Deep Research AI Agentic System

1. Project Overview

The **Deep Research AI Agentic System** automates online information gathering and response generation using AI-powered agents. It consists of a **dual-agent** approach:

- **Research Agent**: Uses **Tavily API** to gather relevant data from the web.
- **Answer Drafter Agent**: Processes collected data and generates structured responses using AI models.
- **LangGraph and LangChain** ensure efficient coordination between agents, enabling intelligent research automation.

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2. Technologies Used

Technology	Purpose
Tavily	Web crawling & data extraction
LangChain	Language model integration & response generation
LangGraph	Orchestration of agent workflow
Python	Primary programming language
GitHub	Version control & collaboration

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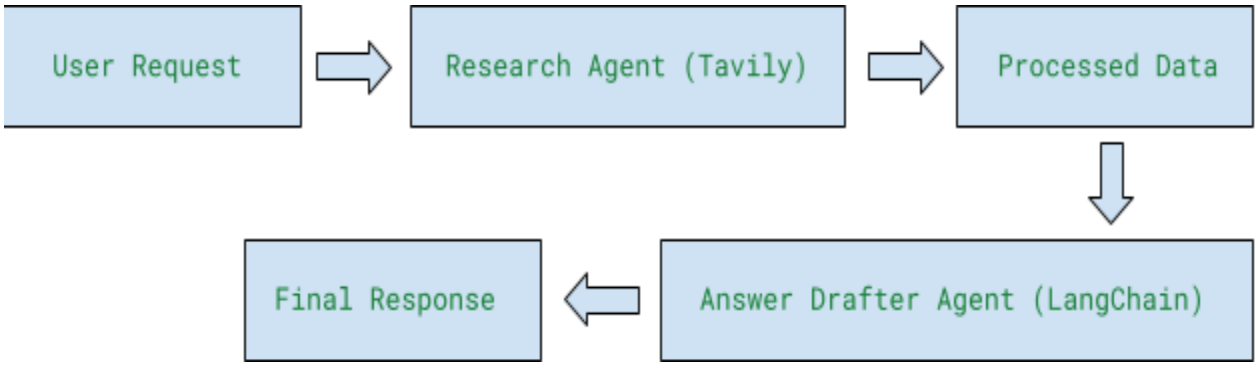
3. System Architecture

The system follows a **modular design**, where each agent has a distinct responsibility:

1. **Research Agent**
    - Uses Tavily to perform **web crawling** and gather **relevant online data**.
    - Filters unnecessary data and stores relevant information.
2. **Answer Drafter Agent**

    - Uses **LangChain** to process gathered data.
    - Formulates a structured **response** based on context.
3. **LangGraph Role**
    - Connects both agents in a workflow.
    - Ensures smooth **interaction and decision-making** between the agents.

Workflow Diagram



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3. System Architecture

The system follows a **modular multi-agent design**, ensuring each agent has a **specific role**:

Research Agent

- Uses **Tavily API** to perform web crawling and fetch relevant online data.
- Filters unnecessary information and extracts meaningful insights.

Answer Drafter Agent

- Uses **LangChain** to process data and generate structured responses.
- Summarizes information using **LLMs (Large Language Models)**.

LangGraph Role

- **Connects** both agents in a seamless workflow.
- Ensures **efficient decision-making** and **task execution flow**.

4. Implementation Details

Agent 1: Research Agent (Web Scraper)

- Fetches **real-time online information** using Tavily.
- Filters **unnecessary data** to keep only relevant details.

Agent 2: Answer Drafter (Response Generator)

- Takes the processed data and **structures a response**.
- Uses **LLMs (Language Models)** via LangChain for summarization.

LangGraph Role

- **Orchestrates interactions** between the two agents.
- Defines conditions and **task execution flow**.

LangChain Role

- Helps **LLMs** understand and summarize research data.
- Supports **NLP-based response generation**.

5.Installation & Setup

To set up the system, follow these steps:

Prerequisites

- Install **Python** (version 3.8+ recommended)
- Install the required dependencies

Run the following command:

```
pip install langchain tavily langgraph
```

6. How to Run the System

Step 1: Clone the GitHub Repository

```
git clone
https://github.com/nayera-hassan2/Deep-Research-AI-Agent.git
cd Deep-Research-AI-Agent
```

Step 3: Set API Key

Create a `.env` file and add your **Tavily API key**:

```
TAVILY_API_KEY=your_api_key_here
```

Step 4: Run the System

```
python main.py
```

Step 5: Enter a Research Topic

The system will prompt you to enter a topic for research.

Example Queries:

- `Enter your research topic: Latest advancements in AI`
- `Enter your research topic: Impact of quantum computing on cryptography`
- `Enter your research topic: Evolution of web development frameworks`

The system will **fetch research data, summarize it, and save the output** to `research_output.json`.

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7. Results & Future Improvements

Current Outcomes

- Automated **real-time research** from web sources.
- AI-powered **structured response generation**.
- Modular agent-based architecture for **scalability**.

Future Enhancements

- Improve **data filtering** for better accuracy.
- Implement **multi-agent collaboration** for deeper insights.
- Add **memory & knowledge retention** for long-term research tasks.