**1. Project Objectives**

The goal of this project is to develop an interactive web dashboard that visualizes Harmful Algal Bloom (HAB) data and integrates a Large Language Model (LLM) such as GPT-4 to provide human-readable explanations for bloom alerts. HABs are a growing threat to marine ecosystems, aquaculture operations, and public health, yet interpreting bloom predictions remains challenging for many stakeholders due to the technical nature of the data.

This project addresses that gap by combining dynamic visualizations with natural language explanations. The system will allow users—such as aquaculture managers and environmental researchers—to interact with time-series data (e.g., Chlorophyll-a levels, sea surface temperature) and spatial bloom alerts through an intuitive dashboard interface. The integration of an LLM will enable users to ask questions such as “Why is this site at high risk today?” and receive detailed explanations of contributing factors (e.g., rapid temperature rise or turbidity changes), along with possible mitigation steps.

The core deliverables of the project include:

* Interactive visualizations for time-series trends and geospatial risk mapping
* A conversational chat interface powered by an LLM for interpretability
* Options to download visual data (as PNG, JPG, etc.)
* A fully containerized frontend (React) and backend (Flask/Express) deployed using Docker

Ultimately, this dashboard aims to enhance the transparency, usability, and actionability of HAB prediction models. By making complex environmental data more understandable and accessible, the system supports informed, real-time decision-making for sustainable aquaculture and ecosystem management.