

BHARATIYA ANTARIKSH HACKATHON

2024

Innovation partner **H2S**



Team Name: CodeKode

Name of College(s)/University(s): National Institute of Technology, Goa

Team Members Details:

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Detailed solution and Approach

Solution: The system will leverage advanced NLP techniques to process and understand user queries, coupled with a robust inference mechanism to extract implicit geospatial information. A sophisticated retrieval system will then fetch relevant geospatial data based on the inferred context.

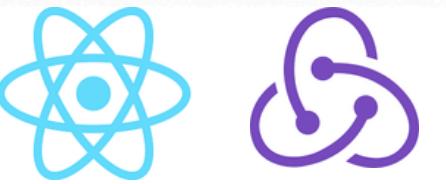
Approach:

1. NLP Model Development: Employ a state-of-the-art NLP model, fine-tune this model on a dataset of geospatial-related queries and responses to enhance its understanding of geospatial language nuances.
2. Inference Mechanism: Develop a rule-based or machine learning-based inference engine to extract implicit geospatial information.
3. Retrieval System: Implement a search engine that can efficiently retrieve geospatial data based on the extracted information.
4. Contextual Understanding: Incorporate world knowledge and common sense reasoning to improve the system's ability to understand complex queries.
5. User Interface: Design an intuitive interface allowing users to input natural language queries and visualize the retrieved geospatial data.



Tools and Technology Used

Frontend



React: enables efficient component-based development and ensures optimal performance,

Redux: promotes predictable state updates, simplifies complex data flows, and enhances code maintainability.

Database



PostgreSQL: offers robust data management capabilities, including complex query handling and efficient data retrieval.

Vector Database: enables efficient similarity searches, crucial for finding relevant geospatial information based on user queries.

Backend



Django: It accelerates development through its rich feature set, including ORM, templating, and authentication mechanisms.,

Folium: enables the visualization of geospatial data,

BERT: empowers the system to extract meaningful information from text input.,

geopy(OSM): facilitates accurate geospatial calculations and enriches the system's ability to handle location-based queries.

Cloud Platform

AWS, docker

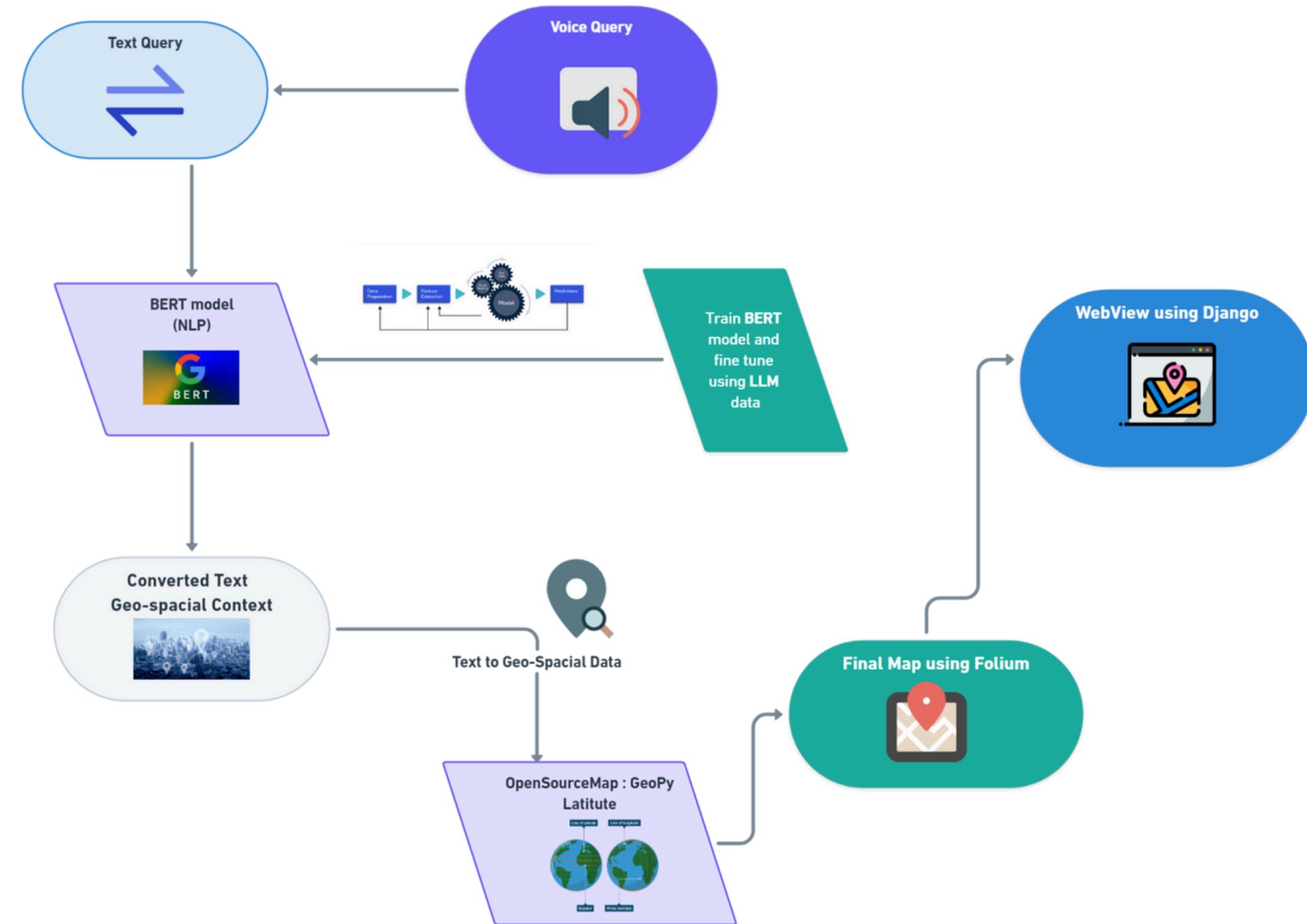


Docker on AWS

USP's

- Searching and locating a place base on natural language.
- Use of Geofencing search from to search images only from the give radius of area.
- Search from the co-ordinates of a location.
- Useful filters like selecting radius of search, population of the area which is useful for drawing meaningful inferences in geological planning.
- Speedy retrieval of data using tools like redis.
- Retrieving facts from an external knowledge base to ground large language models (LLMs) on the most accurate, up-to-date information and to give users insight into LLMs' generative process.
- Searches Data from Vector Database and returns all images in sorted order of its relevance from the searched data.

User Diagram



List of features offered by the Solution

- This advanced **NLP** system is equipped with a variety of features tailored to interpret and process **natural language queries with geospatial context**.
- By utilizing a cutting-edge NLP model, it can grasp intricate geospatial language subtleties. The system's inference mechanism, employing rule-based or machine learning methods, extracts implicit geospatial information to infer context not explicitly mentioned by the user.
- Moreover, the system incorporates world knowledge and common sense reasoning to improve its comprehension and precision.
- The user-friendly interface simplifies the input of natural language queries and offers clear visualization of the retrieved geospatial data, ensuring a smooth and effective user experience.
- Filters for **Radius of Search** for speedy and effective retrieval of data.

Feature Design

CAGS

Select Query ▾ New Jersey Fields with sparsely populated area

Search

Filters

- Satellite
- Topographic
- GIS
- Weather
- Urban



A Field in New jersey



A Field in New Jersey
(topographical map)

Use cases :

- To search an area based on population of the area.
- To search an area based on natural features like field, terrain, etc
- To help locate places quickly based on geo-coordinates
- To Help in Town Planning

Solution Brief

The proposed system is a sophisticated platform that leverages Natural Language Processing (NLP) to understand and interpret user queries with a geospatial context. It goes beyond simple keyword matching by inferring implicit information from the query, such as location, time, scale, and data type. The key components of our solution include:-

- **NLP Model:** This component is trained on a vast dataset of geospatial text and data to understand the nuances of geospatial language.
- **Inference Engine:** Extracts implicit geospatial information from user queries, enhancing query precision.
- **Geospatial Data Retrieval System:** Efficiently fetches relevant geospatial data based on the inferred context, utilizing advanced spatial databases and analysis tools.
- **User Interface:** Provides an intuitive platform for users to interact with the system, visualize results, and explore data.

Functionalities include:

- **Accurate and Relevant Results:** Delivers precise geospatial data aligned with user intent by understanding the context of their query.
- **Enhanced User Experience:** Offers a user-friendly interface with interactive maps, detailed information panels, and various tools for exploration and analysis.
- **Data-Driven Insights:** Enables users to discover valuable insights from geospatial data through advanced search and visualization capabilities.
- **Versatility:** Adaptable to various geospatial datasets and query types, making it a versatile tool for different applications.

Design link:<https://www.figma.com/design/YMazhZmEXauk0pJYGLi7cS/Context-aware-Geospatial-search?node-id=10-11&m=dev>

Current link:<https://context-aware-geospatial-data-retrieval-op1q.vercel.app/>

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THANK YOU

