CAPSTONE PROJECT

PROBLEM STATEMENT NO.6: ECO LIFESTYLE AGENT

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OUTLINE

- **Problem Statement** (Should not include solution)

- **Proposed System/Solution**

- **System Development Approach** (Technology Used)

- **Algorithm & Deployment**

- **Result (Output Image)**

- **Conclusion**

- **Future Scope**

- **References**

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PROBLEM STATEMENT

- An Eco Lifestyle Agent, powered by RAG (Retrieval-Augmented Generation), empowers users to adopt a greener lifestyle through personalized, practical suggestions. It retrieves sustainable living tips, eco-friendly product recommendations, local recycling guidelines, and government schemes from trusted environmental sources. Users can ask natural language questions such as "How can I reduce plastic use at home?" or "What are eco-friendly travel options in my city?" and receive instant, actionable guidance. The agent promotes small daily actions with big environmental impact, making sustainability easy and accessible. This AI-driven assistant fosters eco-conscious decisions, raises awareness, and helps build a more sustainable future.

PROPOSED SOLUTION

- The proposed system aims to promote sustainable living by providing personalized eco-lifestyle suggestions through an AI-powered agent. The solution leverages Langraph (an agentic AI platform) and IBM Cloud services to offer real-time, context-aware environmental guidance. The system comprises the following components:

- **Data Collection:**

  - Retrieve eco-related data from trusted sources such as sustainability guidelines, green living blogs, environmental APIs, and governmental data. Collect user preferences and behavioral patterns to tailor the suggestions effectively.

- **Data Processing:**

  - Structure and refine the collected data using retrieval techniques to ensure relevance and clarity. Perform entity extraction and context linking to enable the AI to understand user queries more naturally.

- **AI Agent (Langraph):**

  - Implement a Retrieval-Augmented Generation (RAG) agent using Langraph to deliver personalized responses. The agent uses dynamic memory and retrieval tools to align responses with current environmental best practices, user input, and local contexts.

- **Deployment:**

  - Deploy the AI agent through IBM Cloud's Deployment Space. Use secured API endpoints for interaction, enabling integration with applications or websites. No manual frontend coding (HTML/CSS) is required, as the deployment is handled entirely through the platform.

- **Evaluation:**

  - Evaluate the system based on response accuracy, relevance of suggestions, and user engagement. Continuously monitor system behavior and fine-tune the retrieval modules to maintain the quality and personalization of recommendations.

  - Result: The deployed agent provides actionable, eco-friendly suggestions to users in real-time, encouraging sustainable lifestyle choices and contributing to environmental awareness.

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SYSTEM APPROACH

Tool Used: Langraph (IBM Agentic AI tool) for creating the core AI agent

Platform: IBM Cloud – used for model deployment and API management

Authentication: IAM token generated via API key for secure access

AI Model: Retrieval-Augmented Generation (RAG) agent providing personalized eco-lifestyle suggestions

Integration: API endpoint (RESTful) connects user input to deployed agent

Interaction: Multi-language user queries processed and responded to via the deployed agent

Deployment: Handled through IBM Cloud Deployment Spaces (no manual HTML/CSS used)

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ALGORITHM & DEPLOYMENT

- In this section, we outline the AI approach used in the Eco Lifestyle Agent, which leverages Retrieval-Augmented Generation (RAG) to deliver personalized sustainability advice. Below is the structured breakdown:

- Algorithm Selection:

  - The RAG (Retrieval-Augmented Generation) framework is chosen as it combines document retrieval with generative models like IBM Granite. It ensures answers are grounded in reliable eco-data while maintaining flexibility in natural language responses.

  - RAG is ideal for dynamic queries related to green living, allowing access to up-to-date government schemes, recycling norms, and eco-friendly tips.

- Data Input:

  - The input includes user queries in natural language such as:

  - "How can I reduce plastic waste?", "Is composting suitable for my locality?"

  - Input of prompts plays a major role.

- Training Process:

  - IBM Granite LLM is pre-trained on a diverse and environmentally focused corpus.

  - The RAG pipeline is enhanced by

  Evaluation metrics include response relevancy, factual accuracy, and personalization success rate.

  Fine-tuning with curated eco-conscious literature and environmental datasets, Retrieval index creation using vector stores optimized for low-latency.
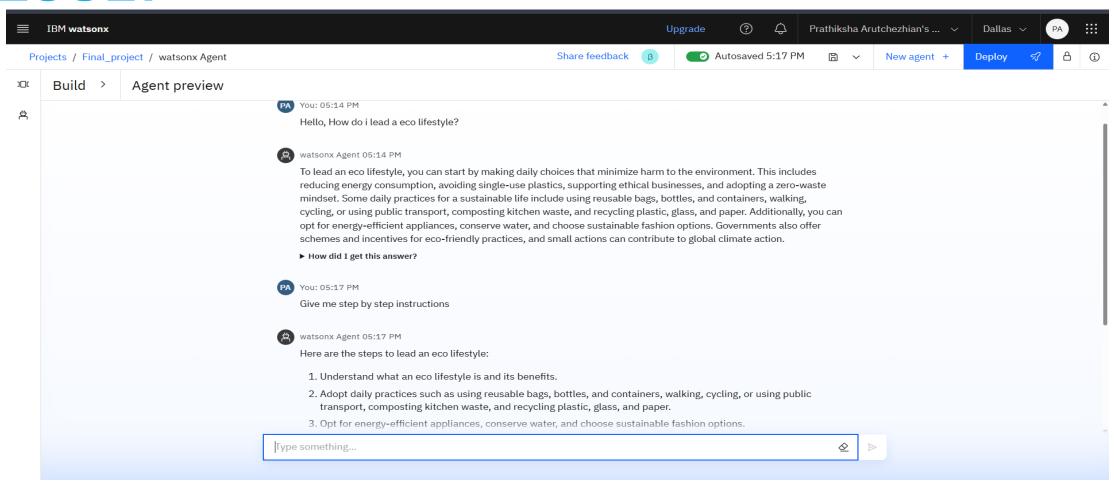
- Prediction Process:

  - When a query is submitted:

  Relevant eco-documents are retrieved from the indexed data store.

  The LLM (Granite) uses these documents to generate context-aware, actionable advice.
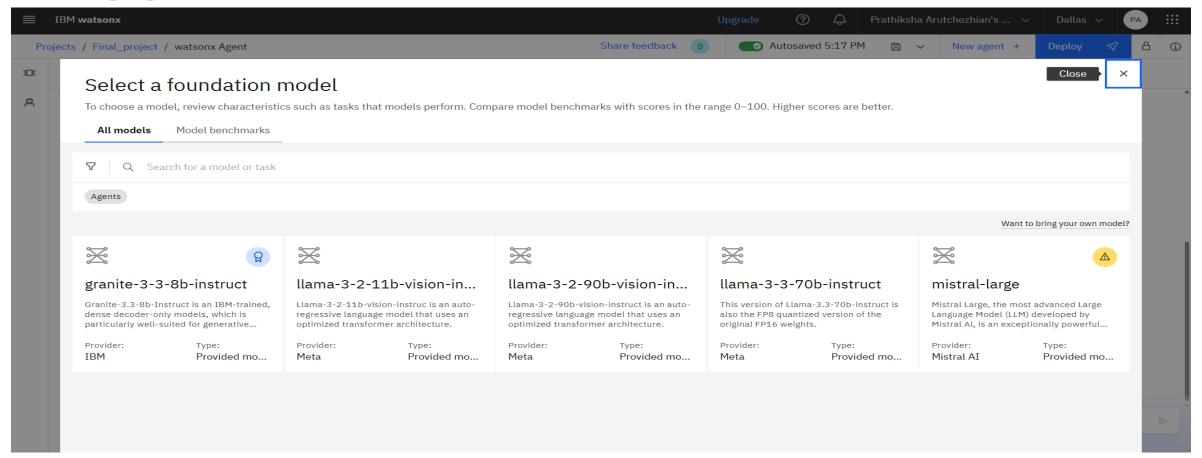
  - The system adapts to:

    - User location (for local guidelines)

    - Repeated query history (to refine responses)

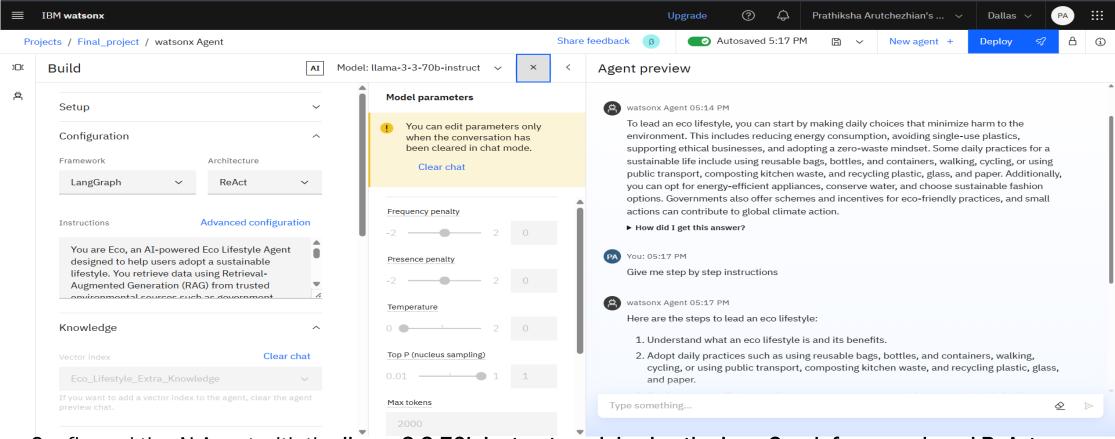   - Real-time updates to government policies or climate alerts

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RESULT

- Successfully implemented a **chatbot/agent** that responds to user queries about sustainable living.
- The agent responds intelligently to both **general and specific questions using the configured model.**
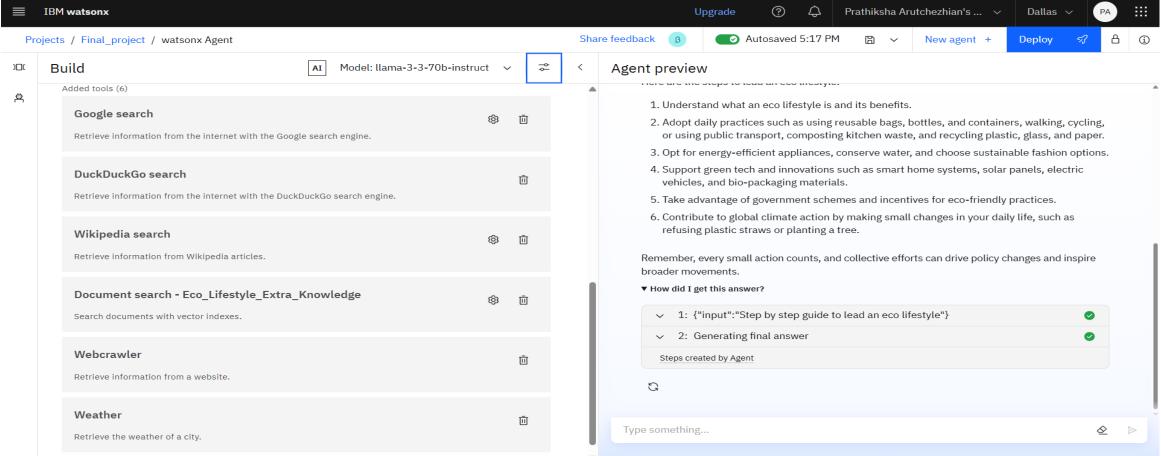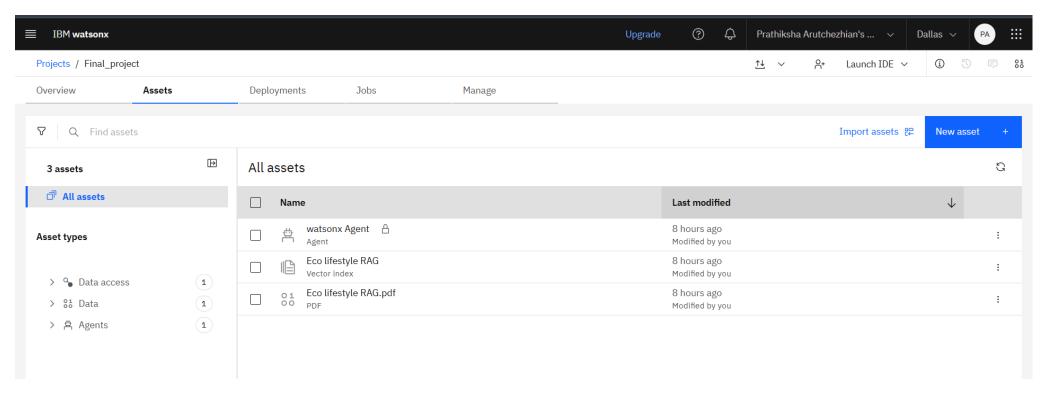
RESULT

- **Accessed the Foundation Model selection screen** in IBM watsonx to review and compare available models like granite-3-3-8b-instruct, mistral-large and others.
- Selected **the llama-3-3-70b instruct model,** a powerful LLaMA 3-based foundation model known for strong reasoning and language generation capabilities.
- **Optimized the agent's performance and response quality** by choosing a model well-suited for conversational and knowledge-intensive tasks.

RESULT

- Configured the AI Agent with the **llama-3-3-70b instruct model using the LangGraph framework and ReAct architecture** to enable structured and interactive reasoning
- **Defined custom instructions to shape the agent's identity as "Eco," an AI guide for sustainable living,** influencing its responses and personality. (Retrieved Augmented Generation) by uploading Eco lifestyle pdf file.
- **Set up foundational model parameters (e.g., temperature, penalties) for controlled generation**, though left at default for initial testing.
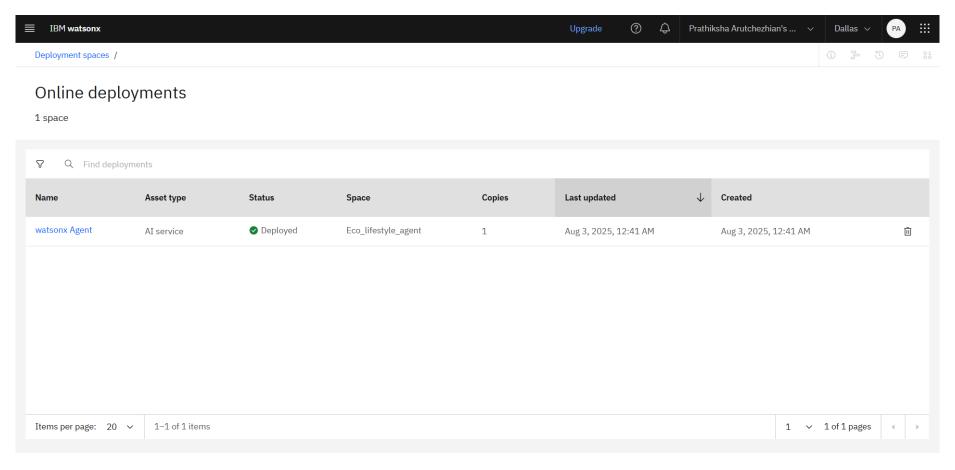
RESULT

- **Integrated multiple external tools** (e.g., Google, DuckDuckGo, Wikipedia, Webcrawler, Weather) to enhance the agent's knowledge and response accuracy via **Retrieval-Augmented Generation (RAG).**
- Connected a custom vector index to allow the agent to retrieve specialized domain knowledge on sustainable living.
- **Enabled the agent to generate detailed, context-aware responses**, such as a step-by-step eco lifestyle guide, by leveraging both real-time and indexed information sources.

RESULT

This screen shows the assets in your Watsonx project, including the deployed watsonx Agent, a custom vector index Eco lifestyle RAG and its source Eco lifestyle RAG.pdf. Uploaded and connected these resources to enable document-based retrieval for AI agent.

RESULT

This screen confirms that I have successfully deployed my watsonx Agent under the Eco_lifestyle_agent project. The deployment is active which means my agent is now live and accessible for real-world use beyond just the development environment.

CONCLUSION

- The Eco Lifestyle Agent makes sustainable living accessible, offering practical and customized advice. It bridges the gap between users and valuable eco-information using cutting-edge AI. By leveraging Retrieval-Augmented Generation (RAG) and IBM's powerful cloud infrastructure, the agent provides accurate, real-time responses tailored to individual preferences. It encourages daily green habits that collectively contribute to significant environmental impact. This smart, intuitive system empowers users to make informed decisions, cultivating a more eco-conscious and sustainable society.

FUTURE SCOPE

- Multilingual Support
  Extend the system to understand and respond in regional languages for broader user accessibility.

- Personalized Sustainability Coaching

  - The agent can evolve to give **tailored eco-living advice** based on a user's location, lifestyle, carbon footprint, and consumption patterns.

  - Integration with smart home devices could help monitor and reduce household energy or water usage.

- Integration with Real-Time Data

  - Use **live environmental data** (e.g., air quality, weather, waste pickup schedules) to provide timely and contextual suggestions.

  - Connect with sustainability APIs for product ratings, recycling guidelines, or green business directories.

- Multi-Channel Deployment

  - Deploy the agent across platforms like **mobile apps, websites, smart assistants (Alexa/Google), or messaging apps (WhatsApp/Telegram)** for broader reach and accessibility.

REFERENCES

- IBM Granite Documentation:https: //www.ibm.com/products/watsonx-granite

- Swachh Bharat Scheme: https://swachhbharatmission.gov.in

- IBM Cloud Lite Plan Overview. IBM Cloud Docs.: https://www.ibm.com/cloud/free

- Government of India – Ministry of Environment. Plastic Waste Managment Rules: https://moef.gov.in

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IBM CERTIFICATIONS: RAG WITH LANGCHAIN

IBM **SkillsBuild**   Completion Certificate

This certificate is presented to

Prathiksha Arutchezhian

for the completion of

Lab: Retrieval Augmented Generation with LangChain

(ALM-COURSE_3824998)

According to the Adobe Learning Manager system of record

Completion date: 24 Jul 2025 (GMT)   **Learning hours:** 20 mins

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GITHUB REPOSITORY LINK

- https://github.com/prathikshaarul/IBM-EDUNET-INTERNSHIP

THANK YOU