CAPSTONE PROJECT

RESEARCH AGENT

Presented By:
1. Aryan Karnwal
2. Meerut Institute of Engineering and Technology(MIET)
3. Information Technology(IT)

edunet foundation

OUTLINE

- **Problem Statement** (Should not include solution)
- **Proposed System/Solution**
- **System Development Approach** (Technology Used)
- **Result (Output Image)**
- **Conclusion**
- **Future Scope**
- **References**

PROBLEM STATEMENT

Researchers in today's academic and scientific domains struggle to manually manage vast amounts of data, literature, and references.

This procedure slows down innovation and lowers research efficiency because it is laborious, repetitive, and prone to mistakes.

Automation tools that can streamline and expedite the process of gathering and managing research data are becoming more and more necessary.

PROPOSED SOLUTION

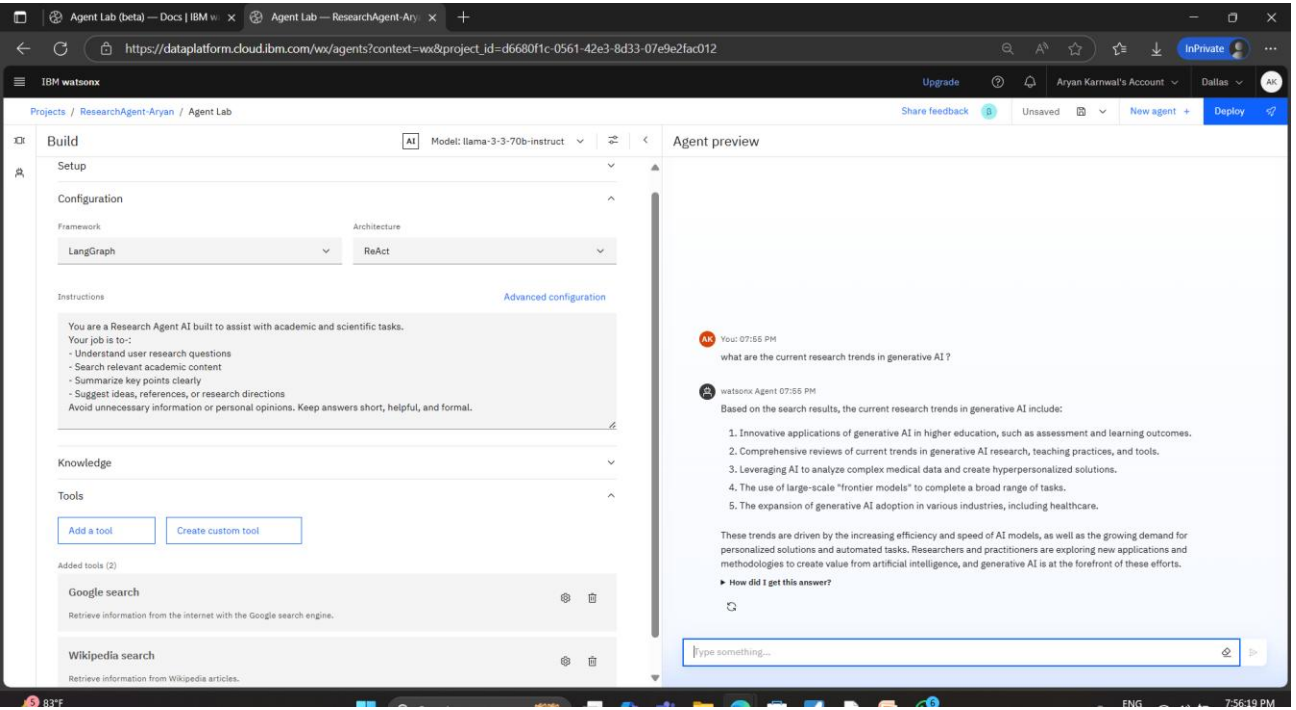
- The proposed system addresses the challenge of time-consuming and repetitive academic research tasks.It offers an AI-powered Research Agent that understands natural language questions and autonomously gathers accurate information from trusted online sources. The solution will consist of the following components:
- Data Collection:
  - The AI agent collects data dynamically using online tools like Google Search and Wikipedia Search.
  - The information is retrieved in real-time based on natural language queries entered by the user.
- Data Preprocessing:
  - The Research Agent interprets user input using natural language understanding to determine the research intent.
  - It filters and refines the response using LangGraph and ReAct architecture to ensure relevance and accuracy.
- Deployment:
  - The Research Agent was deployed using IBM Watsonx.ai runtime by creating a prompt template and deploying it in a configured deployment space on IBM Cloud.
  - The deployment status was verified as “Online”, and an optional API key was generated for secure external access.
- Evaluation:
  - The agent was tested by asking multiple real-world academic queries, and the responses were evaluated for accuracy, clarity, and relevance.
  - It consistently returned helpful, on-topic answers using tools like Google Search and Wikipedia, demonstrating its effectiveness for research support.

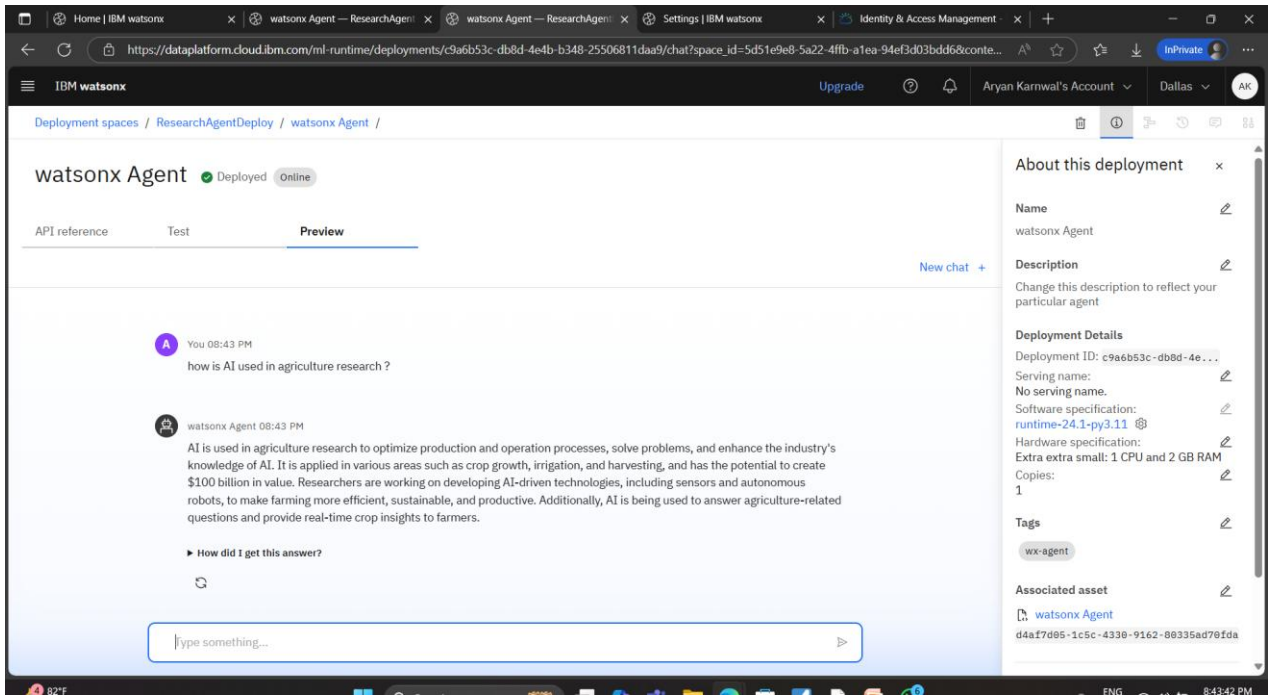
SYSTEM APPROACH

The “System Approach” section explains the strategy and technology used to build and deploy the Research Agent on IBM Cloud. It outlines the technical requirements and tools needed for implementing an AI-powered agent that can search, analyze, and respond to academic research queries efficiently. Here's a suggested structure for this section:

- System requirements
  - IBM Cloud account with access to Watsonx.ai platform.
  - Browser-based interface (Google Chrome or Microsoft Edge recommended).
  - IBM Watsonx Agent Lab with access to AI Foundation Models.
  - Internet connection for real-time data retrieval from tools like Google Search and Wikipedia.
  - Deployed using Extra Extra Small runtime (1 CPU, 2GB RAM) – sufficient for testing and demonstration.
- Library required to build the model
  - Watsonx AI Foundation Models (LLaMA 3-70B Instruct).
  - LangGraph – for managing agent flow and tools interaction.
  - ReAct Architecture – enables reasoning and action-based responses.
  - Tools integrated:
    - Google Search
    - Wikipedia Search
  - IBM Watsonx.ai Runtime (v3.1.1 Python) – for hosting and deploying the agent.

RESULT





- Successfully built an AI-powered Research Agent using IBM Watsonx.ai platform.
- Configured tools like Google Search, Wikipedia, LangGraph, and ReAct architecture to answer real research questions.
- Asked domain-specific questions and received accurate, relevant, and well-structured responses.
- Deployed the agent using Watsonx.ai runtime, verified status as Online, and generated API key for secure use.

edunet foundation

CONCLUSION

- The AI-powered Research Agent successfully addressed the challenge of simplifying and accelerating academic research tasks by automating literature search, summarization, and question answering.
- The solution was implemented using IBM Watsonx Agent Lab, leveraging tools like LangGraph, ReAct, and Watsonx Foundation Models to enable intelligent information retrieval from sources like Google and Wikipedia.
- The project was deployed and tested in a cloud-based runtime environment, confirming its usability, accuracy, and real-time performance.
- During implementation, challenges included configuring the deployment correctly and selecting the appropriate model and tools, but these were resolved with proper documentation and testing.
- Overall, the project demonstrates how agentic AI can improve research workflows, reduce manual effort, and enhance productivity in educational and scientific environments.

FUTURE SCOPE

- Adding more sophisticated AI models, such as Mistral Large, or customized models for particular fields, like scientific, legal, or medical research, can improve the Research Agent.
- Support for directly uploading research papers or datasets for context-based Q&A may be added to future versions.
- To help researchers who are working in multiple languages, multilingual features can be added.
- By integrating with resources such as Arxiv, Google Scholar, or Semantic Scholar, the agent can become more reliable and accurate in academic settings.
- For researchers and students on the go, a lightweight or mobile-friendly version could be created.
- Over time, the agent may develop into a complete research assistant with collaborative capabilities, citation management, and voice input.

REFERENCES

- IBM Watsonx Documentation
  - https://www.ibm.com/docs/en/watsonx
  - Official documentation used to build, deploy, and manage AI agents.
- AICTE-IBM SkillBuild Internship Resources
  - Provided templates and tools to build and submit the Research Agent project.
- ReAct (Reason + Act) Paper by Google Research
  - Yao et al., 2022 – ReAct: Synergizing Reasoning and Acting in Language Models
  - https://arxiv.org/abs/2210.03629
  - Architecture concept used for refining agent responses.
- LangChain Documentation
  - https://docs.langchain.com
  - Used to manage agent flow and tool integration in the Research Agent.

IBM CERTIFICATIONS

edunet foundation

IBM CERTIFICATIONS

IBM CERTIFICATIONS

IBM **SkillsBuild** Completion Certificate

This certificate is presented to

Aryan Karnwal

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

THANK YOU

edunet foundation