Case Study: Climate Hazard Trend Analyzer

For Full-Stack Developer role at Dygnify

Problem Statement

Build a web application that analyzes historical weather data and visualizes trends in climate hazards — such as heatwaves, droughts, or heavy rainfall events — for a selected region over time.

Key Features

Frontend (React):

Allow users to:

- Select a geographic region (city, state, or custom lat-lon box).

- Heatwave hazard type will be by default selected.

- Choose a time range (e.g., 1990–2020).

Display:

- Time-series plots of hazard frequency/intensity.

- Interactive visualizations (e.g., charts, maps).

- Summary insights like “Heatwaves have increased by 40% in this region since 1990.”

Backend (Python):

Ingest and cache historical weather data from public APIs like:

- NOAA NCEI

- Copernicus Climate Data Store

- Open-Meteo API

- Or any other source

Define logic to detect climate hazards:

E.g. Heatwave: 3+ consecutive days with max temp > 95th percentile for that region.

- Analyze frequency and duration trends using rolling averages or regression.

- Store this data in NoSQL database.

- On API call read this data from database and return JSON summaries and trend plots.

Evaluation Dimensions

Data Handling: Working with real-world noisy, inconsistent data

Climate Logic: Ability to define & apply domain-specific rules

Backend Skills: Efficient data processing, API design, safe external API access

Frontend Skills: Visualization using Chart.js, D3.js, or similar

Critical Thinking: Deriving insight from climate indicators

Security + Performance: API caching, rate-limiting, and safe user inputs

Bonus Challenges

- Use a map UI (e.g., Leaflet or Mapbox) to allow region selection.

- Provide PDF/CSV export of insights.

- Apply trend detection techniques like linear regression or Mann-Kendall test.