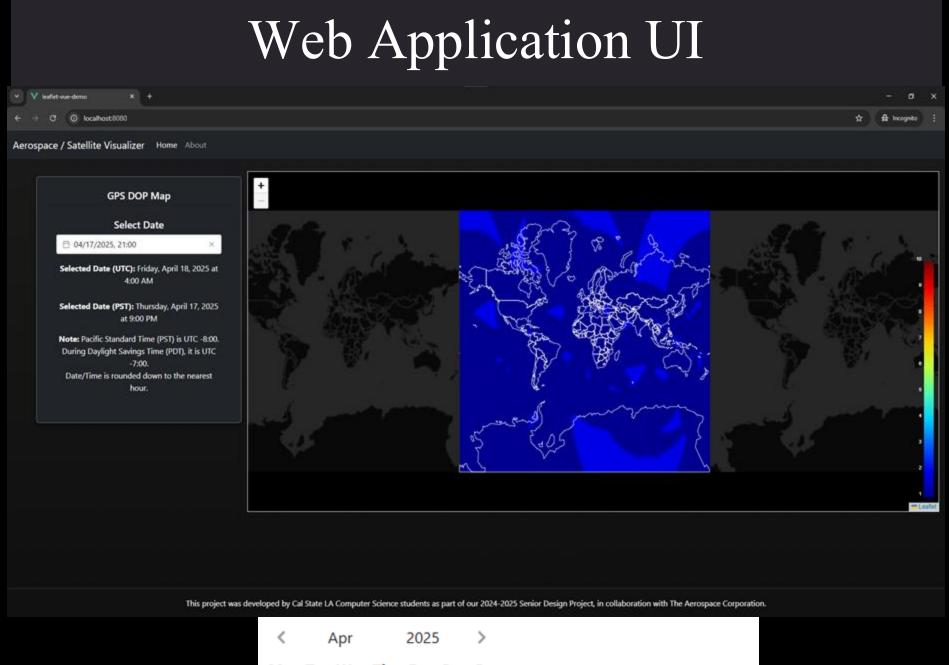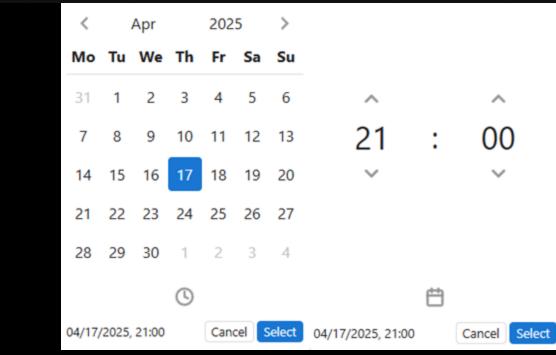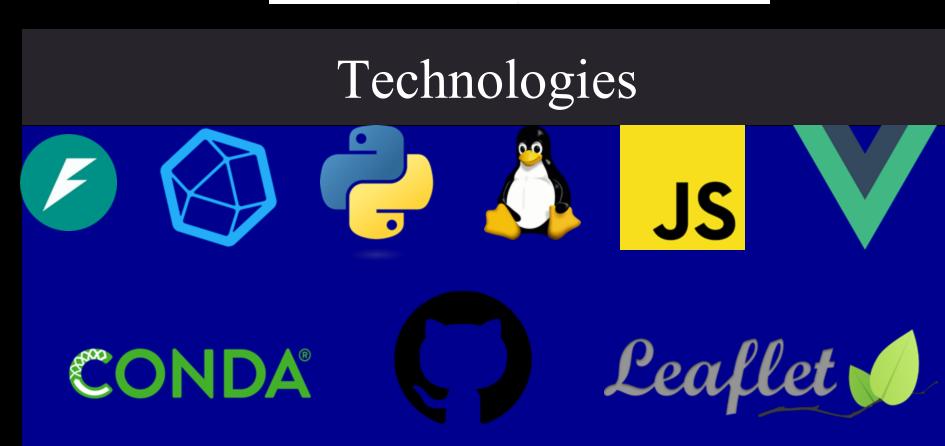
## System Architecture



## What is DOP?

Dilution of Precision (DOP) reflects how satellite geometry affects GPS accuracy. When satellites are well-positioned and there are enough of them, DOP is low and accuracy improves. When satellite positions are less favorable, DOP increases and accuracy drops. PDOP is a type of DOP that specifically measures 3D position accuracy.



## Web Application UI





## Technologies



## Results



Our website's visualization — Official FAA website

The figure on the left represents our result after selecting April 17th, 2025 at 1 PM. The figure on the right corresponds to the exact same date and time as displayed on the Federal Aviation Administration's website, confirming consistency between our findings and official data.

## Conclusion

- Developed a responsive user-friendly web application to visualize PDOP data on a 2D world map.
- Enabled user interaction through:
  - Date/time picker for custom timestamp selection
  - Zoom functionality
  - Real-time hover-based PDOP value display
- Streamlined data visualization by replacing CSV-based frontend input with API integration connected to an InfluxDB v1.8 database.
- Integrated web scraping from navcen.gov to retrieve the SEM almanac for each date selected, ensuring accurate satellite data for each query.
- Optimized backend performance by filtering DOP queries by timestamp, reducing map loading time from **~60 seconds** to **~5 seconds.**
- Visualizations were confirmed to be accurate by a GPS subject matter expert at The Aerospace Corporation and FAA website.