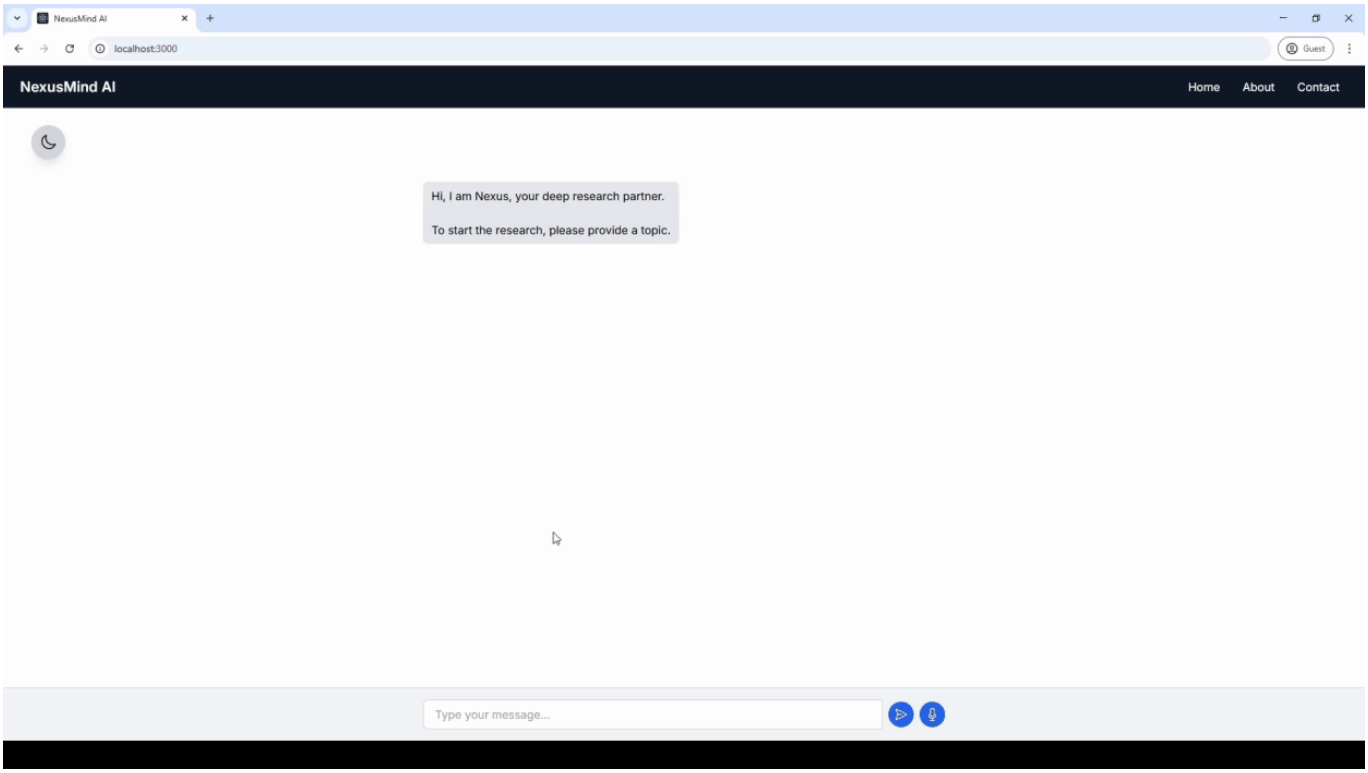
NexusMind AI — Deep Research Agent Web App

NexusMind AI is an advanced research assistant that automates the creation of in-depth research reports by leveraging state-of-the-art **natural language processing (NLP)**, **iterative multi-turn feedback loops**, and modern web technologies. At its core, the system employs a **dual-agent approach** that uses **Tavily** for online data gathering: one agent drafts and refines a structured report plan based on user feedback, while the other creates and compiles the final report. Built on **LangGraph Open Deep Research**, NexusMind AI delivers comprehensive, customizable research reports on any topic with precision and scalability. The backend is powered by **FastAPI**, the frontend is developed in **React**, and the system is containerized with **Docker** for seamless deployment.

Demo

Watch a short demo of NexusMind AI in action:



Features

- **Conversational AI for Research**: Users can input a research topic, receive structured outlines, and refine results through iterative feedback.
- **Multi-Turn Feedback Loop**: The AI dynamically improves the research content based on user feedback.
- **PDF Report Generation**: Converts final research results into downloadable PDF reports.
- **Speech-to-Text Support**: Enables voice-based topic input and interaction.
- **Dark Mode**: User-friendly theme switching between light and dark modes.
- **Automatic Conversation Reset**: Restarts the conversation while preserving the final report.

How It Works

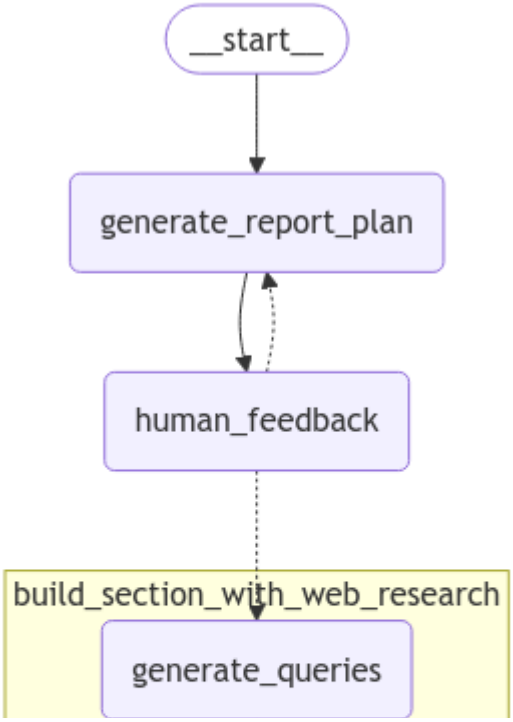
1. **Start a Research Session**
    - The user enters a research topic in the chat.
    - The AI generates an initial structured outline and report plan.
2. **Iterate with Feedback**
    - The AI asks for feedback before finalizing the report.
    - The user can request refinements or approve the current version.
3. **Generate the Final Report**
    - Once approved, the AI completes the research report.
    - The report is structured and formatted based on best practices.
4. **Download the Report as a PDF**
    - The user can download the report as a well-formatted PDF.
5. **Restart the Conversation**
    - The system clears previous interactions and allows the user to start fresh with a new topic while preserving access to previous reports.

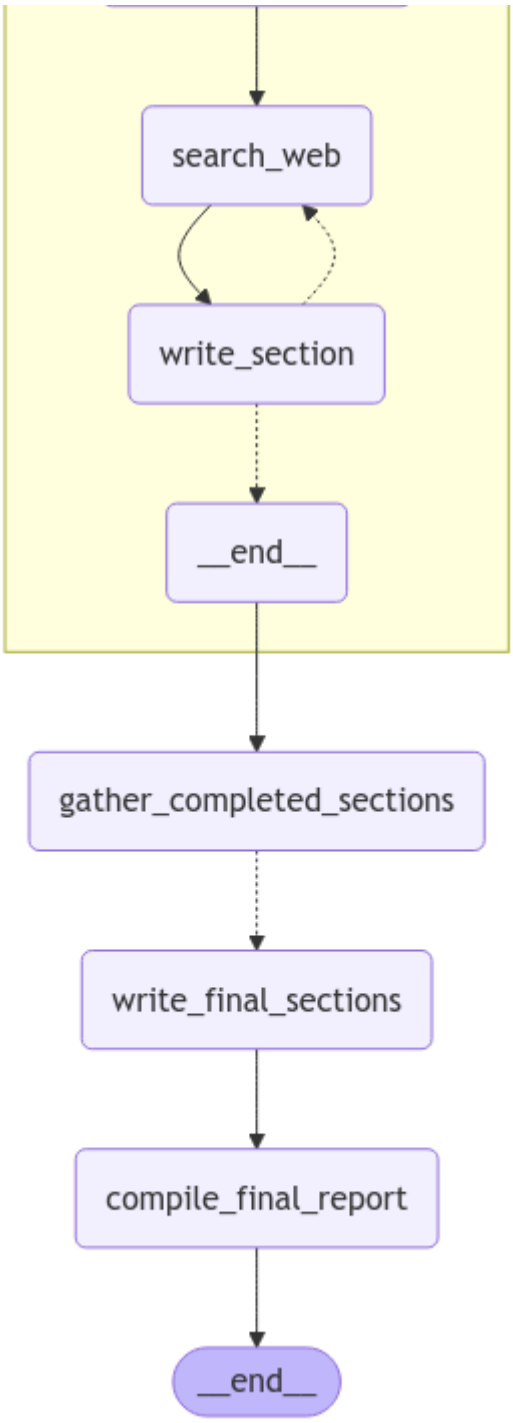
Deep Research Agent Workflow

NexusMind AI uses **two specialized agents** to generate high-quality research reports:

1. **Report Planning Agent** – This agent generates a structured report plan and sections based on the user's topic, then iteratively refines the plan based on user feedback until it meets their satisfaction.
2. **Final Report Generation Agent** – Once the plan is approved, this agent compiles and refines the sections into a cohesive, well-structured final report.

The diagram below illustrates the complete workflow:





Workflow Breakdown

1. **Generate Report Plan** – The AI structures an initial plan for the research report.
2. **Incorporate Human Feedback** – Users review and refine the plan before proceeding.
3. **Conduct Web Research** – The AI generates search queries, gathers relevant information, and writes sections iteratively.
4. **Assemble Completed Sections** – All researched sections are gathered together.
5. **Write Final Sections** – The AI compiles the sections into a cohesive report.
6. **Compile Final Report** – The final document is structured and prepared for download.

This multi-agent approach ensures a **customizable, iterative, and high-quality** research generation process.

Technologies Used

Backend (FastAPI)

- **FastAPI** (Python) – High-performance API framework.
- **LangGraph & LangChain** – Handles deep research agent creation.
- **OpenAI API** – Powering language generation.
- **Tavily Search API** – Fetches relevant web content for research.
- **Deepgram API** – Speech-to-text transcription.
- **PDFKit & Markdown** – Generating structured reports in PDF format.
- **Docker** – Containerization for easy deployment.

Frontend (React.js)

- **React.js** – Interactive UI development.
- **Tailwind CSS** – Modern styling for UI.
- **Axios** – API communication.
- **React Markdown & Highlight.js** – Renders research results with rich formatting.

Deployment

- **Docker Compose** – Manages both frontend and backend services.

Project Structure

```
NexusMind-AI/
├── backend/                              # Backend service
│   ├── Dockerfile                        # Backend container setup
│   ├── requirements.txt                  # Python dependencies
│   └── app/
│       ├── __init__.py
│       ├── main.py                       # FastAPI app entry point
│       ├── api/
│       │   ├── __init__.py
│       │   └── routes.py                 # API endpoints
│       └── core/
│           ├── __init__.py
│           ├── deep_research_agent.py    # AI-powered research agent
├── frontend/                             # Frontend service
│   ├── Dockerfile                        # Frontend container setup
│   ├── package.json                      # Node.js dependencies
│   ├── postcss.config.js                 # PostCSS configuration
│   ├── tailwind.config.js                # Tailwind CSS setup
│   ├── public/
│   │   └── index.html                    # Main HTML entry
│   └── src/
│       ├── App.js                        # Root React component
│       ├── index.js                      # React app entry point
│       ├── components/
│       │   ├── Navbar.js                 # Navigation bar
│       │   └── ChatBox.js                # Main chat interface
│       ├── pages/
│       │   ├── Home.js                   # Home page
```

```
│       │   ├── About.js                  # About page
│       │   └── Contact.js                # Contact page
│       └── utils/
│           └── downloadPdf.js            # PDF generation utility
└── docker-compose.yaml                   # Orchestration for frontend & backend
```

Installation & Setup

Prerequisites

- **Docker** & **Docker Compose** installed.

Running with Docker

1. Clone the repository:

```
git clone https://github.com/yourusername/NexusMind-AI.git
cd NexusMind-AI
```

2. Start the services using Docker Compose:

```
docker compose up --build
```

3. Access the web app:

```
http://localhost:3000
```

API Endpoints

Endpoint	Method	Description
`/api/start_research`	POST	Start a research session
`/api/resume`	POST	Resume research with feedback
`/api/generate_pdf`	POST	Convert research to PDF
`/api/transcribe`	POST	Convert speech to text
`/api/reset`	POST	Reset conversation & AI memory

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