

# CAPSTONE PROJECT

## LIBRARY AI AGENT

### Presented By:

1. Name - Kuheli Nag
2. College Name – Government College of Engineering and Textile Technology , Serampore
3. Department – Computer Science and Engineering

---

# OUTLINE

- **Problem Statement**
- **Proposed System/Solution**
- **System Development Approach (Technology Used)**
- **Algorithm & Deployment**
- **Result (Output Image)**
- **Conclusion**
- **Future Scope**
- **References**

# PROBLEM STATEMENT

## Problem Statement No.21 – Library AI Agent

The Challenge – A Library AI Agent is an intelligent system designed to assist students in finding the right learning materials based on their academic needs. It can autonomously analyze user profiles, study topics, and course syllabi to suggest relevant books and resources. Using natural language processing, it understands student queries and matches them with the most suitable books in the library database. The agent can check real-time book availability, prioritize high-demand titles, and assist with reservation or waitlist actions. It saves time by streamlining the search process and offering personalized recommendations aligned with current academic work. Library AI Agents enhance access, engagement, and resource utilization in educational environments.

Technology – Use of IBM Cloud Lite services

# PROPOSED SOLUTION

The proposed system aims to address the challenge of predicting the requirements of student queries and matches them with the most suitable books in the library database. This involves natural language processing and AI Agent to assist students in finding the right learning materials based on their academic needs.

## Data Collection:

- Gather historical data on student queries, borrowing records, book metadata, user profiles, and course syllabi.
- Integrate real-time data such as newly added books, current book availability, semester-wise subject trends, and student activity logs.

## Data Preprocessing:

- Clean and preprocess the collected data to handle missing or outdated book records, duplicate queries, and inconsistent tagging.
- Apply feature engineering to extract useful attributes like course relevance, book popularity, and subject matching for better recommendations.

## Natural Language Processing & AI Modelling:

- Implement NLP techniques to interpret free-text student queries and map them to academic topics.
- Use classification and recommendation algorithms(e.g., content-based filtering, collaborative filtering, or hybrid models) to match students with relevant books.

## Deployment:

- Develop a user-friendly interface for query input and suggestions.
- Integrate with the library system to enable real-time availability and reservations.

## Evaluation:

- Refine the model based on user feedback and ongoing usage data.
- Result:
  - Enhances learning access
  - Reduces search time
  - Improve library management.

# SYSTEM APPROACH

- **System requirements :**

- **Hardware Requirements:**

- A server or cloud-based environment to host the AI model and user interface.
    - Minimum 8 GB RAM and i5/i7 processor or equivalent for development and testing.

- **Software Requirements:**

- Database system (e.g., MySQL or MongoDB) to store book metadata, user profiles, and borrowing history.
    - Or, various tools like Wikipedia search, Google search for checking the availability of the relevant book or resources.

- **Library/services required to build the model :**

- IBM Watsonx.ai
  - Watsonx.ai Studio
  - Watsonx.ai Runtime
  - Cloud Object Storage

# ALGORITHM & DEPLOYMENT

- In the Algorithm section, we describe the ai/machine learning algorithm chosen for predicting books availability & resources according to the user's queries.
- **Algorithm Selection:**
  - We use a hybrid approach combining:
    - NLP foundation models(Watsonx.ai) for understanding user queries.
    - AutoAI-generated classification or recommendation models for predicting book recommendations or availability.

This setup suits the variety of library queries and enables intelligent, data-driven suggestions.

- **Data Input:**
  - User queries (text)
  - Book metadata (genre, author, availability)
  - Historical borrow data
  - User profile (if available)
  - Time/date (e.g., exam season patterns)
- **Training Process:**
  - Data cleaned with Data Refinery
  - AutoAI used to build and tune models
  - Text classification done via NLP
  - Models trained with cross-validation on historical data

# ALGORITHM & DEPLOYMENT

- **Prediction Process:**
  - User input is processed for intent
  - for recommendations, the model uses user history + book metadata
  - For availability, real-time stock data is checked
  - Output: Recommendations or live book status
- **Deployment:**
  - Platform:
    - Deployed using Watson Machine Learning (WML) as a REST API
    - Integrated with Watsonx.ai for NLP
  - Interaction:
    - User sends a message → NLP detects intent
    - Real-time availability checked via database or API
  - Maintenance:
    - Managed in Watson Studio

# RESULT

The screenshot displays the IBM watsonx interface for building and previewing an AI agent. The top navigation bar includes the IBM watsonx logo, an upgrade button, a help icon, a notification bell, the user's account (Kuheli Nag's Account), location (Dallas), and a profile icon (KN). The main header shows the project path: Projects / Library AI Agent / watsonx Agent, along with a share feedback button, a beta badge, an autosave status (Autosaved 9:21 PM), and buttons for 'New agent +' and 'Deploy'.

The interface is divided into two main sections: 'Build' and 'Agent preview'.

**Build Section:**

- Setup:** Includes a dropdown for 'Model: mistral-large' with a warning icon.
- Configuration:** Features two dropdowns: 'Framework' set to 'LangGraph' and 'Architecture' set to 'ReAct'.
- Instructions:** A text area containing the prompt: "You are a helpful assistant that uses tools to recommend academic books based on student queries. When greeted, say 'Hi, I am your Library AI Agent. How can I assist you with your academic needs today?' please give me information about your course syllabus, so that I can suggest relevant books and resources." A link for 'Advanced configuration' is also present.
- Knowledge:** A section for adding knowledge to the agent.
- Tools:** Includes buttons for 'Add a tool' and 'Create custom tool'.
- Added tools (4):** A list of tools, with 'Google search' currently visible.

**Agent preview Section:**

- Initial Message:** "Hi, I am your Library AI Agent. How can I assist you with your academic needs today? please give me information about your course syllabus, so that I can suggest relevant books and resources." A link 'How did I get this answer?' is provided.
- User Input:** "You: 09:20 PM" followed by the text: "Data communication Components: Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum." and "this is my syllabus".
- Agent Response:** "watsonx Agent 09:20 PM" followed by "Here are some relevant resources based on your course syllabus:".
  - 1. Data Communication - Definition, Components, Types, Channels ...**
    - Description:** Transferring data over a transmission medium between two or more devices, systems, or places is known as data communication.
    - URL:** [GeeksforGeeks](#)
  - 2. UNIT 1 ( PART 1 ) Data Communication : Components:**
    - Description:** LANs are not limited to wire connection, there is a new evolution to the LANs that allows local area network to work on a wireless connection.
- Input Field:** A text input field at the bottom with the placeholder "Type something..." and a send button.



# RESULT

IBM watsonx

Upgrade ? Bell

Kuheli Nag's Account Dallas KN

Projects / Library AI Agent / watsonx Agent

Share feedback β Autosaved 9:21 PM New agent + Deploy

Build

AI Model: mistral-large

Setup

Configuration

Framework LangGraph Architecture ReAct

Instructions

needs today?  
please give me information about your course syllabus, so that I can suggest relevant books and resources."  
you can check real-time book availability, prioritize high-demand titles, and assist with reservation or waitlist actions

Advanced configuration

Knowledge

Tools

Add a tool Create custom tool

Added tools (4)

Agent preview

- URL: [Mumbai University](#)

6. Computer Networks Unit-1.pdf

- Description: Data Sharing: One of the reason, why we use a computer network is to share the data between different systems connected with each other through a transmission
- URL: [JSS College of Arts, Commerce and Science](#)

7. Data Communication and Computer Networks | PDF | Osi Model ...

- Description: Mobile phone service charges by time used, while internet charges by data used due to differences in bandwidth usage patterns and network throughput
- URL: [Scribd](#)

8. B.Tech : CSE Sixth (6th) Semester Syllabus - AKU Bihar

- Description: Data communication Components (8 Hours). Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model,
- URL: [AKU Bihar](#)

9. lecture notes on data communication and computer networks (theory ...

Description: A protocol is a set of rules that govern data communications. It represents

Type something...

# RESULT

IBM watsonx

Upgrade ⓘ 🔔 Kuheli Nag's Account ▾ Dallas ▾ KN ⋮

Projects / Library AI Agent / watsonx Agent

Share feedback ⓘ ⬢ Autosaved 9:21 PM 📁 ▾ New agent + Deploy 🔗 🔒 ⓘ

Build

AI Model: mistral-large ⚠ ▾ ⚙ <

Knowledge ▾

Tools ▴

Add a tool

Create custom tool

Added tools (4)

Google search

Retrieve information from the internet with the Google search engine.

⚙ 🗑

DuckDuckGo search

Retrieve information from the internet with the DuckDuckGo search engine.

🗑

Wikipedia search

Retrieve information from Wikipedia articles.

⚙ 🗑

Webcrawler

Retrieve information from a website.

🗑

Agent preview

devices, systems, or places is known as data communication.

- URL: [GeeksforGeeks](#)

**2. UNIT 1 ( PART 1 ) Data Communication : Components:**

- **Description:** LANs are not limited to wire connection, there is a new evolution to the LANs that allows local area network to work on a wireless connection.
- URL: [PVP Siddhartha Institute of Technology](#)

**3. Data Communications and Computer Networks**

- **Description:** Know the Functioning of various Application layer Protocols.
- URL: [MRCET](#)

**4. UNIT – I – Data communication and Computer networks – SITA1401**

- **Description:** Introduction to data communication - Network protocols & standards - Line configuration - Topology -Transmission mode -Categories of networks - OSI model -
- URL: [Sathyabama Institute of Science and Technology](#)

**5. Unit 1. Introduction to data communications and networking ...**

- **Description:** Data Communication is a process of exchanging data or information. In

🔍 ➤

# RESULT

IBM watsonx

Upgrade ? Kuheli Nag's Account Dallas KN

Used to call watsonx.ai APIs such as LLM inferencing, embedding, training, and chatting.

Create API key +

Manage IBM Cloud API keys →

foundation models and code libraries for your AI applications.

Resource hub

Foundation models

Explore foundation models from IBM and other third-parties depending on your use case.

[Explore foundation models →](#)

Prompts →

Data →

Projects →

Notebooks →

Agents →

What's new

Save resources by training, deploying, and inferencing foundation models that are fine tuned with the low-rank adaptation technique

Aug 01, 2025 →

The mistral-medium-2505 foundation model is now available in the Frankfurt region

Jul 30, 2025 →

Token usage limit increased with the watsonx.ai Runtime Limit

Jul 30, 2025 →

Recent work

Projects

Library AI Agent

2 d ago

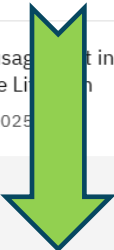
Nutrition agent

2 d ago

Deployment spaces

Library AI Agent

2 d ago



# CONCLUSION

- The proposed Library AI Agent effectively addresses the challenge of helping students find the most relevant academic resources by leveraging natural language processing and recommendation algorithms. The system demonstrates strong potential in improving search accuracy, student satisfaction, and resource utilization within academic libraries.
- Despite its promising results, challenges such as handling ambiguous queries, integrating with legacy library databases, and ensuring real-time availability updates were encountered. Future improvements may include enhancing the NLP model with larger language models, adding multilingual support, and incorporating voice-based queries.
- Accurate and intelligent recommendation systems like this play a vital role in modern education, streamlining access to knowledge, reducing search time, and supporting personalized learning paths for students.

# FUTURE SCOPE

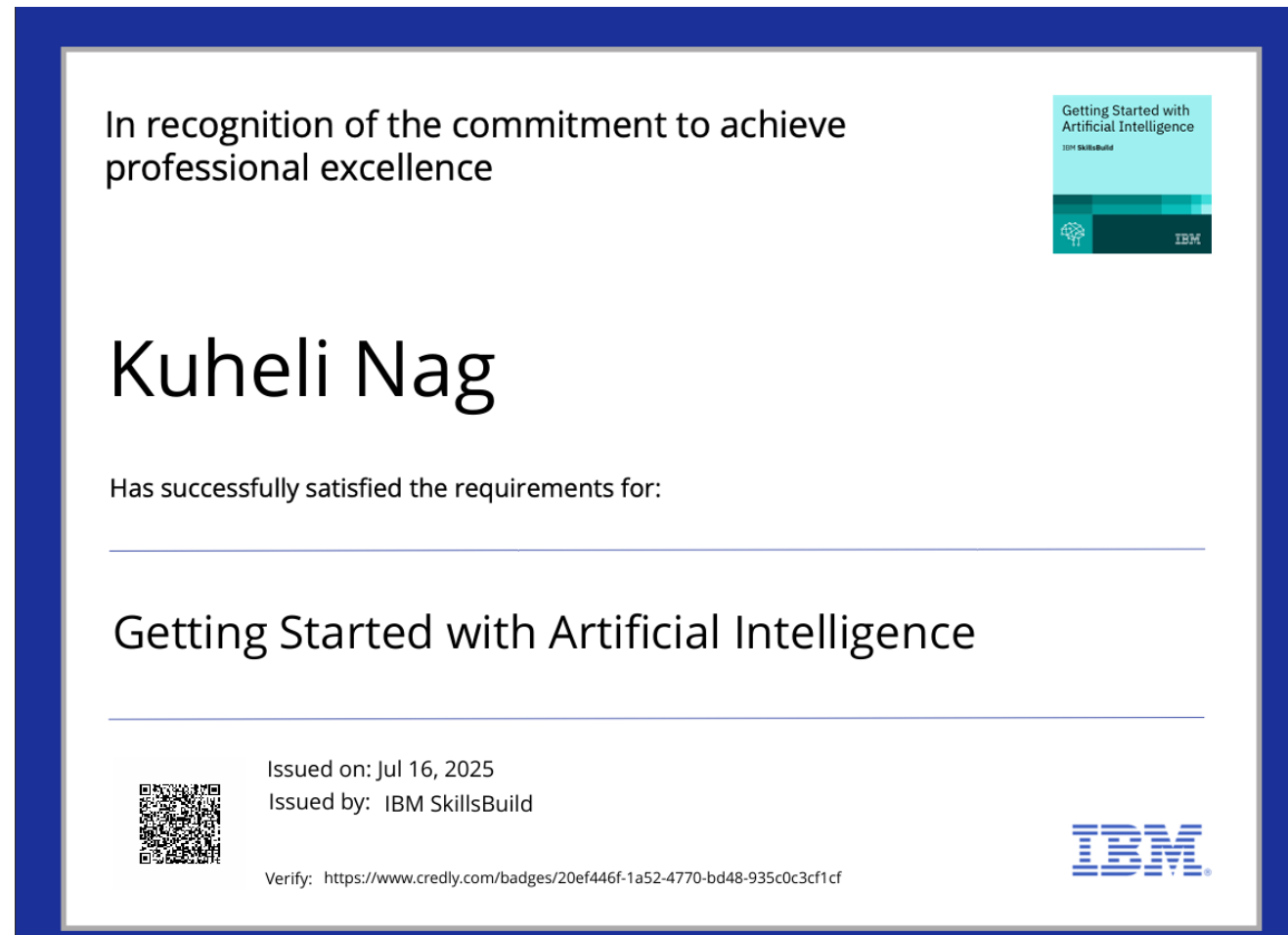
- The system can be enhanced by incorporating additional data sources, such as real-time course schedules, professor-recommended reading lists, and student academic performance data, to improve personalization and relevance.
- The algorithm can be further optimized using advanced machine learning techniques like deep learning-based recommenders, context-aware filtering, and knowledge graphs for better semantic understanding of queries.
- The system could be expanded to support multiple institutions, enabling cross-library resource sharing, inter-university recommendations, and broader access to academic materials.
- Integration with emerging technologies like edge computing can allow real-time recommendation processing in mobile or offline environments, while chatbots and voice assistants can enhance accessibility and user experience.

# REFERENCES

- IBM Cloud Lite services
- Wikipedia
- Research papers and articles – Artificial Intelligence and library services by Bornali Konwar.
- Academic papers on books demand prediction.

# IBM CERTIFICATIONS

- Screenshot/ credly certificate( getting started with AI)



# IBM CERTIFICATIONS

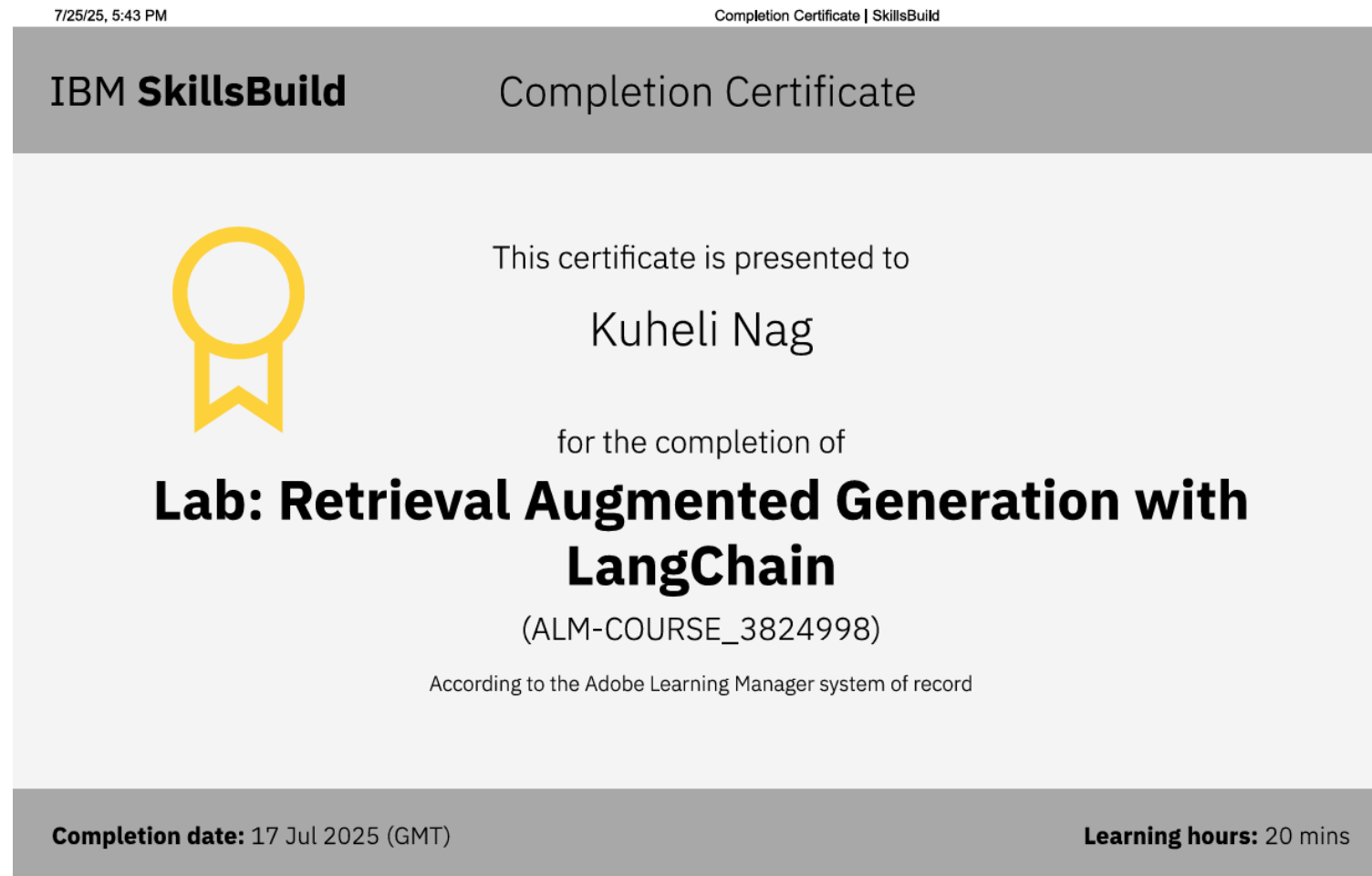
- Screenshot/ credly certificate( Journey to Cloud)





# IBM CERTIFICATIONS

- Screenshot/ credly certificate( RAG Lab)





**THANK YOU**