

Ministry:

पृथ्वी विज्ञान मंत्रालय

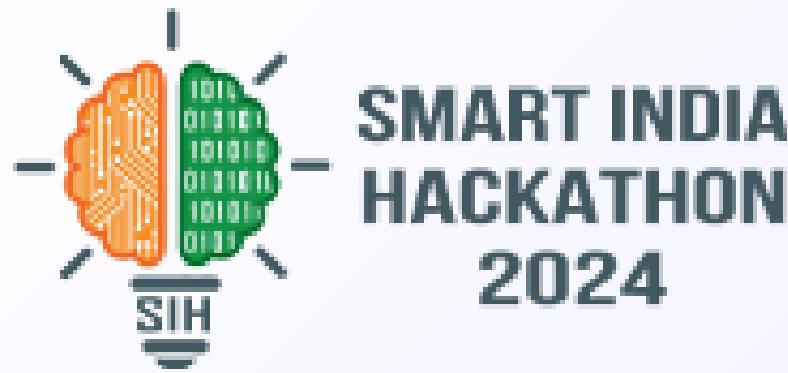
Ministry Of Earth Sciences

Nodal Center:

Vardaman College Of Engineering

Problem Statement: SIH1656

Development of a mobile application to provide recreational suitability information of beach locations across India.

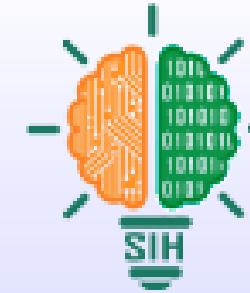


TEAM BENZENE 2.0

Jalpaiguri Government Engineering College, West Bengal

KSHITIJ

Helping tourists be safer, and beaches
be more prosperous



Kshitij has been created in keeping with the aim of The Ministry of Earth and Sciences to enable tourists to remain safe while enjoying their favourite activities, by the dint of prompt alerts, user-friendly interface and easy access to emergency services.

How Kshitij streamlines your beach venture?



1. Safety Profiling

Kshitij leverages the abilities of machine learning to classify locations and activities into categories of safe, unsafe or moderate, so users can make quick decisions.



2. Geospatial Visualization

Fully furnished Geospatial maps are integrated into the very system of the app to make the visibility of safe and troubled zones easier.



3. Prompt Alerts

With a single click, users are empowered to share their live locations with their SOS contacts, aiding both families and NDRF in cases of emergencies.



4. Crowd Reporting

Allowing users to generate their own reports based on their experiences on a beach, properly moderated by community notes, empowering users to act like on-ground reporters.



5. Real-Time Info

Our solution seamlessly integrates requests to up-to-date relevant APIs like INCOIS, WeatherBit etc to let the user be wary of any environment/weather turmoil.



6. Furnished with AI

Our very own travel planner chat bot leverages latest fine-tuned Gen AI models to provide one-of-a-kind interactive experience to users planning their future beach trips.



7. Community

A holistic and inclusive community, which is properly moderated to ensure tourists can make acquaintances close to their places of visit..



8. Multi-Lingual Support

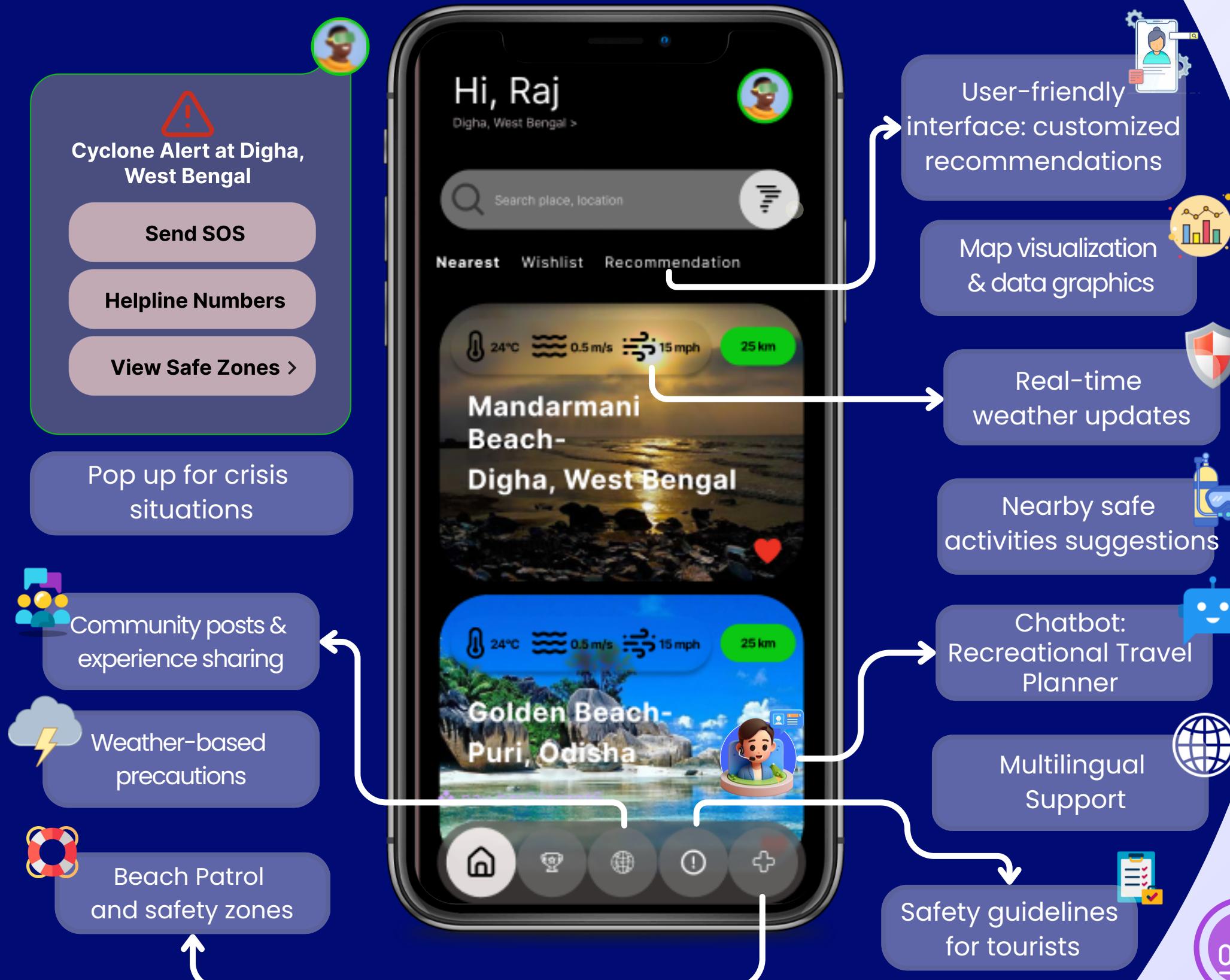
As we are dedicated to building an inclusive solution for the diverse space of our nation, we intend to provide a multi-lingual support for users across the country.



**Hi! I am Kshitij-Mitra.
Your personal AI Travel Planner**

Kshitij is a geo-encoded platform that leverages new age tools to classify beach locations and activities safe or unsafe based on inputs from INCOIS API along with time series data about weather conditions, which are then leveraged using an apt machine learning model.

IMPACTS & BENEFITS



Social

Tourist Safety: Provides timely alerts and precautions, potentially saving lives and preventing accidents.

Public Awareness: Informs users about oceanic conditions, fostering a safety-conscious society.

Economic

Boost in Tourism: Safer tourism attracts more visitors, increasing revenue for local businesses.

Cost Savings: Prevents accidents, reducing emergency response and healthcare costs.

Environmental

Sustainable Tourism: Saves resources helping tourists pick sustainable recreational activities, thus preventing environmental degradation.

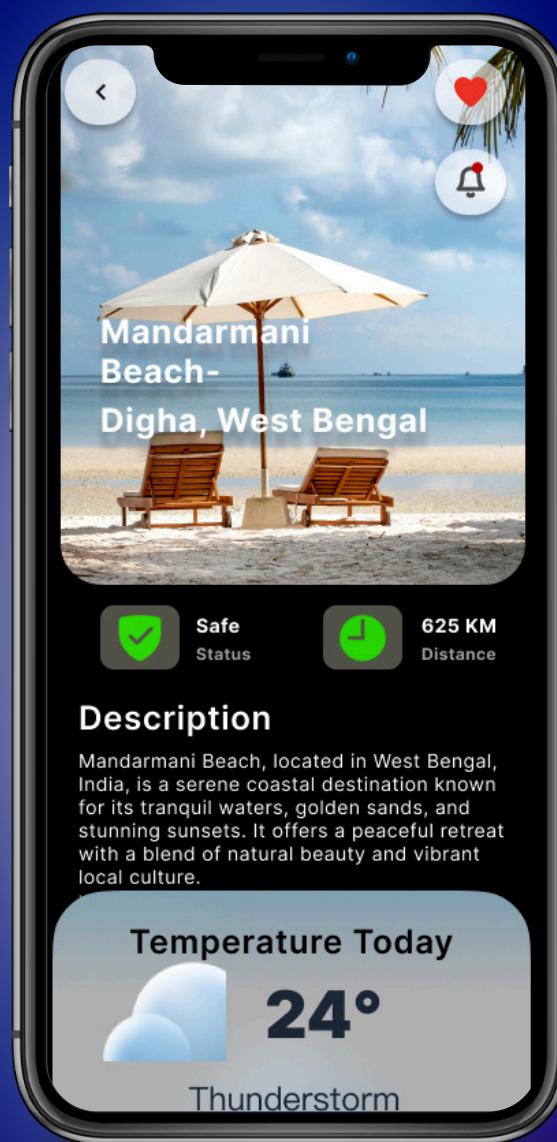
Data-Driven Decisions: Uses real-time data to promote responsible use of natural resources and sustainable practices.

Why to choose Kshitij app?

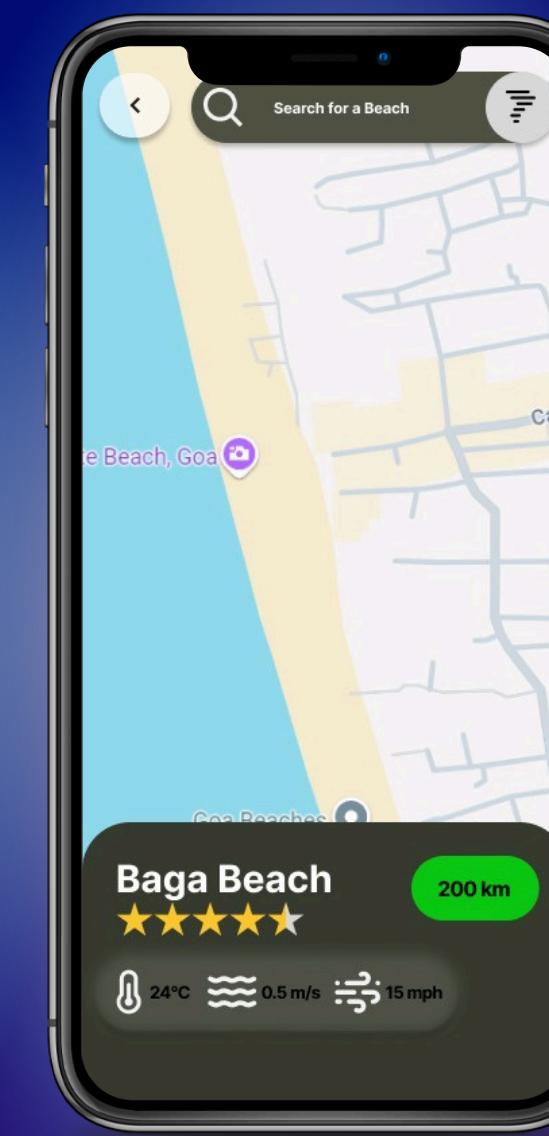
Available Solutions in the market	Realtime weather & Tide Information	Geo spatial Map Visualization	Realtime Alert Notification	Live Suitability Status	Live Location Sharing & Safe zone	AI Powered ChatBot & Travel Planner	Community Feature & user Generated Alerts
Kshitij (our app)	✓	✓	✓	✓	✓	✓	✓
My Coast	✓	✓	✗	✗	✗	✗	✗
Beach Safe India	✓	✓	✗	✓	✗	✓	✗
Lifeguard Connect	✓	✗	✓	✗	✓	✗	✓
Beach Flags	✗	✓	✗	✗	✗	✗	✗

APP UI

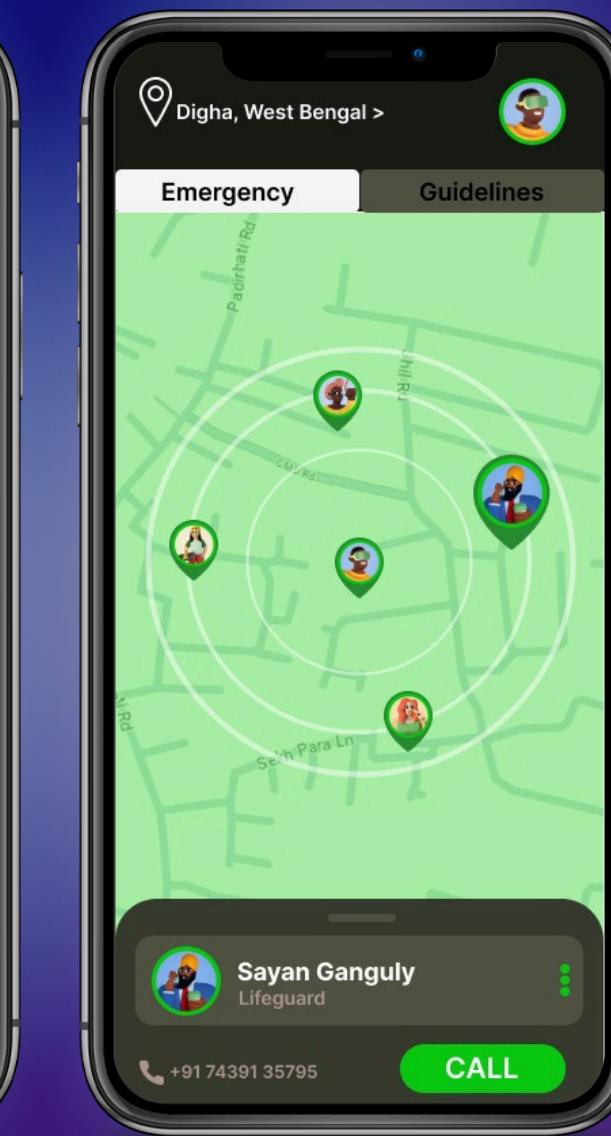
Presenting Kshitij, a one-stop platform to guarantee safety and best experiences for all beach tourists across the country by the dint of APIs, Machine Learning and Geospatial visualization of target locations.



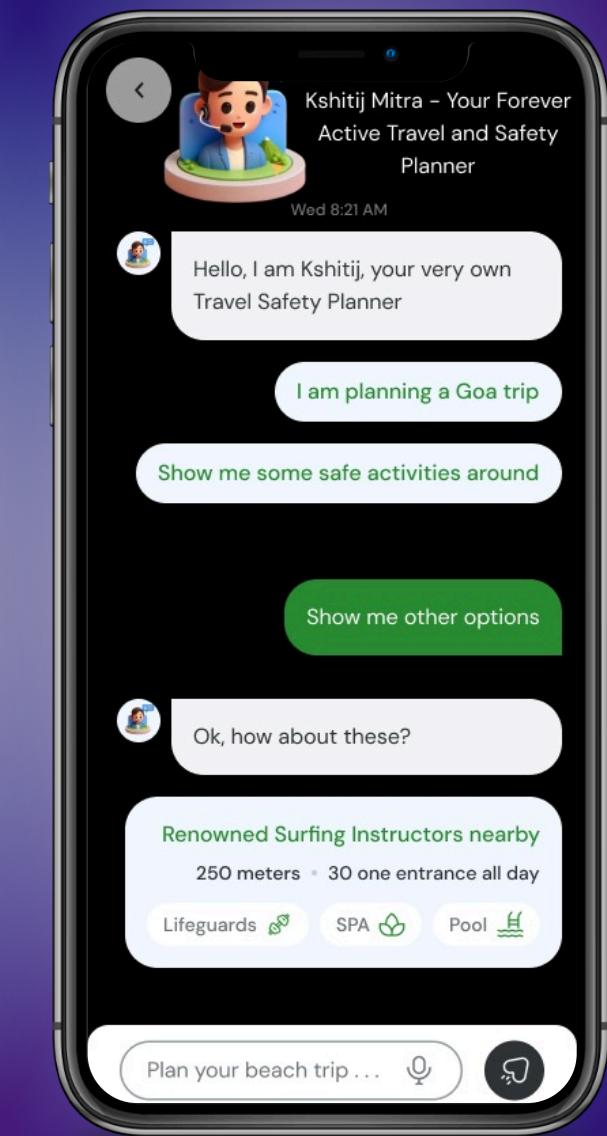
Beach Landing Page



Beach Suitability Map

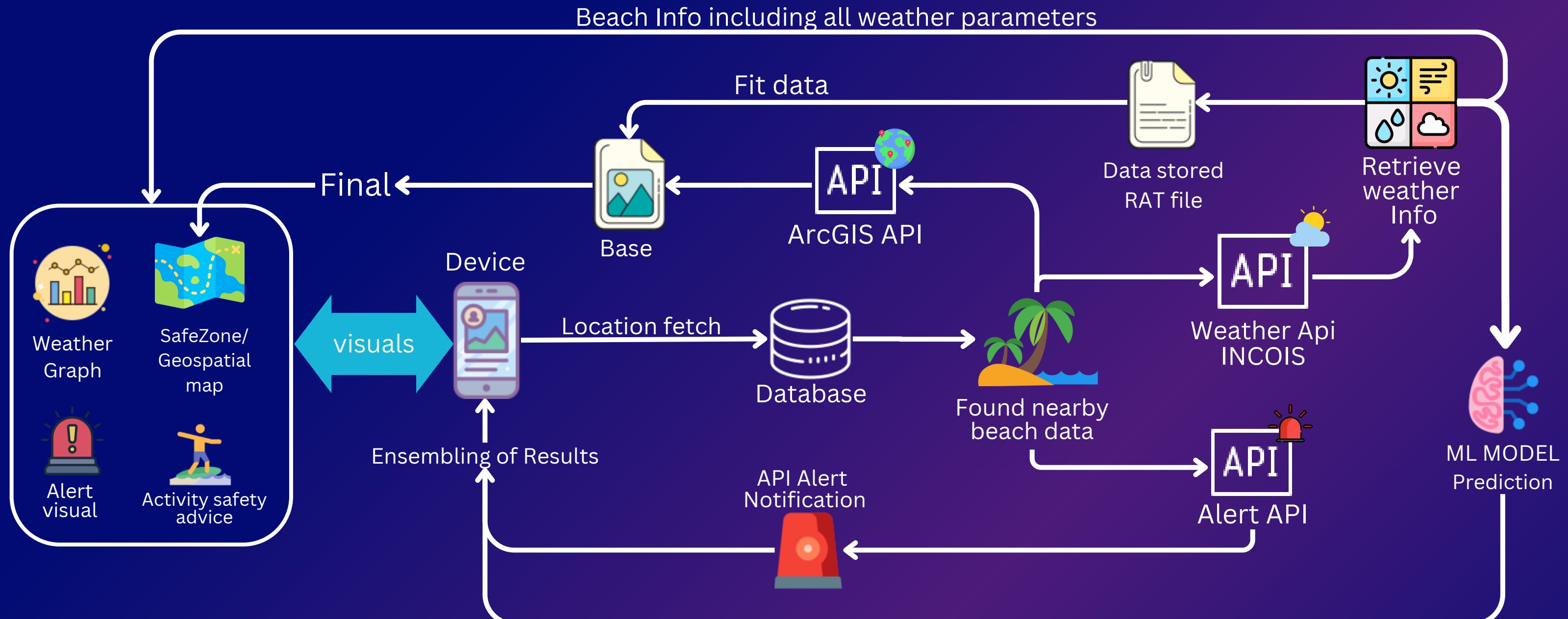


Instant Helpline

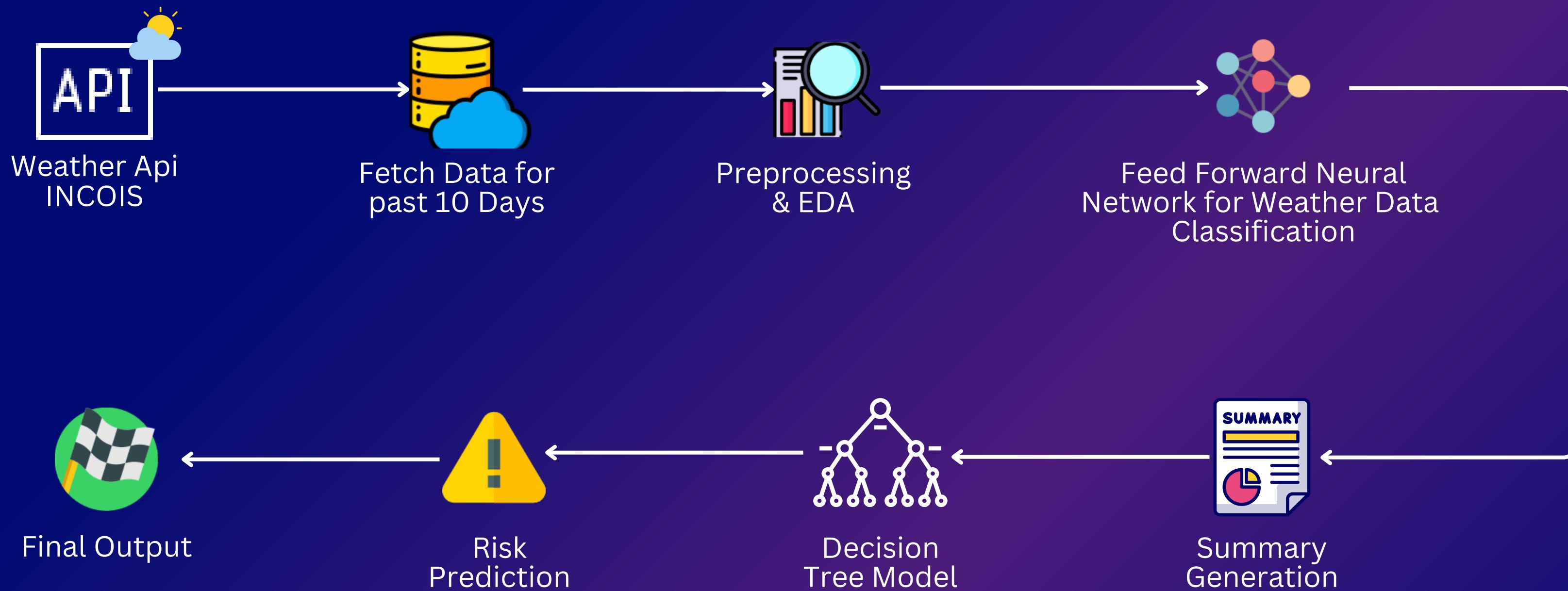


Chatbot - Travel Planner

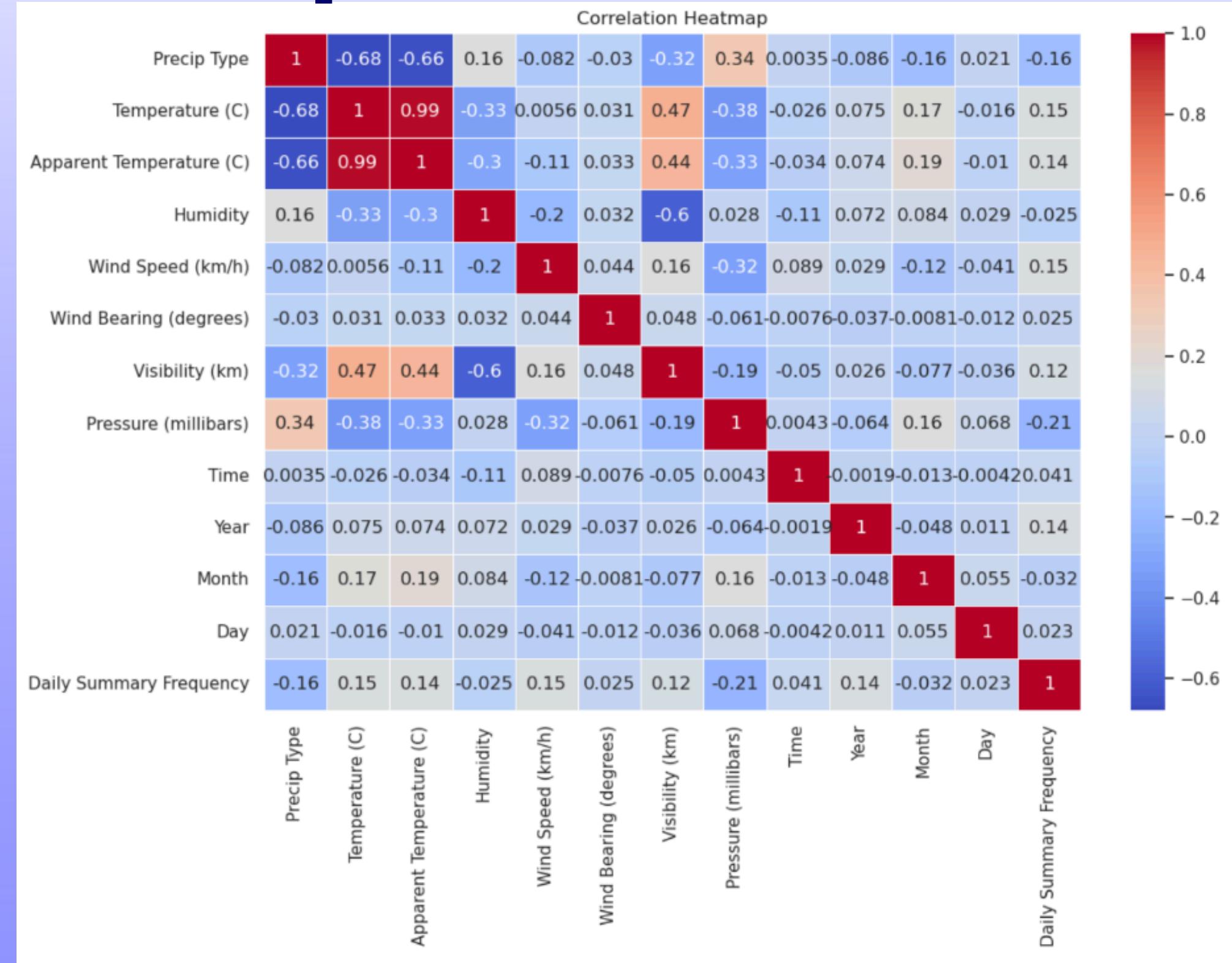
APP WORKFLOW



ML MODEL FLOWCHART



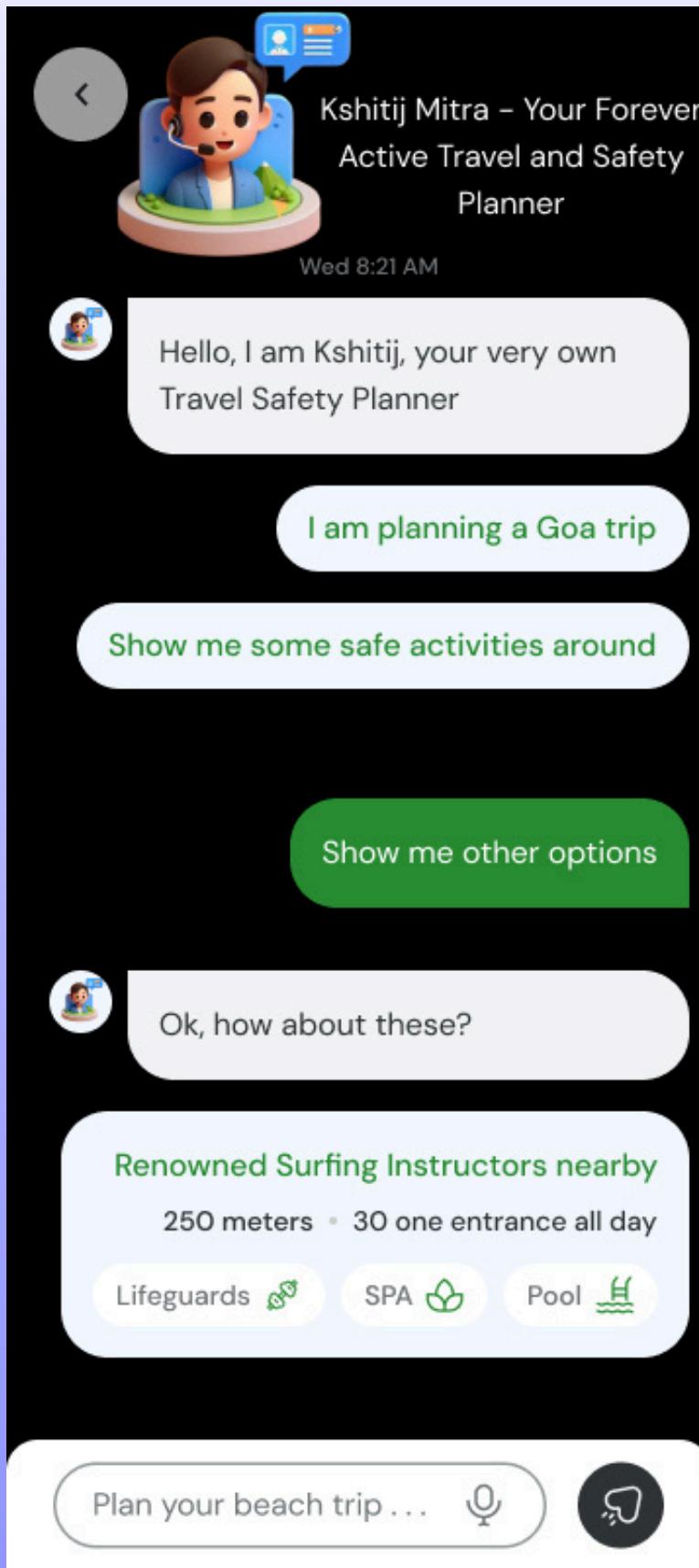
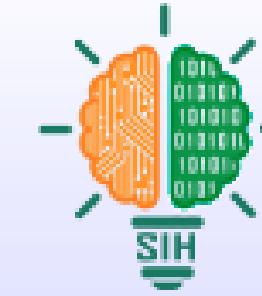
Correlation between different weather parameters



Comparison between different classification models over the dataset

	Accuracy	Precision	Recall	F1 Score
Algorithms				
Logistic Regression	0.834	0.830	0.834	0.830
Gaussian Naive Bayes	0.795	0.792	0.795	0.792
SVC	0.825	0.823	0.825	0.824
SGD Classifier	0.823	0.821	0.823	0.822
Decision Tree	0.889	0.890	0.889	0.890
KNN	0.905	0.905	0.905	0.905
Random Forest	0.941	0.941	0.941	0.940
Extra Trees Classifier	0.942	0.942	0.942	0.942
Bagging Classifier	0.940	0.940	0.940	0.940
Gradient Boosting Classifier	0.942	0.942	0.942	0.942

	Activation Functions	Optimizers	Accuracy	Loss
Algorithms				
64-64-128-3 Feed Forward Neural Network	relu	Adam	0.909	0.259
32-256-3 Feed Forward Neural Network	relu	SGD	0.838	0.381
32-256-3 Feed Forward Neural Network	sigmoid	SGD	0.771	0.592
32-64-128-3 Recurrent Neural Network	relu	Adam	0.902	0.290
32-256-3 Recurrent Neural Network	relu	Adam	0.898	0.275
32-256-3 Recurrent Neural Network	relu & tanh	RMSprop	0.878	0.299



Keeping in mind, the usability and accessibility needs of the people across the nation, we have provided for a convenient multi-lingual AI powered travel planner bot **Kshitij Mitra**

PARAMETERS	OUR SOURCE
Ocean Current, pH level of the water, Salinity level , Temperature of the water, Concentration of dissolved oxygen in the water, Concentration of dissolved methane in the water, Partial pressure of CO2 in the air, Partial pressure of CO2 in the water, Chlorophyll concentration in the water, Presence of bacteria or algae, Turbidity of water, Concentration of coloured dissolved organic matter (CDOM) in the water	INCOIS API
Real-time alerts for Tsunami	Tsunami Threat Map API (provided by INCOIS)
Real-time alerts for Cyclone	Storm Surge Cyclone Data API (provided by INCOIS)
High and low tides, tidal patterns	Astronomical Tides API (provided by INCOIS)
Air temperature, pressure, wind speed, wind direction, cloud cover, humidity, precipitation, sea level, swell height, visibility	StormGlass API
Satellite Images	Google Earth Engine
Flights and Hotels Information	Serp API
Alert Zones	WeatherBit API
Map	Google Map SDK
Generating GeoJSON file from shape filled maps	QGIS API
Crowd Density	Google Traffic API
Travel Bot Base Model	Hugging Face LLAMA 3

TECHNOLOGY STACK

Application	Backend	Database	Cloud	Geospatial	API	ML and AI
Android Native app development using Android Studio Kotlin XML	Django Python	PostgreSQL Firebase Cloud Messaging (for push notifications using)	Amazon Web Services (for hosting and services like EC2 for hosting)	ArcGIS (for interactive geospatial map visualization)	INCOIS Weatherbit ArcGis Stormglass SerpAPI Google Traffic QGIS	Pytorch (for machine learning models) Hugging face Langchain for natural language processing Llama3.1



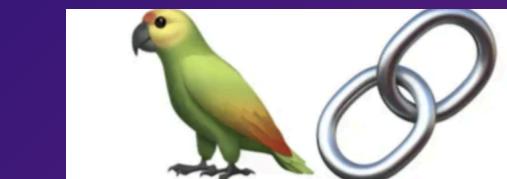
Cloud



Python



Firebase



Langchain



INCOIS API



Pytorch



PostgreSQL



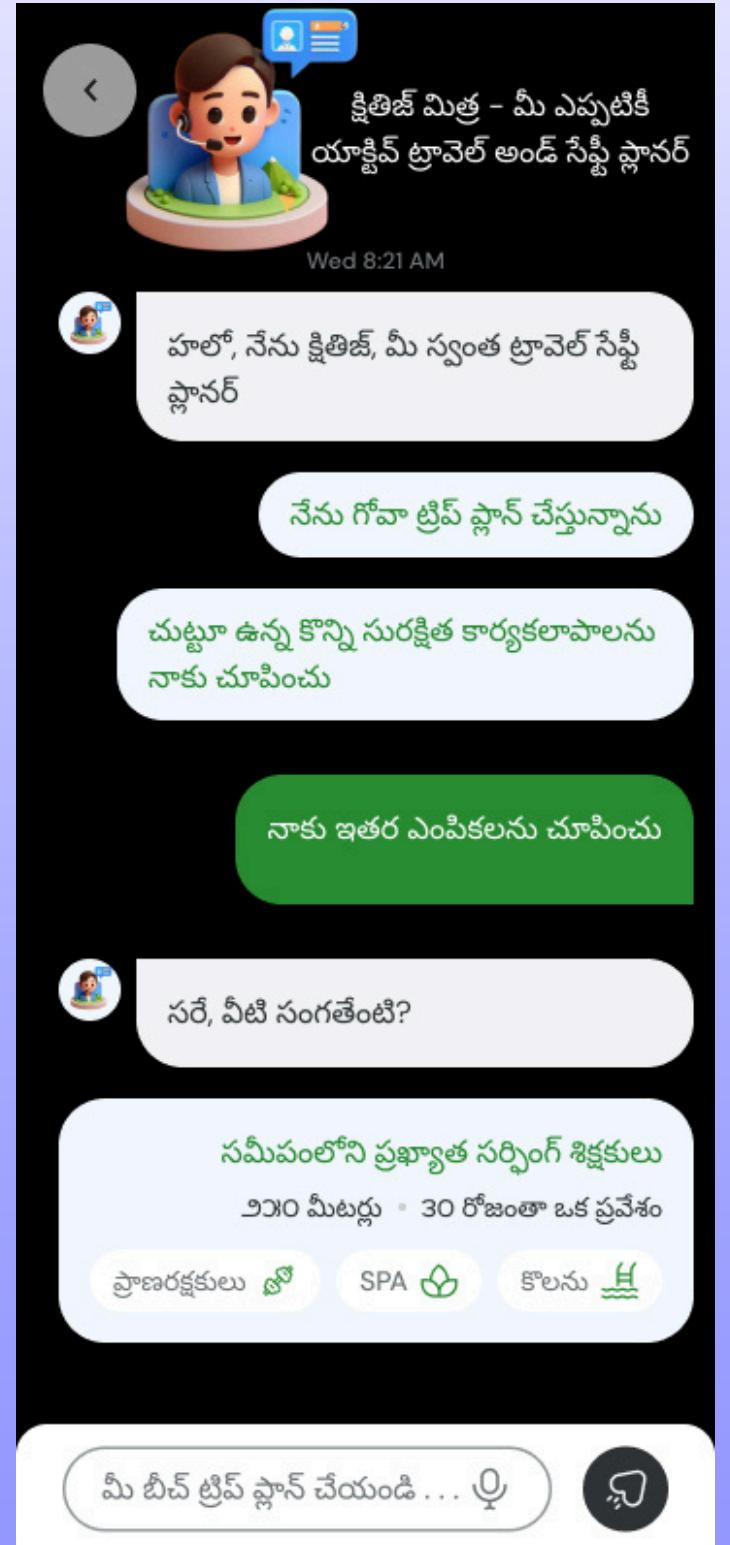
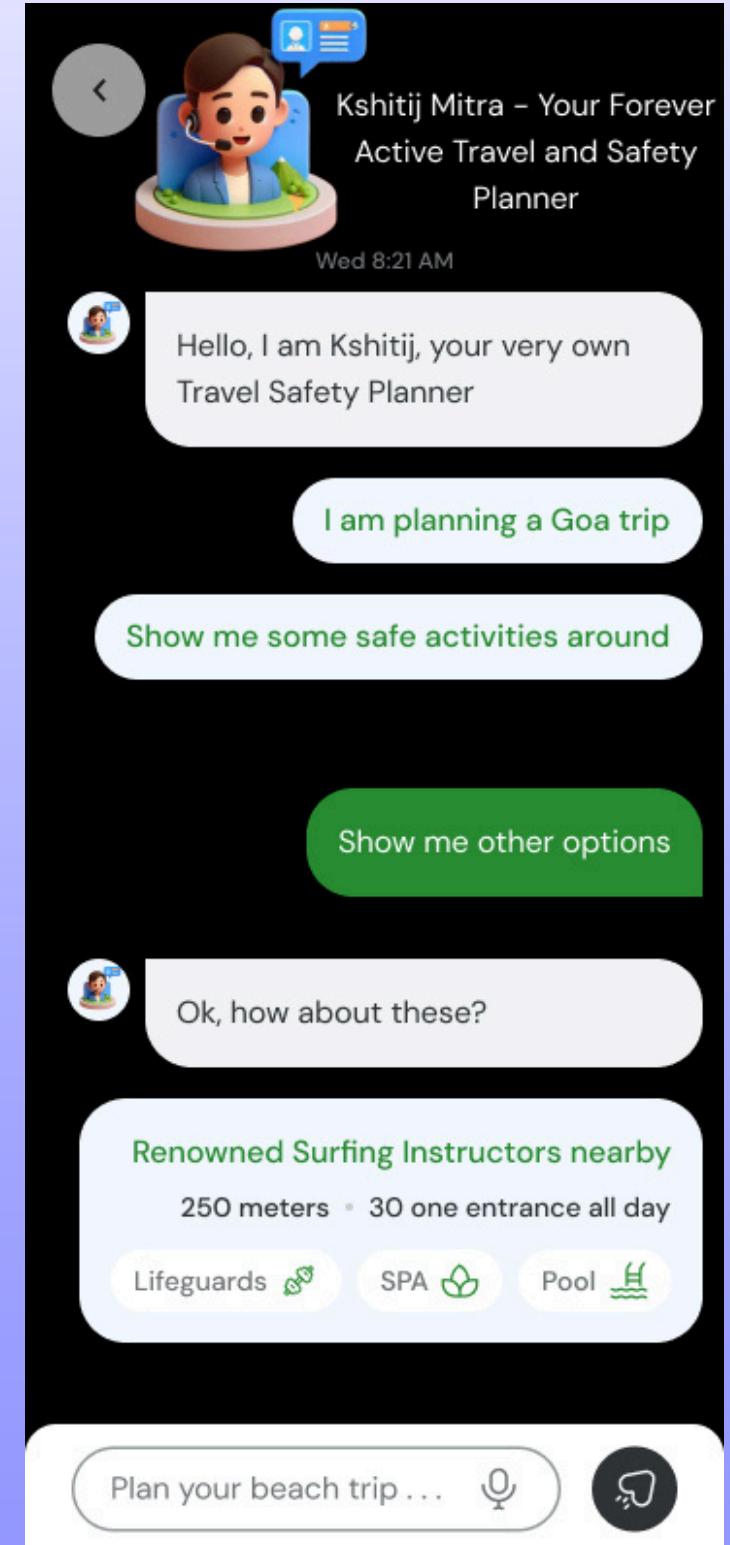
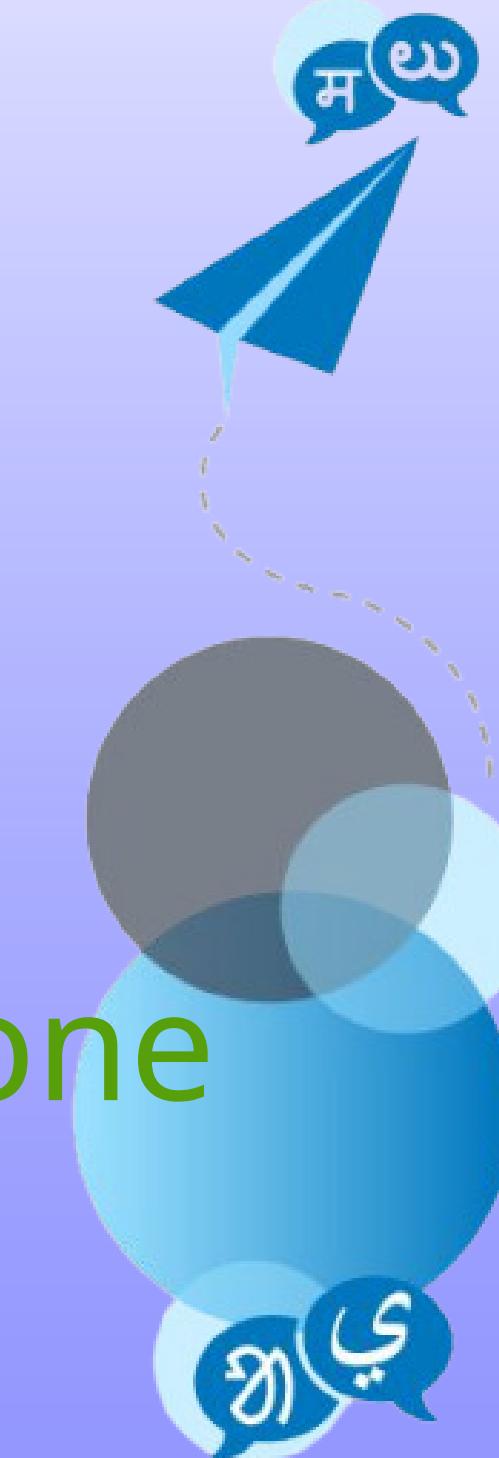
ArcGIS API



Android

No Language Barrier!

Supports **15+**
Indian
Languages
An App for everyone



A Framework for Ocean Satellite Image Classification Based on Ontologies

Jesús M. Almendros-Jiménez, Luis Domene, and José A. Piedra-Fernández

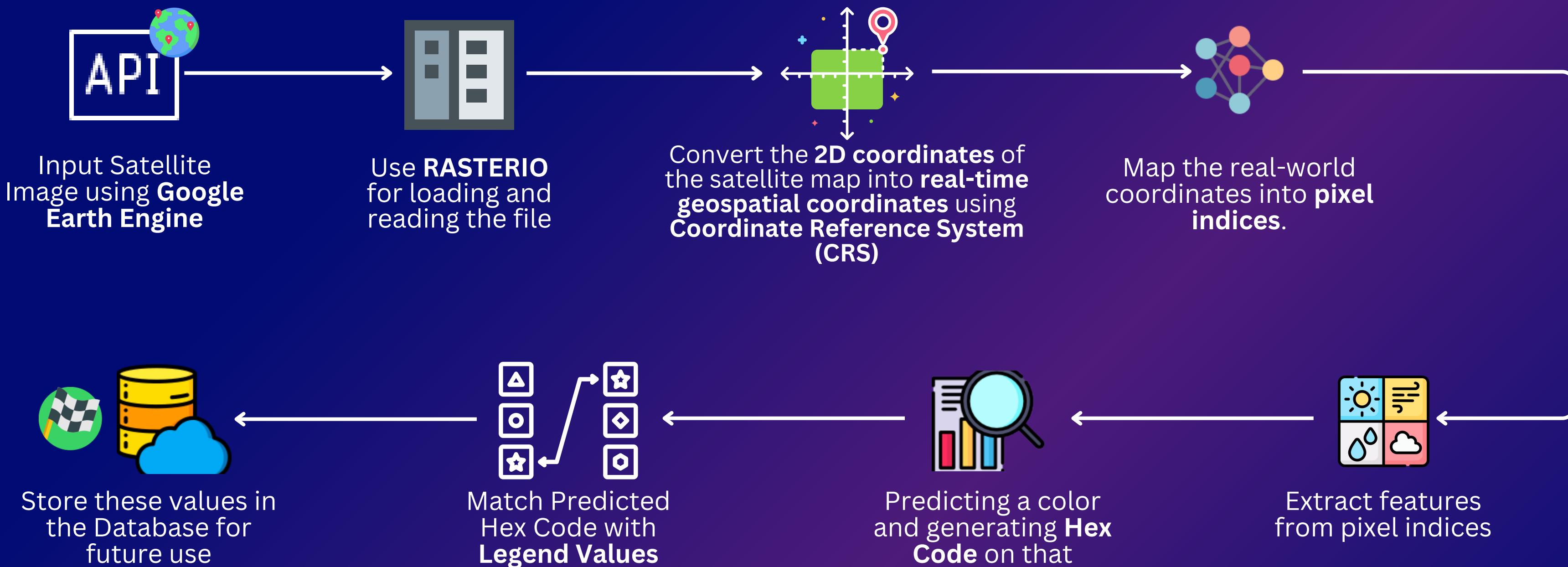
Abstract—In this paper we present a framework for ocean image classification based on ontologies. With this aim, we will describe how low and high level content of ocean satellite images can be modeled with an ontology. In addition, we will show how the image classification can be modeled with the ontology in which decision tree based classifiers and rule-based expert systems are represented. Particularly, the rule based expert systems include rules about low-level features (called training and labeling rules), and rules defined from the labeling (called human expert rules). The modeling with the ontology provides an extensible framework in which accommodate several methods of image classification. One of the main aims of our proposal is to provide a mechanism to share data about image classification between applications. We have developed an extensible Protégé plugin to classify images.

Index Terms—Content based image retrieval, image classification, ocean satellite images, ontology engineering, OWL, remote

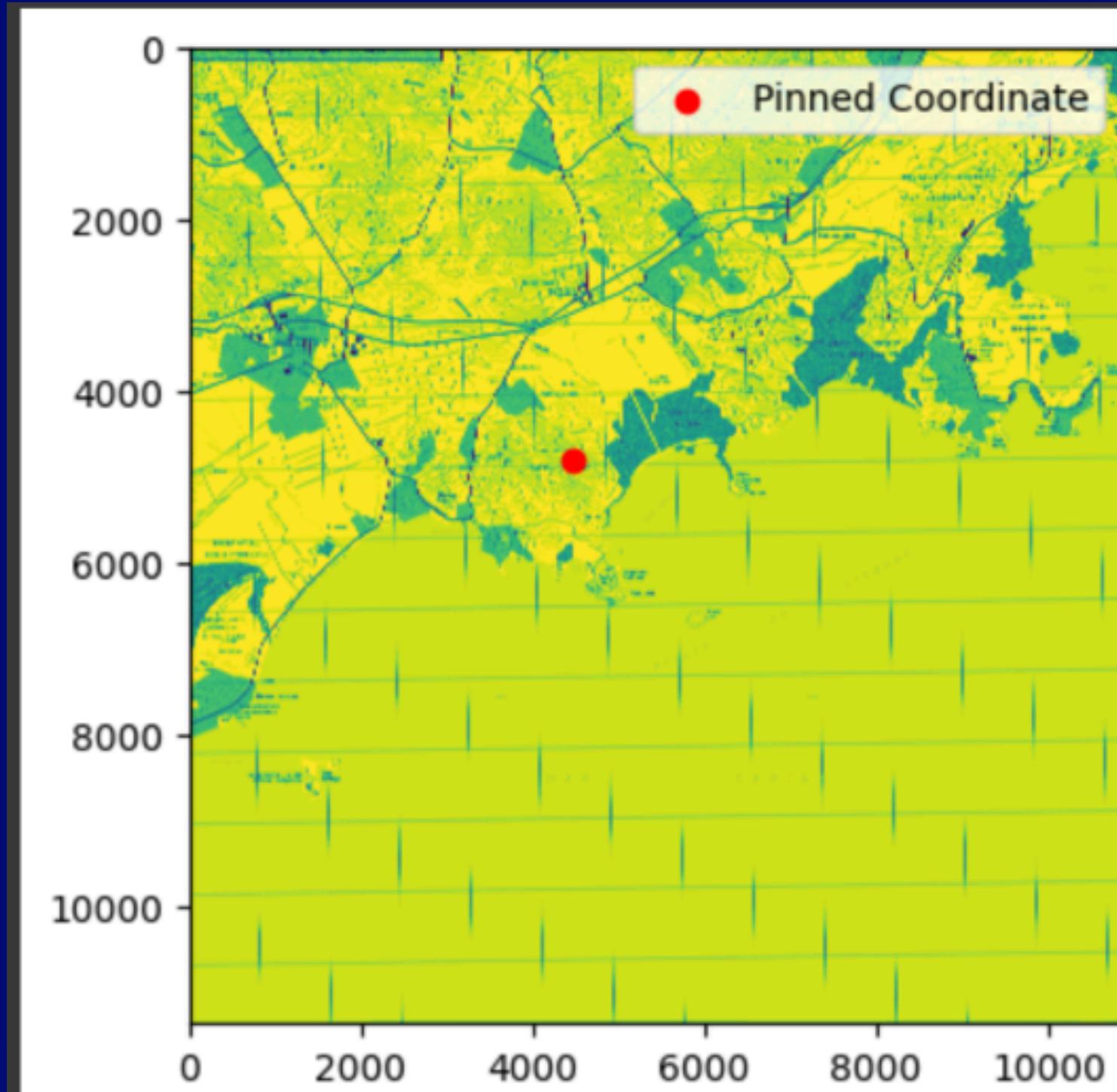
for some examples). The *Advanced Very High Resolution Radiometer (AVHRR)* on board the *National Oceanic and Atmospheric Administrations (NOAA)* polar orbiting satellites is perhaps the most widely used sensor for operational and long-term monitoring of global atmospheric, oceanic and terrestrial environments from the space. This sensor covers five channels in the infrared and visible spectra. Infrared information particularly has been utilized in oceanic structure identification (see [14]–[19] for some examples).

In spite of satellite image processing and classification has been extensively studied, and some tools are utilized (ERDAS Imaging [20] and ESRI [21], among others) the topic can be enriched from technologies used in modern CBIR systems. More concretely,

How we are integrating satellite images in our app?



Hex-code Generation for Pixels Based on Location Using Geo-Satellite



```
{  
  "Pixel Location": {  
    "Row": 4815,  
    "Column": 4471  
  },  
  "Coordinates": {  
    "Longitude": -65.6985,  
    "Latitude": 18.197,  
    "UTM Easting": -10409505.591821395,  
    "UTM Northing": 7136615.820451794  
  },  
  "Color Prediction": {  
    "Sample Value": 494.40817860513926,  
    "Color (RGBA)": [  
      0.9040369088811996,  
      0.9429757785467128,  
      0.9793310265282583,  
      1.0  
    ],  
    "Hex Color": "#e6f0f9"  
  }  
}
```

Bio Hazard and Risk Detection Based on Ocean Color - Our Novel Approach

Two-stage methods

Faster R-CNN w TDM [25] Inception-ResNet-v2- TDM 36.8

Faster R-CNN w FPN [34] ResNet-101-FPN 36.2

One-stage methods

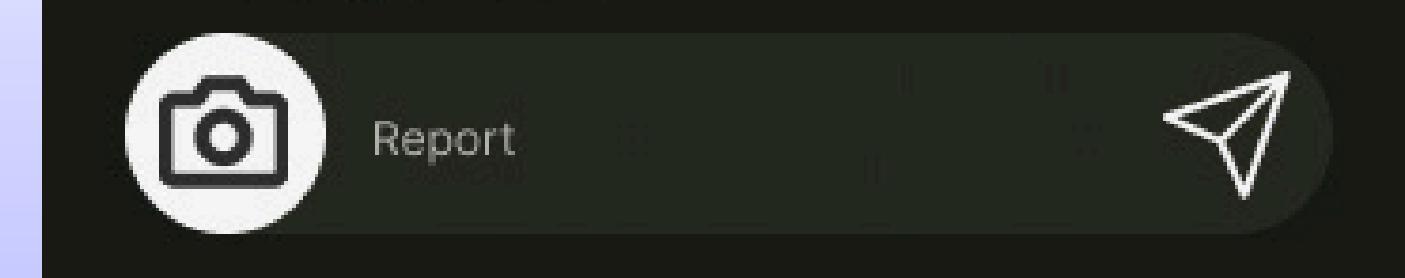
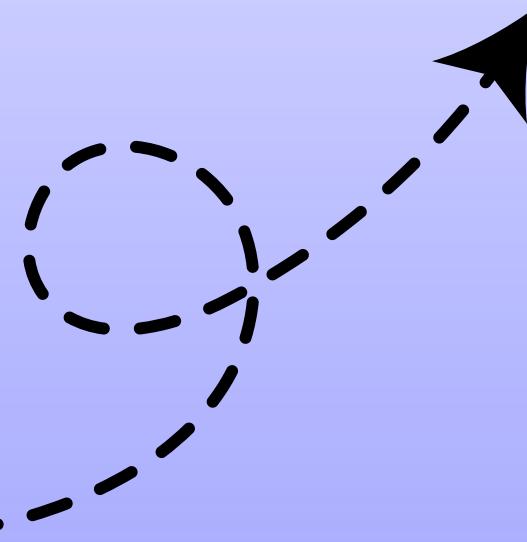
DSSD513 [31] ResNet-101-DSSD 33.2

RetinaNet [32] ResNet-101-FPN 39.1

Table3. Hyperparameters used to train AquaVision Dataset.

Epochs	Batch size	Steps	Time per step	Train/Test size
20	8	500	4s/step	80/20

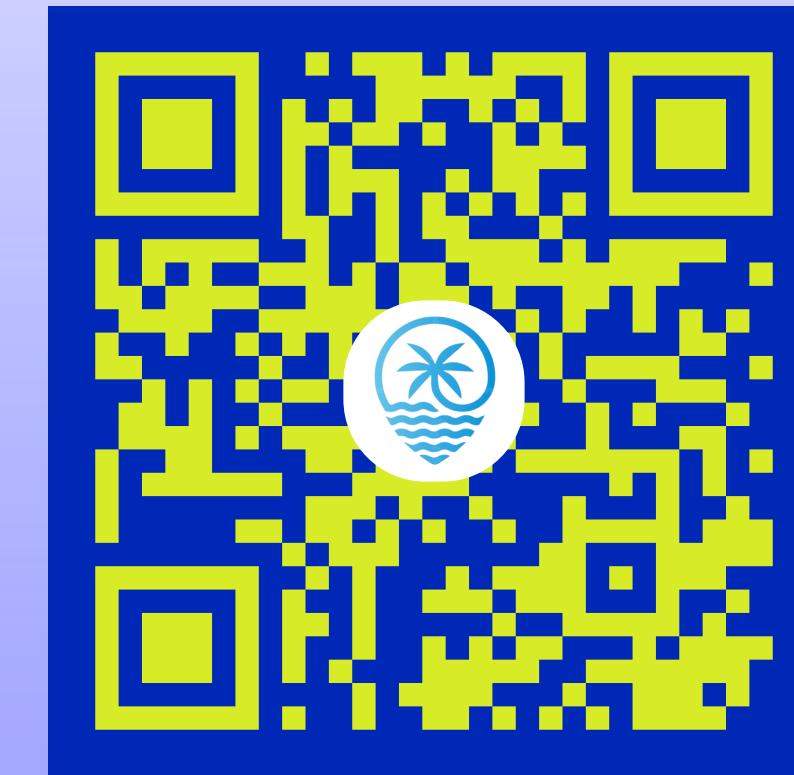
Don't blame, Contribute



Have a grievance about your nearest beach? Just make a report and make sure its noticed by the necessary authorities.

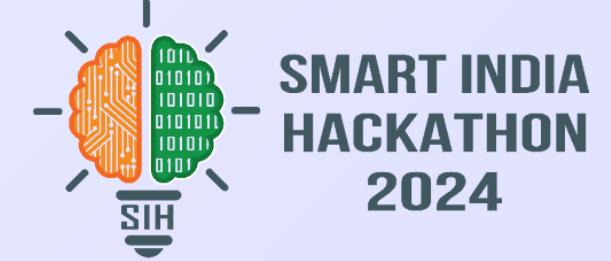
Make your beach journey cleaner and happier, and thus, help yourself and others at the same time.

Don't have KSHITIJ but do have sense!



if you don't have KSHITIJ app installed in your device you can still use KSHITIJ grievance submit portal for submitting your report against the inappropriate

FEASIBILITY & VIABILITY



Technical Feasibility

- Ensures **real-time data** retrieval with minimal delays.
- Critical for **timely** and **accurate safety alerts**.
- High accuracy models** for predicting beach suitability.
- Efficient algorithms optimized for mobile platforms.



Legal Feasibility

- Compliance with **data protection regulations** to safeguard tourist privacy.

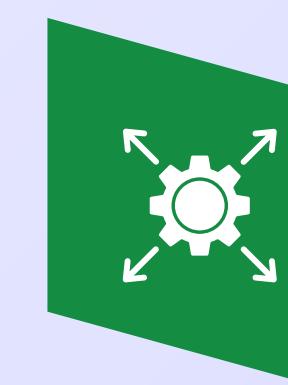
Business Feasibility

- Partner with **local businesses** (e.g., hotels, restaurants) and **travel agencies**



Resolution

- Unique integration of **real-time data** with user-friendly **geospatial mapping**, setting the app apart from existing solutions.

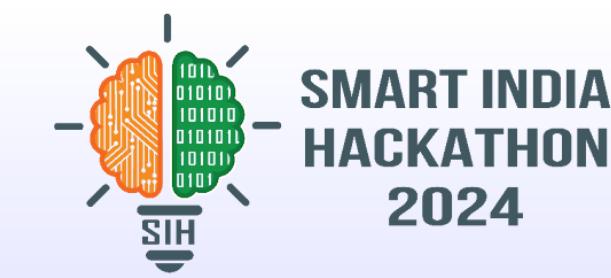


Market Demand

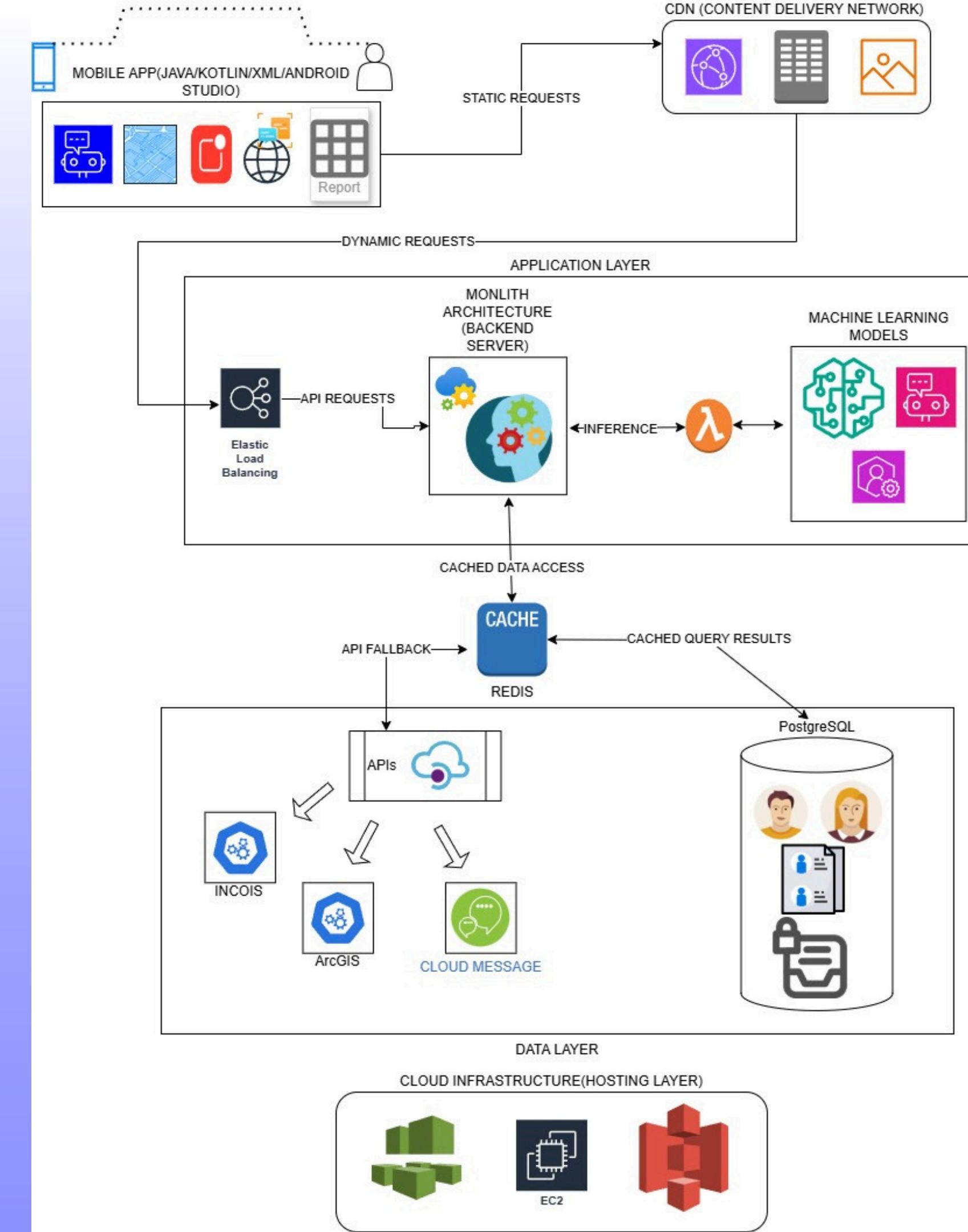
- High demand** for safety information among tourists, ensuring **widespread adoption**.

Scale

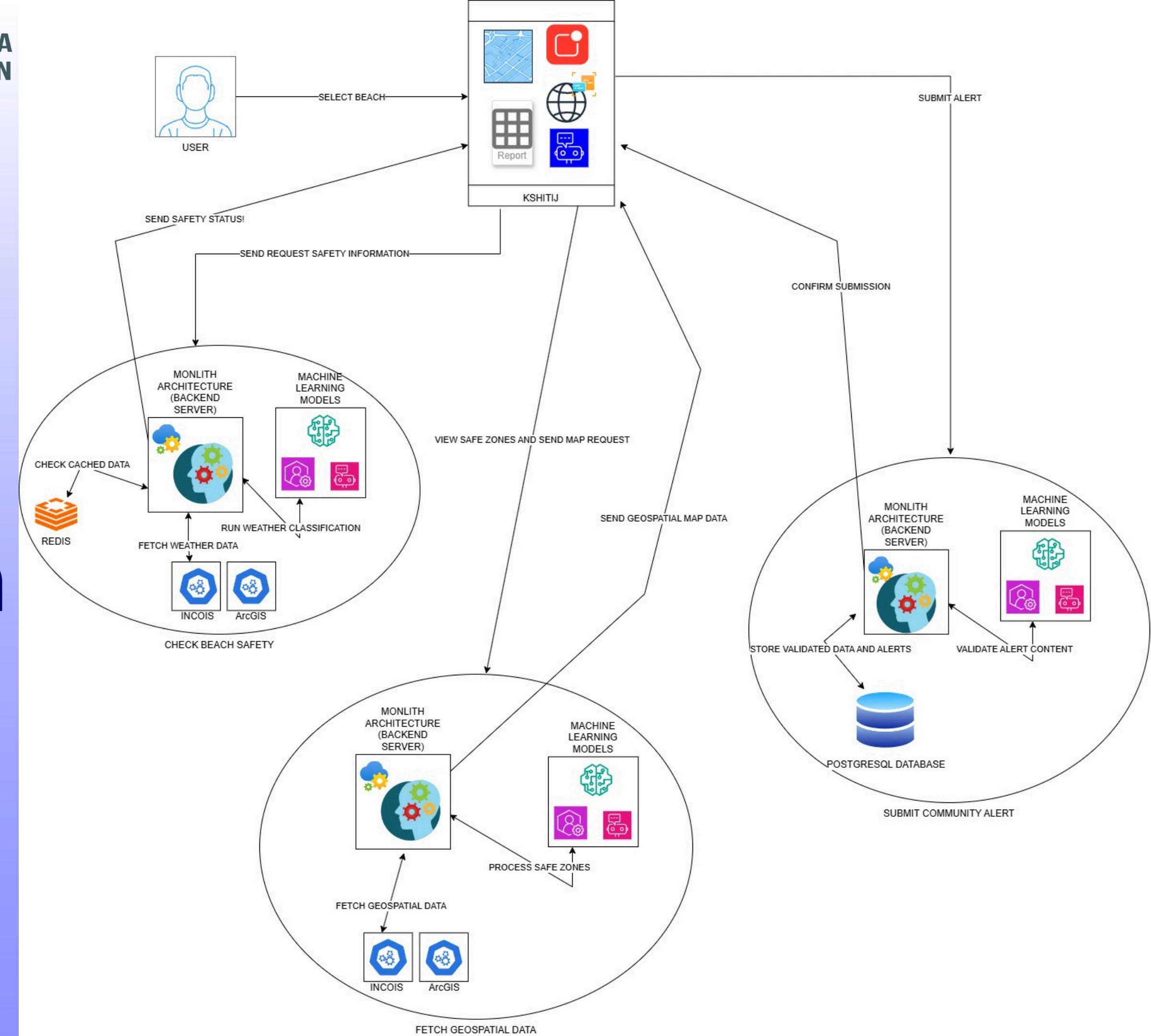
- To scale for future load we propose **Horizontal scaling** techniques which works effectively with multiple instances. To achieve this we deploy using **EC2** amazon webservice which provides the **benefit of elasticity**.



High Level System Design



User Defined System Design



Justifying Calculations



Assumptions for the Revised Project :

1. Active Users: 150 crores active Indian users.
2. Daily Usage: 50% of users use the system daily → 75 crores daily active users.
3. Requests per User per Day: Each user makes 50 requests per day.
4. Media Requests: 40% of requests include media.
5. Data Retention Period: Data is stored for 5 years.

Query Per Second (QPS) Calculation :

Step 1: Calculate Total Daily Requests

$$\begin{aligned} 1. \text{Total Daily Requests} &= \text{Daily Active Users} \times \text{Requests per User} = \\ &75 \text{ crores} \times 50 = 3750 \text{ crores requests/day} \end{aligned}$$

Step 2: Calculate Queries(Requests) Per Second

$$\begin{aligned} 1. \text{QPS} &= \text{Total Daily Requests} \div \text{Seconds in a Day} = \\ &3750 \text{ crores} / (24 \text{ hours} \times 3600 \text{ seconds}) \approx 43,400 \text{ QPS} \end{aligned}$$

Step 3: Peak QPS : Peak QPS (Queries Per Second)

refers to the maximum number of requests or queries a system is expected to handle in one second during its busiest time.

Assuming peak usage is 2 times the average:

$$\text{Peak QPS} = 2 \times 43,400 \approx 86,800 \text{ QPS}$$

Server Requirements :

1. QPS per Server: 15,000 QPS per server.
2. Total Servers Needed:
3. Servers = Peak QPS / QPS per Server = $86,800 / 15,000 \approx 6 \text{ servers}$

Server Requirements :

- Average Request Size:
 1. ID: 64 bytes
 2. Text: 150 bytes
 3. Media: 1 MB (for 40% of the requests)

Step 1: Calculate Daily Storage

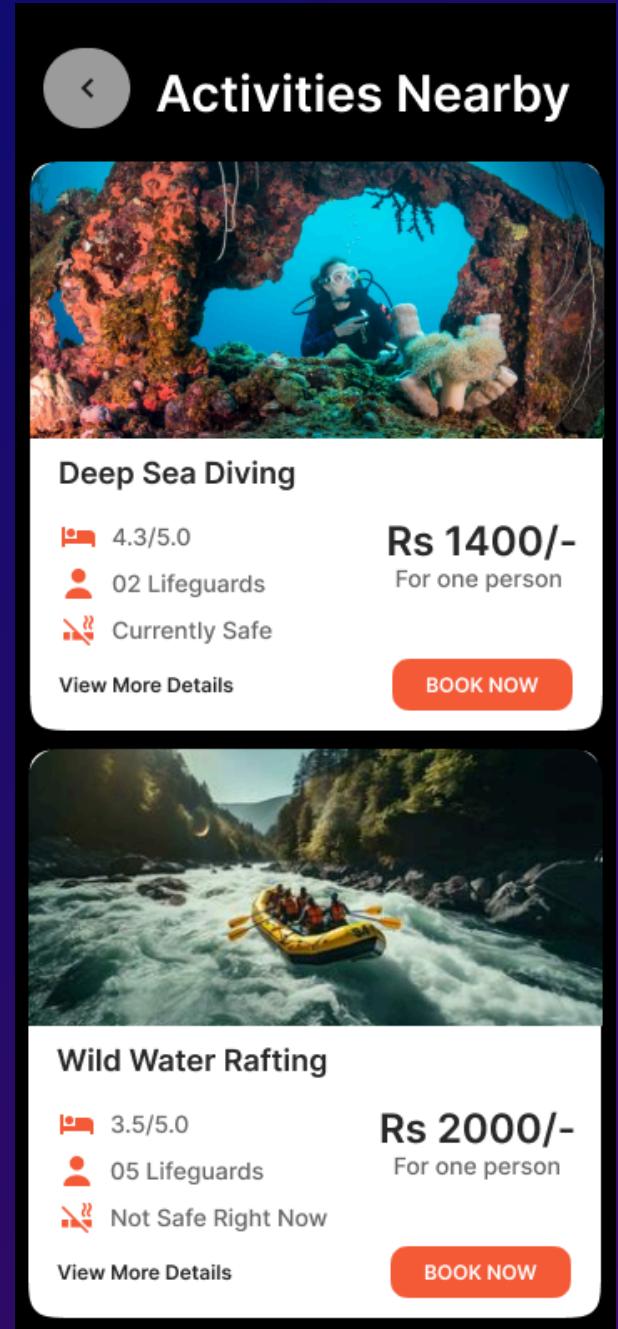
1. Non-Media Requests (60%): $3750 \text{ crores} \times 60\% \times 214 \text{ bytes (ID + Text)} \approx 482.4 \text{ GB/day}$
2. Media Requests (40%): $3750 \text{ crores} \times 40\% \times 1 \text{ MB} = 1500 \text{ TB/day} = 1.5 \text{ PB/day}$.
3. Total Daily Storage: $1.5 \text{ PB} + 482.4 \text{ GB} \approx 1.5 \text{ PB/day}$

Step 2: Calculate 5-Year Storage

- 5-Year Storage = Daily Storage × 365 days × 5 years =
- $1.5 \text{ PB} \times 365 \times 5 = 2737.5 \text{ PB} (\text{or } 2.74 \text{ Exabytes})$

*****1 Petabytes = 10^{12} Bytes

Future Scope and Business Plan



Activities Nearby

Deep Sea Diving

- 4.3/5.0
- 02 Lifeguards
- Currently Safe

Rs 1400/-
For one person

[View More Details](#) [BOOK NOW](#)

Wild Water Rafting

- 3.5/5.0
- 05 Lifeguards
- Not Safe Right Now

Rs 2000/-
For one person

[View More Details](#) [BOOK NOW](#)



Leaderboard

[Rankings](#) [Redeem](#)

#4 Thank You for keeping your countrymen safe

Rank	User	QP
1	Davis Curtis	2,569 QP
2	Alena Donin	1,469 QP
3	Craig Gouse	1,053 QP
4	Raj Singh(you)	590 points
5	Zain Vaccaro	

Beyond the realm of traditional alerts and safety, Kshitij promises to be an overall boost for the local economies near the beaches across India, while taking care of our financial viability.

Report alerts and anomalies and after thorough verification, you can get rewards that can later be redeemed at small and major businesses across the country.

Kshitij plans to be a one stop application to let local businesses promote themselves on national scale, while maintaining complete transparency about our sponsor and legal obligations.

India's Blue Economy - An Untapped Goldmine

As India progresses in developing its blue economy, it has the opportunity to unlock significant economic and environmental benefits. We can use our app for the following purposes :

Job Curation



Economic Growth



Business Growth



Environmental conservation



Security & Data Integrity

Keep you safe at all times (without stalking...)

UUID v4 (Universally Unique Identifier version 4) is a type of identifier commonly used in cybersecurity and software development to uniquely identify objects or entities in a system. It is a *randomly generated* identifier and is part of the broader UUID standard defined by [RFC 4122].

Making use of UUID based mapping, we do not need real-time location at all times, instead we map your locations based on major zones, thus preventing load on our application while also helping us push the most relevant alerts.

authentication  **authorisation**

authentication

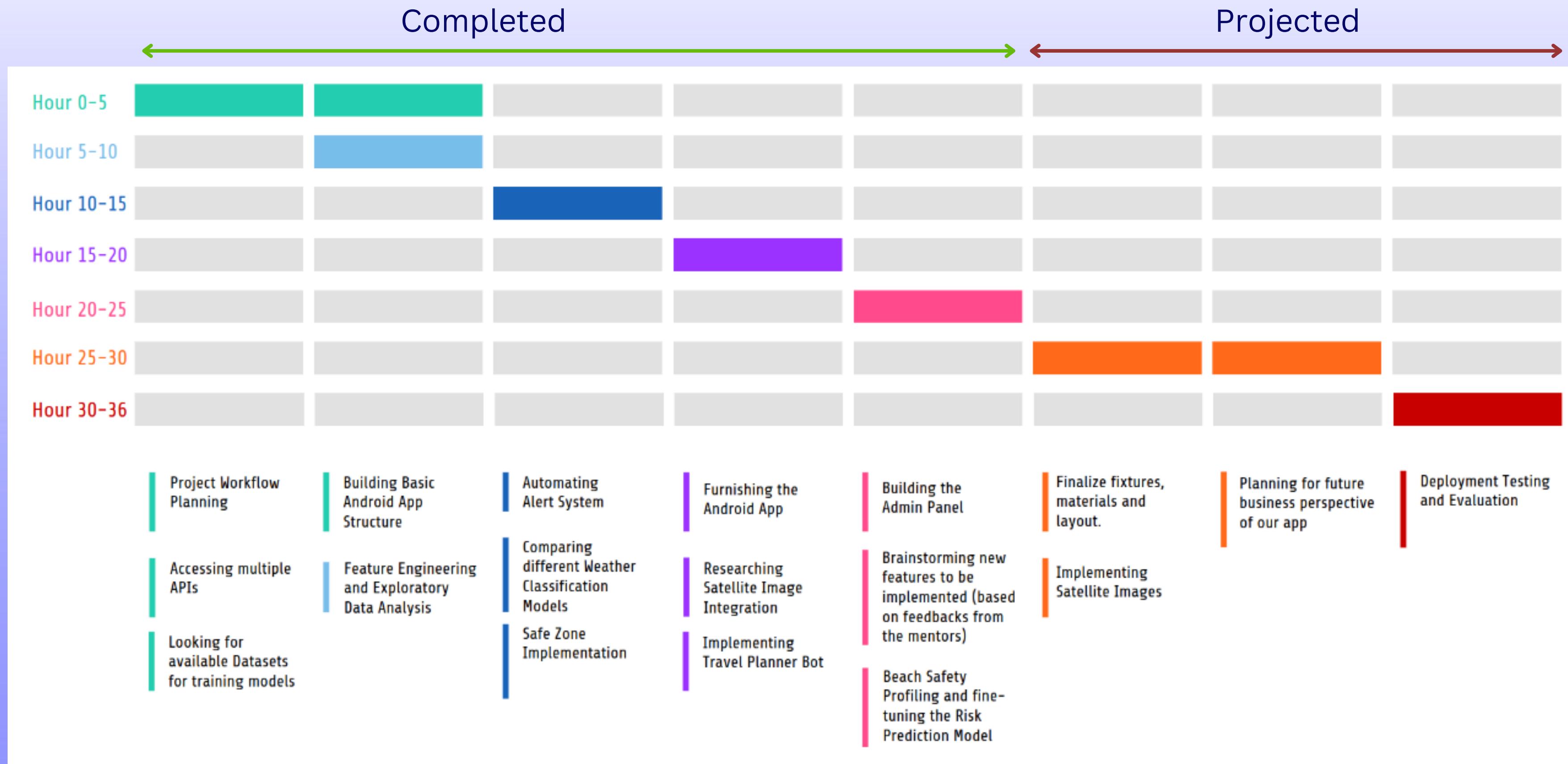


authorisation



user session management

PROJECT TIMELINE



NAME	EMAIL	PhNO
Zaid Mahmud	itssubi76@gmail.com	7595995214
Sayan Ganguly	sayanganguly128@gmail.com	7903940824
Urnisha Paul	urnishapaul05@gmail.com	7908659711
Diptesh Karmokar	dk2615@cse.jgec.ac.in	8900348163
Sampurno Sarkar	sampurnosarkar.ind@gmail.com	7439135785
Rupam Sadhukhan	rsadhukhan859@gmail.com	8335974336

MENTOR NAME	EMAIL	PHNO
ANUBHAB SARKAR	anubhabsarkarofficial@gmail.com	7044312862

Thank You !