Infinite Loopers

Project Description

HurriScan is an advanced hurricane tracking and scanning system designed to offer unparalleled insights into hurricane activities in the Pacific Ocean. The platform utilizes wind and temperature data from a network of strategically positioned buoys throughout the equatorial Pacific, providing hurricane tracking, detailed forecasts, and potential impact assessments.

HurriScan aims to cater to a diverse range of users, including meteorologists, climate researchers, companies engaged in shipping goods across the Pacific, and media outlets alerting coastal cities. The platform accomplishes this by delivering an interactive oceanographic data map, machine-learning-powered predictions, helpful data visualizations, and timely alerts. These features empower users to stay safe and well-informed about natural events and changes occurring throughout the Pacific.

User Requirements:

- Login/Registration system
- Interact with the map (Filtering)
    - Map and hurricane profile updates as the user interacts with the site/map
    - Displaying graphs based on data selected
- Hurricane Profile -
    - See temperature and wind speeds
- Admins will be able to update the dataset
- User Query and handling to send requests

Non-Functional Requirements:

- Implement database -
    - Remove extra values
    - Delete redundant/useless columns/rowsInitialize the database.
    - Load data into an SQLite database
    - Load database into the web app using appropriate Python API

- Initialize the web-app
  - Create a basic webpage
  - Connect the webpage to our database data
  - Have a space for us to implement a map
  - Use JS/HTML/CSS + Python
  - Adding styling and responsiveness to the page
- Use ML
  - Regression on the map
  - Make predictions about when and where hurricanes may occur
  - Have an interactive interface for users to interact with the data like graphs and charts
- Complete the site
  - Update the styling of UX/UI features
  - Ensure accessibility so that all users can access our site
- Prediction Graph:
  - Use machine learning and linear regression to predict future hurricane data
- Connecting the alerting system with Twilio

Functional Requirements:
- Map buoy data on a map of the Pacific Ocean - Visualization 1
  - Find a suitable API to display a map on the website
  - Overlay wind and temperature data on the generated map
  - Display wind direction with arrows
  - Display wind speed and temperatures using a pop-up on hover
- Hurricane Profile
  - Show path, intensity, and predicted damage for each hurricane
- Interactive graph
  - Updates based on maps' location
  - Shows wind speed data, temperature data, etc.
- Alerts
  - Send users alerts regarding hurricane information

- Graphs - Visualization 2
    - Showing predicted hurricane data
    - Bar plot showing past data
    - Scatter plot for predicted data
- Heat map - Visualization 3
    - Shows which zones have more hurricanes/more severe hurricanes
    - Use colors to differentiate all of the different zones

- Admin dashboard with user analytics

Proto Personas

Proto-Persona 1: The Meteorologist
- Name: Dr. Emily Nguyen
- Age: 35
- Occupation: Meteorologist at a national weather service
- Goals: To provide accurate and timely weather updates; to understand weather patterns, especially hurricanes.
- Needs: Real-time data on hurricane locations, paths, and intensities; historical hurricane data for comparative analysis.
- Behaviors: Checks hurricane data multiple times a day, especially during hurricane season; uses data to make forecasts and weather reports.

Proto-Persona 2: The Shipping Coordinator
- Name: Carlos Martinez
- Age: 42
- Occupation: Logistics and shipping coordinator for a global shipping company
- Goals: To ensure safe and timely delivery of goods across the Pacific; to reroute ships away from dangerous weather.
- Needs: Up-to-date information on predicted hurricanes; alerts on weather changes.
- Behaviors: Monitors weather conditions daily; adjusts shipping routes based on weather forecasts.

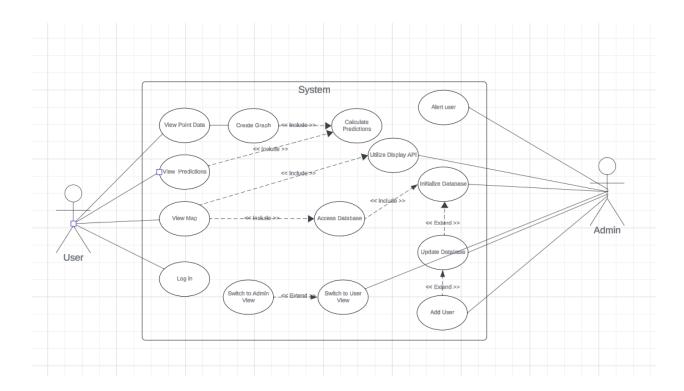**Proto-Persona 3: The System Administrator**
- Name: Alex Johnson
- Age: 30
- Occupation: IT Specialist and System Administrator for HurriScan
- Goals: To maintain and update the HurriScan platform; ensure data accuracy and system reliability.

- Needs: Efficient tools for updating and managing the database; clear feedback channels from users.
- Behaviors: Regularly reviews system performance and updates datasets

Use-Case Diagram and Descriptions

Description of the Use Case Diagram

General Users: Interact with the system by logging in, viewing maps, viewing predictions, and receiving alerts. They can switch between user and admin views if they have the necessary permissions.

View Point Data: Users can view specific data points on the map, such as wind speeds and temperature.

View Map: Allows users to interact with the geographic map displaying real-time data and predictions.

View Predictions: Users can view predictions made by the system regarding hurricane paths, intensities, and potential impact areas.

Create Graph: The system generates visual representations of data for easier interpretation by users.

Calculate Predictions: The system processes current and historical data to forecast hurricane activities.

Access Database: The system retrieves data from a centralized database for display and analysis. Utilize Display API: Integrates with external APIs to render map and data visualizations effectively.

Log In: Users must authenticate to access personalized and secure content.

Switch to Admin View: Authorized users can switch to an admin interface to perform administrative tasks.

Switch to User View: Admins can switch back to the standard user view to see the user perspective.

Administrators: Perform system maintenance tasks such as initializing and updating the database, adding or removing users, and configuring alert settings.

Specific Scenarios and Prototype Creation

Scenario 1: User Logs In and Views Hurricane Predictions

Prototype: Create a login page that transitions to an interactive map of the Pacific Ocean. Once logged in, the user can click on a "Predictions" tab to view current hurricane forecasts, displayed as overlays on the map. Include clickable elements that reveal more detailed data and predictions when selected.

Scenario 2: Admin Updates Database and Alerts Users

Prototype: Design an admin dashboard where admins can update the database with new data points. Include forms for data entry, a section for initiating database updates, and a console for sending alerts to users. Upon updating the database, illustrate how an admin can trigger an alert about a new hurricane formation, which is then sent to users.

Scenario 3: User Interacts with Map and Graphs

Prototype: Develop an interactive map interface where users can zoom in/out and select regions to view detailed environmental data. Alongside the map, display a sidebar or pop-up windows where graphs and other visual data representations (like wind speed and temperature) related to the selected region are shown. Include filter options for users to customize the data displayed on the map and in graphs.

Scenario 4: Admin Initializes the Database

Prototype: Create a prototype for an initial setup wizard used by admins to initialize the database. This should include step-by-step instructions, input fields for necessary information, and a final "initialize" button. Show how this process links to the overall system's ability to start tracking hurricanes.