FINTRACK

NASA SPACE APPS 2025

EXPLORE THE OCEAN'S APEX PREDATORS!

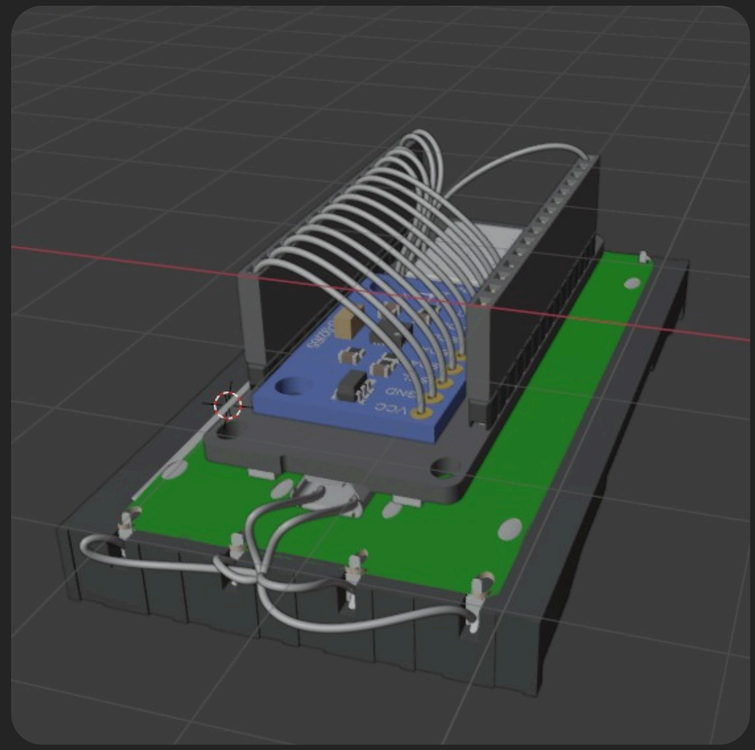
 | CREDITS

LET'S INTRODUCE FINTRACK!

The sound used in the video is AI Generated using Elevenlabs.io

THE PROJECT:

The FinTrack project is a complete framework depending on our ESP32 with an accelerometer, gyroscope and GPS modules. All of that works to detect the feeding events and dietary data, by recognizing movement and vibration patterns. The thing that differs us from the rest is the fully automated cloud pipeline. The data collected from the tracker device using its C++ code sending data through HTTPS to our google script which then sends the data to our spreadsheet and the csv file connected to the map.html file, in order to update the map location every 30 minutes. We also made a Python based machine learning model that predicts the location of the sharks after migration using PACE, MODIS, SWOT and EDDIES Influence.



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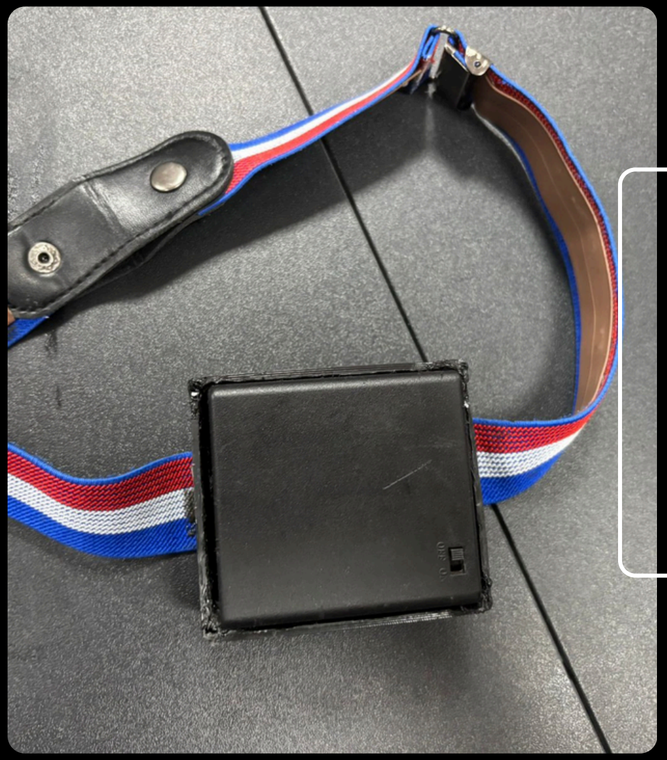
AUTOMATION

The automation part works by using google script that takes data from the esp32 through https as it is a secured channel. It uses this data to update the google spreadsheet for human viewing and the csv file in the GitHub repository which then updates the map.html file located in the same repository. This allows the map on our website to always be updated with the latest data, also the prediction model runs in the background taking the location and shark data from the esp32 and predicting the next location and then sending it to the script using an MQTT server which then sends it to the sheet and the csv to update the predicted location on the map.

THE TRACKER & CORE TECHNOLOGIES

The FinTrack system is an advanced monitoring framework built on strategic analysis (SWOT/PACE). Its core is a cost-effective ESP module, integrating an accelerometer, gyroscope, and GPS. These sensors capture high-resolution movement data to detect signature feeding events and location, establishing a detailed dietary profile by referencing a marine species database. This data collection is fully automated: a real-time cloud pipeline transfers device logs to a central Google Sheet, which then automatically synchronizes the timestamped dataset to a public GitHub CSV file for immediate transparency. The resulting rich, multi-sensor data feeds a dedicated Python-based machine learning model. This model forecasts migratory paths and generates alerts, transforming raw sensor input into actionable ecological intelligence for informed conservation strategies.



NASA DATA USED IN FINTRACK

PACE: https://pace.gsfc.nasa.gov/
Usage: We used PACE to find the sustainability of the current locations of our tracked sharks and to predict the future locations of the sharks after the yearly migration

SWOT: https://podaac.jpl.nasa.gov/SWOT
Usage: We used SWOT to predict the next location of the shark and analyze the current location depending on the depth of the shark, each shark needs a different depth in order to find there food sources

MODIS: https://modis.gsfc.nasa.gov/data/
Usage: We used MODIS to find if the location is of the shark is actually in a marine body or on land due to an error in the gps tracker or the shark has been injured and drifted to a beach

Eddies: https://www.pnas.org/doi/abs/10.1073/pnas.1903067116
https://www.nature.com/articles/s41598-018-25565-8
Usage: We used Eddies to find the perfect location for the shark after migration according to the temperature of the ocean at the predicted depth and to follow positive temperature anomalies

RECOMMENDATIONS

Due to limited time and resources, some features weren't included, for anyone who intends to complete this research, we recommend:

1- Using eDNA sensors to detect the DNA surrounding the shark to help identify the species of the prey.

2- Installing waterproof cameras that capture live footage of the shark's surroundings when the shark makes any sudden movements.

3- Adjust the curvature and size of the tracker depending on the shark.

4- Use more biodegradable materials

5- Use shark movement to generate energy to elongate the prototype's lifetime.