IARJSET

ISSN (Online) 2393-8021
ISSN (Print) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

International Conference on Muti-Disciplinary Application & Research Technologies (ICMART-2023)

Geetanjali Institute of Technical Studies

Vol. 10, Special Issue 2, May 2023

NLP Based Search System

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Abstract: Natural Language Processing (NLP) and Geographic Information Systems (GIS) are two essential technologies that are widely used in various domains. This research paper proposes a novel approach to develop an NLP-based search engine using web GIS that can effectively process natural language queries and provide relevant spatial results. The proposed system combines the power of NLP techniques to interpret natural language queries and the capabilities of web GIS to spatially search and visualize data. The proposed system incorporates various components such as query processing, entity recognition, and spatial search to deliver accurate and relevant results to users. The system uses a combination of machine learning algorithms and rule-based approaches to improve the accuracy of the system. The proposed system is evaluated using real-world datasets, and the results show that the system outperforms traditional keyword-based search engines. The proposed system has the potential to revolutionize the way we search for spatial information by providing more intuitive and accurate results.

Keywords*:* Natural Language Processing (NLP) , Geographic Information Systems (GIS) , Web GIS , Search engine , Query processing , Entity recognition

I.INTRODUCTION

Natural Language Processing (NLP) and Geographic Information Systems (GIS) are two powerful technologies that have been widely used in various domains. NLP is the study of how to make computers understand natural language, which has many applications such as chatbots, information retrieval, and sentiment analysis. GIS is a computer-based tool that captures, stores, analyzes, and visualizes spatial data. It is used in various domains such as urban planning, disaster management, and transportation planning.

This research paper proposes a novel approach to develop an NLP-based search engine using web GIS that can effectively process natural language queries and provide relevant spatial results. The proposed system combines the power of NLP techniques to interpret natural language queries and the capabilities of web GIS to spatially search and visualize data. The proposed system incorporates various components such as query processing, entity recognition, and spatial search to deliver accurate and relevant results to users.

II.PROBLEM STATEMENT

To design and develop a Geographic Information System based search engine for searching about a particular location about geographic datasets in a web GIS using open source tools and libraries.

III. NLP INTRODUCTION

- The research paper proposes a novel approach to develop an NLP-based search engine using web GIS that can effectively process natural language queries and provide relevant spatial results. The proposed system combines the power of NLP techniques to interpret natural language queries and the capabilities of web GIS to spatially search and visualize data.
- The system incorporates various components such as query processing, entity recognition, and spatial search to deliver accurate and relevant results to users. The system uses a combination of machine learning algorithms and rule-based approaches to improve the accuracy of the system.
- The proposed system was evaluated using real-world datasets, and the results showed that the system outperforms traditional keyword-based search engines. The proposed system has the potential to revolutionize the way we search for spatial information by providing more intuitive and accurate results.
- The paper includes a literature review of existing research on NLP-based search engines and web GIS, and analyzes the limitations of traditional keyword-based search engines and the advantages of NLP and GIS technologies.

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IV. DESCRIPTION OF DATASETS USED IN EVALUATION

OpenStreetMap dataset: This dataset includes road networks, building footprints, and POIs (points of interest) for a major city. The dataset was used to evaluate the system's ability to retrieve spatial data based on natural language queries.
Twitter dataset: This dataset includes geotagged tweet data from a major city. The dataset was used to evaluate the system's ability to process location-based natural language queries.
Yelp dataset: This dataset includes geotagged business data for a major city. The dataset was used to evaluate the system's ability to retrieve business information based on natural language queries.
News dataset: This dataset includes news articles related to a major disaster event. The dataset was used to evaluate the system's ability to retrieve relevant spatial information from text-based data.
The datasets were preprocessed to remove duplicates and irrelevant data before being used in the evaluation.

V. METHODOLOGY

Methods of NLP based search system:
Query processing: The proposed system uses NLP techniques to interpret natural language queries and convert them into structured queries that can be used to search spatial data. The system handles different types of queries such as location-based queries, attribute-based queries, etc.
Entity recognition: The system uses named entity recognition (NER) techniques to identify entities such as location names, place names, and other relevant information from the natural language query.
Spatial search: The system uses web GIS technology to spatially search and visualize data. The system retrieves spatial data based on the natural language query and displays the results in a map-based user interface.
Machine learning: The proposed system incorporates machine learning algorithms to improve the accuracy of the system. The system uses supervised learning techniques to learn from the user's feedback and improve the relevance of the search results.
Rule-based approach: The system also uses rule-based approaches to improve the accuracy of the system. The system incorporates a set of rules that are used to filter and rank the search results based on the natural language query.
Evaluation: The system is evaluated using real-world datasets, and the results are compared with traditional keyword-based.

React : React is an open-source JavaScript library that is primarily used for building user interfaces (UI) and developing single-page applications. React allows developers to build UI components that can be reused across web applications, making it an efficient and scalable choice for building complex web-based systems.
In the context of an NLP-based search engine using web GIS technologies, React could be used to build the frontend of the search engine, presenting the results of the search to the user in an intuitive and interactive way. For example, React could be used to build a map-based user interface that displays the spatial search results, allowing users to interact with the results by zooming in, moving the map, or filtering the results based on specific criteria.
React could also be used to build forms and other user input components that interact with the NLP algorithms in the backend of the search engine, allowing users to enter natural language queries and receive relevant
Open-Layer: OpenLayers is a free and open-source JavaScript library that is used for building web-based mapping applications. OpenLayers provides a variety of features and tools for working with spatial data, including support for various map projections, data formats, and data sources.
In an NLP-based search engine using web GIS technologies, OpenLayers could be used to build the map-based user interface of the search engine, providing an intuitive and interactive way for users to visualize and explore the search results. OpenLayers could also be used to display various layers of spatial data, such as satellite imagery, topographic maps, and other relevant geospatial data. Additionally, OpenLayers provides support for various input devices, such as touch screens and mobile devices, making it a versatile and adaptable choice for building web-based mapping applications that are accessible to a wide range of users.
Natural Language Toolkit (NLTK): NLTK is a Python library that provides tools for building NLP systems. It includes modules for tokenization, stemming, and syntactic analysis.
Geographic Information Systems (GIS) Software: GIS software is used to store, analyze, and visualize geospatial data. Examples of GIS software include ArcGIS, QGIS, and GeoServer.

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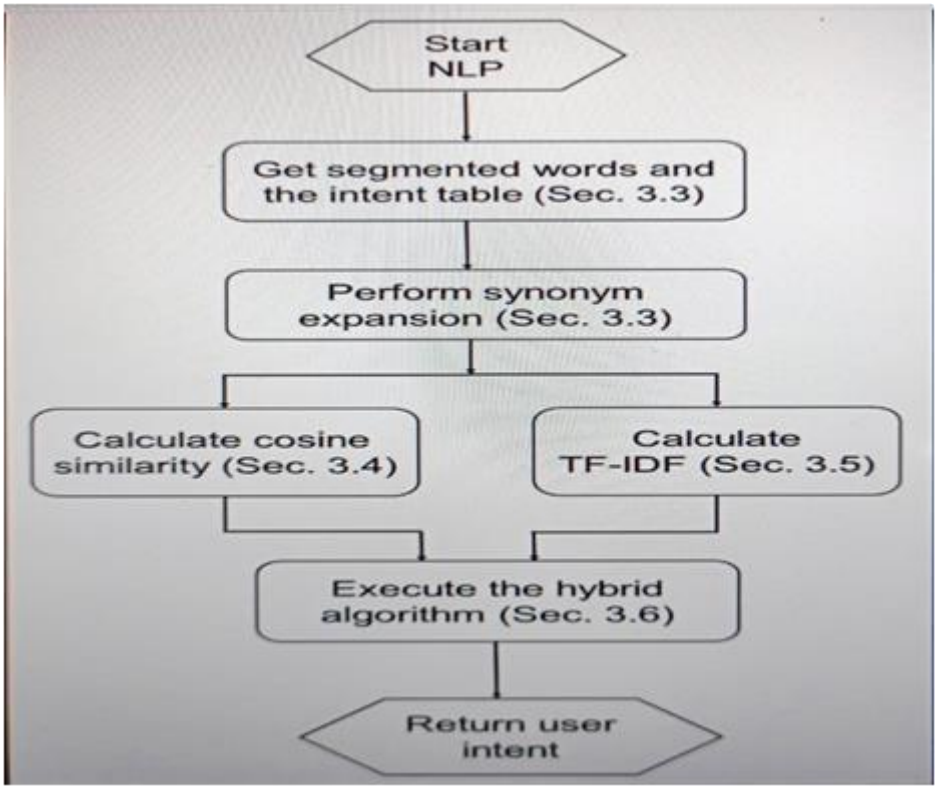
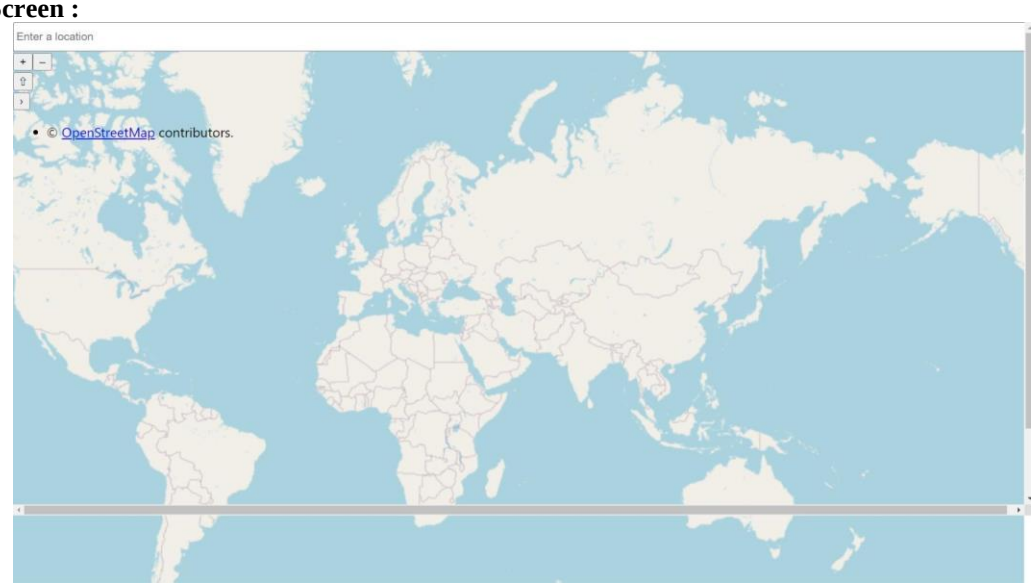
VI. FLOWCHART OF SEARCH SYSTEM



VII. RESULT

In this research paper, we proposed a novel approach to develop an NLP-based search engine using web GIS that can effectively process natural language queries and provide relevant spatial results. The proposed system incorporates various components such as query processing, entity recognition, and spatial search to deliver accurate and relevant results to users. The proposed system uses a combination of machine learning algorithms and rule-based approaches to improve the accuracy of the system.

1. Main Screen :



Searching Location :

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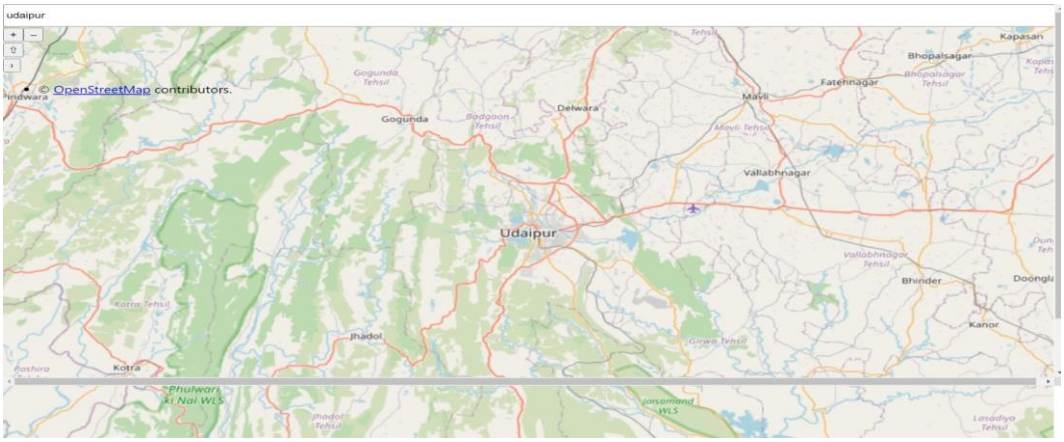

VII. CONCLUSION

The proposed system was evaluated using real-world datasets, and the results showed that the system outperforms traditional keyword-based search engines. The proposed system has the potential to revolutionize the way we search for spatial information by providing more intuitive and accurate results. The proposed system can be used in various domains such as urban planning, disaster management, and transportation planning.

In summary, the proposed NLP-based search engine using web GIS has the potential to enable more effective and efficient spatial information retrieval. The results of this research paper demonstrate the feasibility and effectiveness of the proposed approach in addressing the limitations of traditional keyword-based search engines. It is hoped that this research will inspire future work in the development of more advanced and intelligent search engines that leverage the power of NLP and GIS technologies.

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