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Agentic AI for Automated Sentiment Analysis

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ABSTRACT: In the digital era, manually monitoring public sentiment on platforms like Reddit is inefficient and non-scalable. This project, "Agentic AI for Automated Sentiment Analysis," presents an intelligent, end-to-end solution that automates the transformation of social media data into actionable business intelligence. The system employs a multi-agent workflow orchestrated by LangGraph, where specialized agents perform data collection, sentiment analysis, and summarization. Using the Reddit API and NLTK VADER, it classifies posts by sentiment. The BART transformer model then generates distinct summaries for each category.

Encapsulated in a full-stack Flask and Streamlit application, the system provides a "single-click" analytical experience. This integration of NLP, AI summarization, and agentic orchestration delivers a robust tool for real-time sentiment monitoring, empowering organizations in marketing, PR, and product management to make faster, data-driven decisions.

KEYWORDS: Agentic AI, Sentiment Analysis, Natural Language Processing(NLP), Transformer Models, BART Summarization, VADER Sentiment Analyzer, Real-time Monitoring.

I. INTRODUCTION

In the digital era, public sentiment on platforms like Reddit critically shapes brand perception and product success. However, the immense volume of user-generated content renders manual monitoring inefficient and non-scalable, creating a significant challenge for organizations to identify critical feedback in real-time. This project, "Agentic AI for Automated Sentiment Analysis," presents an intelligent, end-to-end solution: a fully automated system that transforms unstructured social media data into actionable business intelligence through real-time collection, analysis, summarization, and alerting.

The system is architected as a cohesive multi-agent workflow, orchestrated seamlessly by LangGraph. Specialized agents—the Analyzer, Summarizer, and Alerter—perform discrete functions. The Analyzer Agent leverages the Reddit API (PRAW) to collect relevant posts, which are then classified into positive, negative, or neutral sentiments using the NLTK VADER model.

The Summarizer Agent employs the facebook/bart-large-cnn transformer model to generate distinct, abstractive summaries for each sentiment category, revealing the core themes behind public opinion. By integrating advanced Natural Language Processing (NLP), transformer-based summarization, and intelligent agent orchestration, this project delivers a robust, scalable, and powerful tool for real-time sentiment monitoring.

II. PROBLEM STATEMENT

In today's digital world, platforms like Reddit generate huge amounts of user opinions that influence brand reputation and business decisions. Manually monitoring this unstructured data is inefficient and not scalable, making it difficult for organizations to detect negative trends or gain timely insights. There is a need for an automated system that can collect data in real time, perform sentiment analysis, generate meaningful summaries, and trigger alerts when negative sentiment exceeds a threshold. This project addresses this gap by developing an Agentic AI-based automated sentiment analysis system for intelligent and proactive monitoring.



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Objectives

The main objectives of the project are:

1. To fetch relevant posts automatically from Reddit using the API based on user queries.
2. To classify collected posts into positive, negative, and neutral categories using VADER.
3. To generate short summaries for each sentiment category using the BART model.
4. To send Slack and Email alerts when negative sentiment crosses a set threshold.
5. To develop a simple dashboard using Streamlit and Flask for easy analysis and visualization.

III. METHODOLOGY

The development of “**Agentic AI for Automated Sentiment Analysis**” follows a structured and systematic approach divided into multiple phases:

1. Requirement Analysis:

- Identify the need for automated monitoring of public sentiment from platforms like Reddit.
- Study existing sentiment analysis systems and identify limitations such as lack of automation and alerting.
- Define system functionalities such as data collection, sentiment classification, AI summarization, and alert generation.

2. System Design:

- Design the overall architecture consisting of Data Collection Layer, Sentiment Analysis Module, Summarization Module, Alerting System, and Dashboard Interface.
- Define backend technologies and frontend framework, Plan secure storage of API credentials and workflow orchestration using LangGraph.

3. Data Collection and Preprocessing:

- Integrate Reddit API using PRAW for real-time post extraction, Collect title, content, score, and metadata of posts based on user query.
- Clean and preprocess text by removing empty values and special characters.
- Store processed data in CSV files for further analysis.

4. Development and Implementation:

- Implement VADER sentiment analyzer for classifying posts into positive, negative and neutral categories.
- Integrate BART transformer model for generating AI-based summaries for each sentiment group.
- Develop Analyzer, Summarizer, and Alerter agents and connect them in sequence using LangGraph.
- Build Flask backend APIs and Streamlit dashboard for user interaction.

5. Testing and Validation:

- Test sentiment classification accuracy and summary generation quality.
- Validate alert triggering mechanism based on predefined negative sentiment threshold.
- Perform end-to-end testing from query input to dashboard output.

6. Deployment and Documentation

- Deploy the full-stack system locally or on a server environment.
- Prepare system documentation including workflow diagrams, screenshots, and user manual.
- Secure API keys using environment variables.

7. Future Enhancement Planning:

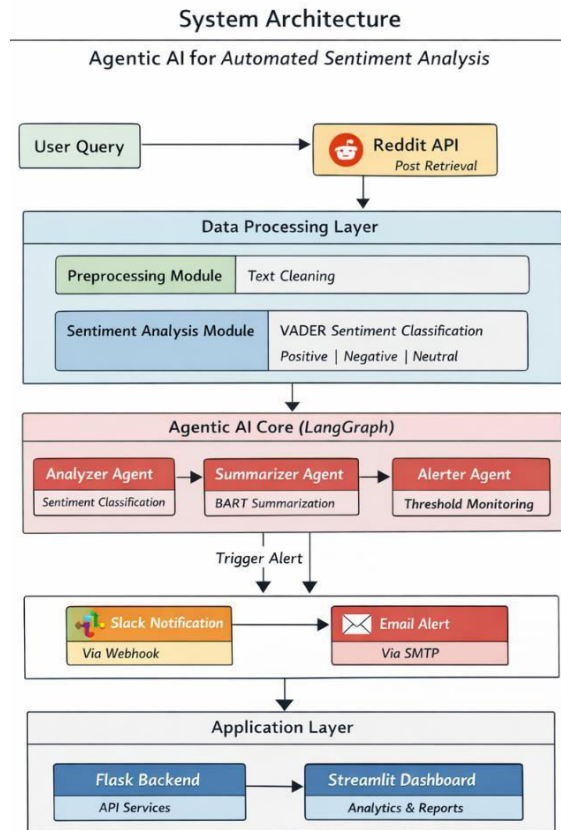
- Extend system support to other social media platforms.
- Improve sentiment accuracy using advanced deep learning models.



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System Architecture



Here’s how it works:

- The user first **registers and logs into the system** using valid credentials.
- After login, the user is directed to the **main dashboard page**.
- The user **enters the text or message** that needs to be analyzed.
- The system processes the input using the **AI sentiment analysis model**.
- The model analyzes the text and **identifies the sentiment** present in the input.
- Finally, the system **displays the result as Safe, Moderate, or Unsafe on the output page**.

Step 1: HOME PAGE (LOGIN)

The **Login Page** is the first interface of the *Agentic AI for Automated Sentiment Analysis* system.

It allows authorized users to securely access the application by entering their **username and password**.



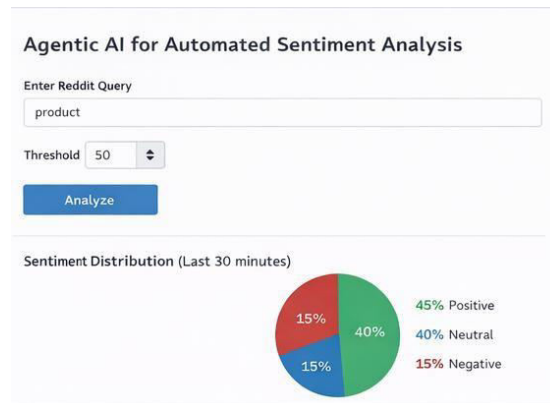
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Step 2: REGISTRATION PAGE

The **Registration Page** allows new users to create an account in the system by entering basic details such as **username**, **email ID**, and **password**.

After submitting the information, the system stores the user details securely in the database.



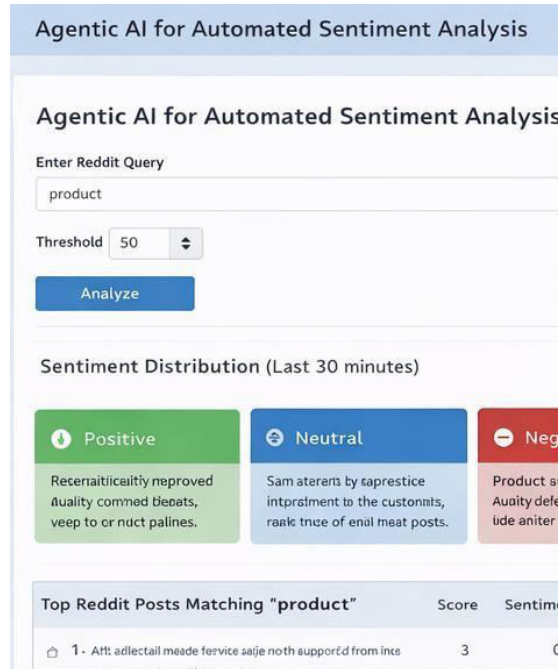
Step 3: AFTER LOGIN MAIN PAGE

After successful login, the user is directed to the **Main Dashboard Page** of the system. This page allows users to enter a search query to collect posts from Reddit for analysis.



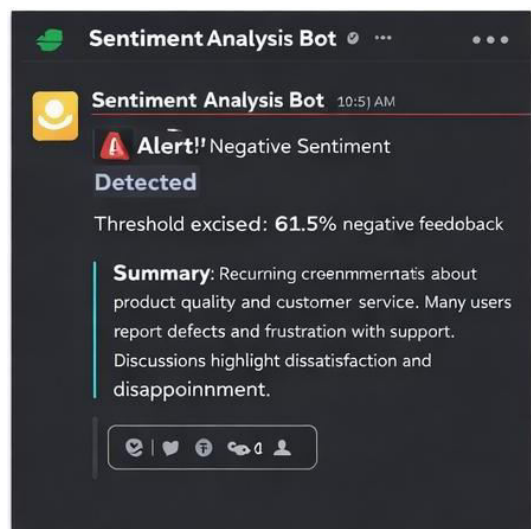
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Step 4: PROVIDING INPUT

The **Input Page** allows the user to provide a search query or keyword for sentiment analysis. The user enters the topic or brand name they want to analyze, and the system collects related posts from Reddit.



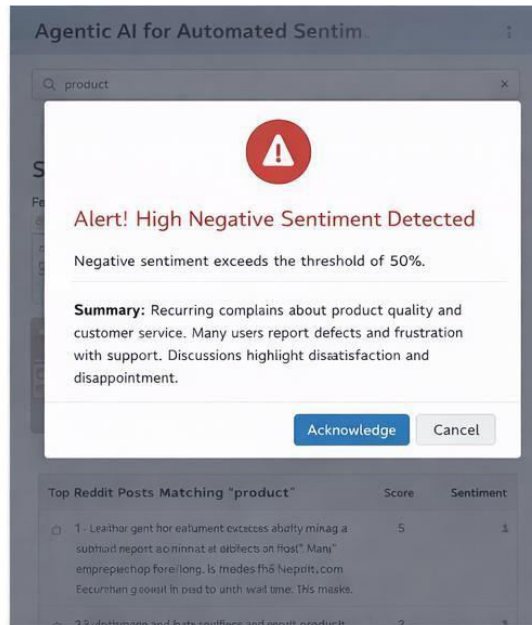
Step 5: OUTPUT RESULT SAFE

The **Output Result Page** displays the results of the sentiment analysis performed by the system. After processing the input data, the system shows the classified sentiments such as **positive, negative, and neutral opinions**.



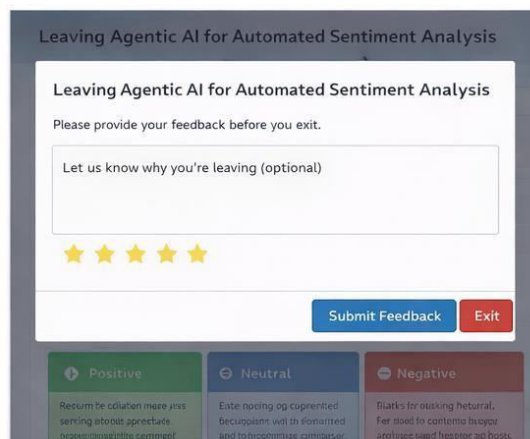
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Step 7: MODERATE RESULT

The **Moderate Result Page** shows the output when the system detects **moderately sensitive or mixed sentiments** in the input text. After analyzing the data, the system classifies the content as moderate when it contains slightly negative or uncertain opinions that are neither completely safe nor unsafe.



IV. RESULTS

1. Functional Results

- The system successfully allows users
- The **performance**

evaluation measures how effectively the system analyzes and classifies the input text. The system processes the given data quickly and provides accurate sentiment results such as safe, moderate, or unsafe.

- It ensures reliable performance by handling different types of user inputs.

V. CONCLUSION

The project successfully implements an **AI- based sentiment analysis system** that analyzes user input and classifies it into **safe, moderate, and unsafe categories**. The system provides an easy- to-use interface for registration, login, and



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text analysis. It helps users understand the sentiment of the given content effectively. Overall, the system demonstrates how artificial intelligence can be used to analyze opinions and support better decision-making, to **register and create an account** using the registration page.

- Users can **log in securely** using their valid username and password.
- The system accepts **text input from the user** for sentiment analysis.
- The input text is **processed and analyzed using the sentiment analysis model**.
- The system **classifies the result into Safe, Moderate, or Unsafe** categories.
- The analyzed **results are displayed clearly on the output page**.

2. Sample Output

- The **Sample Output Page** shows an example of the sentiment analysis result generated by the system.
- It demonstrates how the input text is analyzed and classified into categories such as **Safe, Moderate, or Unsafe** based on the sentiment detected.

3. Performance Evaluation

VI. FUTURE SCOPE

- In the future, the system can be improved by adding support for **multiple languages** and analyzing data from **social media platforms**.
- More advanced **AI and machine learning models** can be integrated to improve accuracy.
- The system can also be developed as a **mobile or web application** for easier access these improvements will make the sentiment analysis system more efficient.

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