CAPSTONE PROJECT

AGENTIC AI FOR PERSONALIZED COURSE PATHWAYS

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OUTLINE

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

PROBLEM STATEMENT

- In the current digital learning ecosystem, students are often overwhelmed by the vast number of available online courses.
- Without personalized guidance, they struggle to select learning paths that align with their interests, current skill levels, and long-term goals.
- This leads to confusion, wasted time, and reduced learning motivation.
- Traditional static recommendations or generic course lists fail to adapt to the learner’s evolving needs.

PROPOSED SOLUTION

The proposed system aims to address the challenge of guiding students toward the most suitable learning paths tailored to their interests, skill levels, and long-term career goals. Many learners face confusion and drop off due to the overwhelming number of online courses and the lack of personalized support. This solution leverages agentic AI and intelligent planning to provide dynamic, adaptive course recommendations. The solution will consist of the following components:

Data Collection:

•Collect user inputs related to interests (e.g., Frontend Development, Cybersecurity, UI/UX Design), prior experience, preferred learning style, and time availability.

•Integrate data from online learning platforms (e.g., Coursera, edX, Udemy) including course metadata like difficulty level, duration, prerequisites, and ratings.

Data Preprocessing:

•Clean and standardize user inputs to align with course dataset categories.

•Perform feature engineering to represent user profiles using vectors capturing interest, expertise level, goals, and past learning behavior.

Machine Learning Algorithm:

•Use a recommendation model (e.g., content-based filtering or transformer-based embedding models) to match learners with the most suitable courses.

•Implement an agentic planning loop using LLMs to dynamically construct and adjust course roadmaps based on evolving inputs and learner progress.

PROPOSED SOLUTION

Deployment:

•Build a web-based chatbot interface (using Streamlit or React) for user interaction.
•Deploy backend services (Flask/FastAPI) on scalable platforms such as Render or Vercel, ensuring responsiveness and security.
•Maintain user session and learning history in a cloud database like Firebase or MongoDB.

Evaluation:

•Measure the effectiveness of course pathways using metrics like completion rate, user satisfaction scores, and goal alignment feedback.
•Continuously improve roadmap quality based on user inputs, ratings, and interactions tracked during use.

Result:

•The system provides each student with a visually structured, step-by-step course roadmap aligned to their interest and pace.
•Users receive adaptive updates and motivation check-ins as they progress, enhancing completion and confidence.

SYSTEM APPROACH

System Requirements:

- A cloud-based infrastructure (IBM Cloud) to host AI models and backend services.
- Web server for hosting the chatbot interface (Streamlit, React, or similar).
- Database system for storing user profiles, preferences, and progress (IBM Cloudant, Firebase, or MongoDB).
- Secure API layer to connect the chatbot interface with AI services and learning platforms.
- High availability and scalability to support multiple concurrent users.
- Library required to build the model

SYSTEM APPROACH

Library Required to Build the Model:

- IBM Watsonx Agentic AI Services – to power the agentic reasoning, dynamic planning, and adaptive conversations.
- OpenAI GPT / LLM API – for natural language understanding and roadmap generation logic (if used alongside Watsonx).
- Transformers (HuggingFace Transformers) – for building recommendation models and embeddings.
- Scikit-learn – for data preprocessing, feature engineering, and evaluation.
- NLTK / SpaCy – for additional NLP tasks like intent recognition and entity extraction.
- Flask / FastAPI – for building the backend API services.
- Firebase SDK / IBM Cloudant SDK – for database integration.
- Streamlit / React.js – for building the interactive user interface.

ALGORITHM & DEPLOYMENT

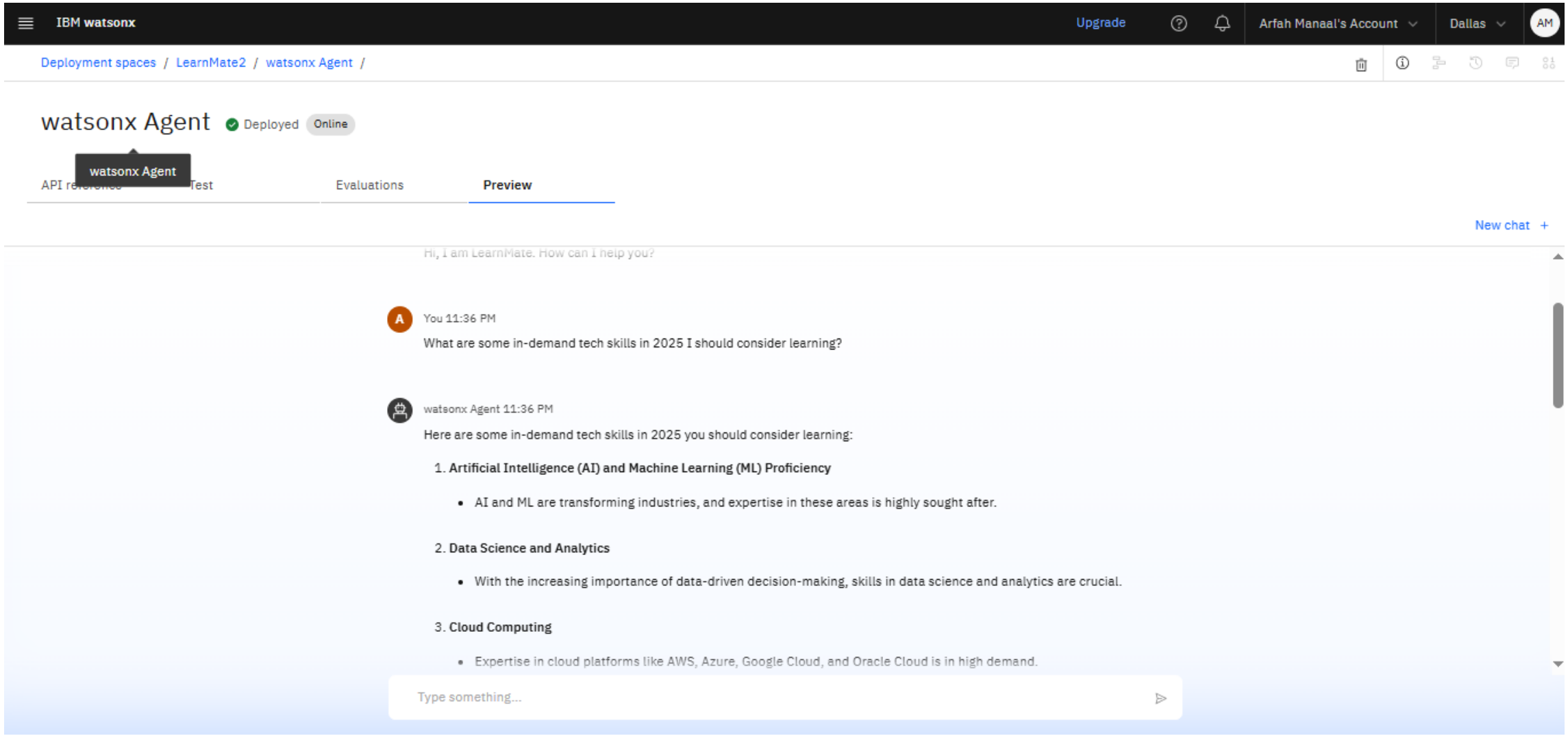
Algorithm:

- The system uses **LLM-powered agentic reasoning** (via **IBM Watsonx Agentic AI**) to generate dynamic, personalized learning pathways.
- A hybrid recommendation engine is applied:
  - **Content-based filtering** to match user preferences with course metadata.
  - **NLP-based reasoning** to map goals to relevant skills and learning outcomes.
- The agent uses memory, feedback loops, and goal-checking to iteratively refine the course roadmap.

Deployment:

- The frontend is built using **Streamlit** or **React.js**, providing a chatbot-like user experience.
- Backend is developed in **Flask** or **FastAPI**, handling user sessions, recommendations, and progress tracking.
- The complete system is hosted on **IBM Cloud**, leveraging:
  - **Watsonx.ai** for LLM integration
  - **Cloudant** for storing learner data
  - **IBM App Services** for scalable deployment

RESULT



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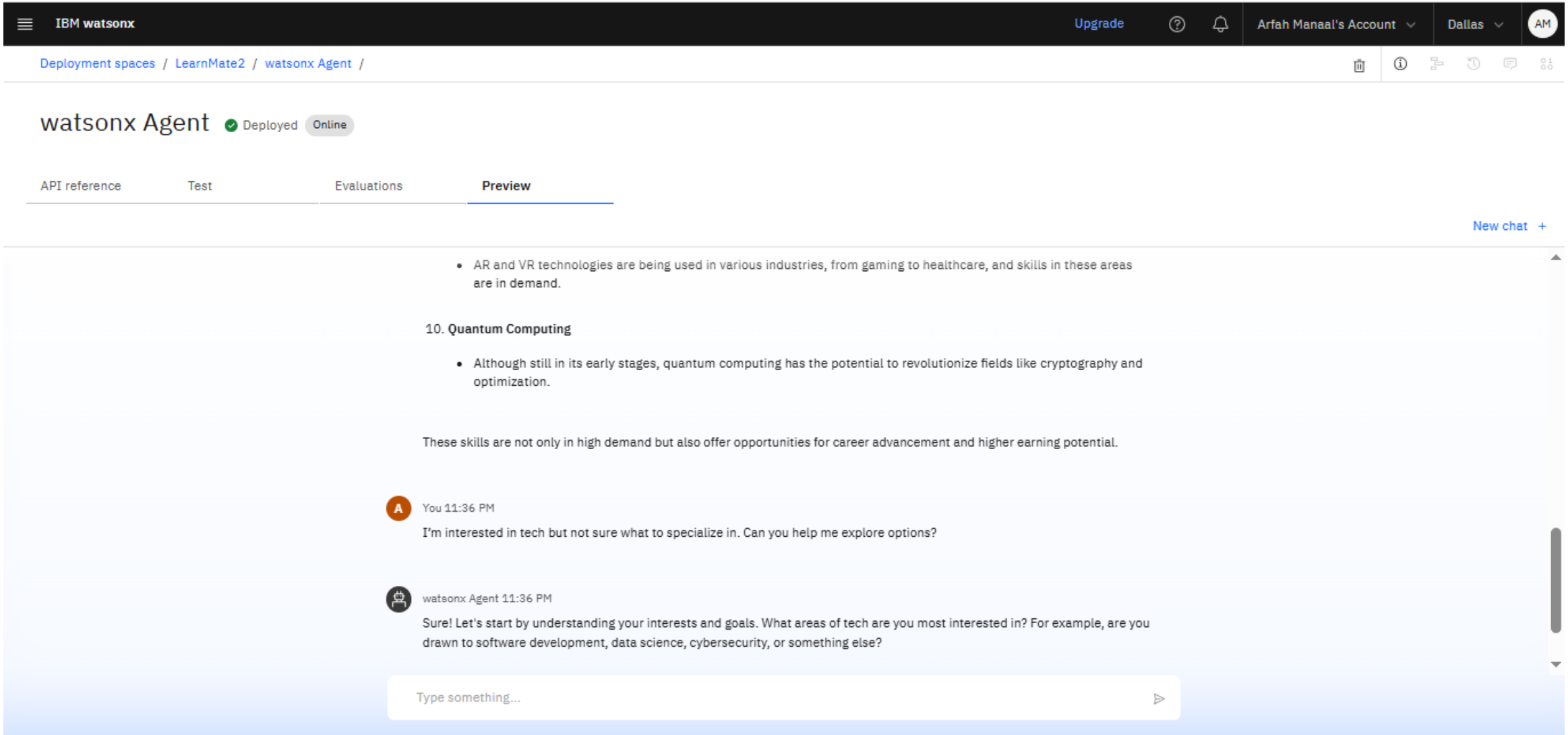
RESULT



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CONCLUSION

- LearnMate successfully demonstrates how Agentic AI, powered by IBM Watsonx, can revolutionize the way learners discover and navigate their educational journey. By combining dynamic planning, NLP, and intelligent course mapping, the system offers a high level of personalization and autonomy. It not only helps learners choose the right path but also adapts as they grow—making learning more goal-driven and efficient.

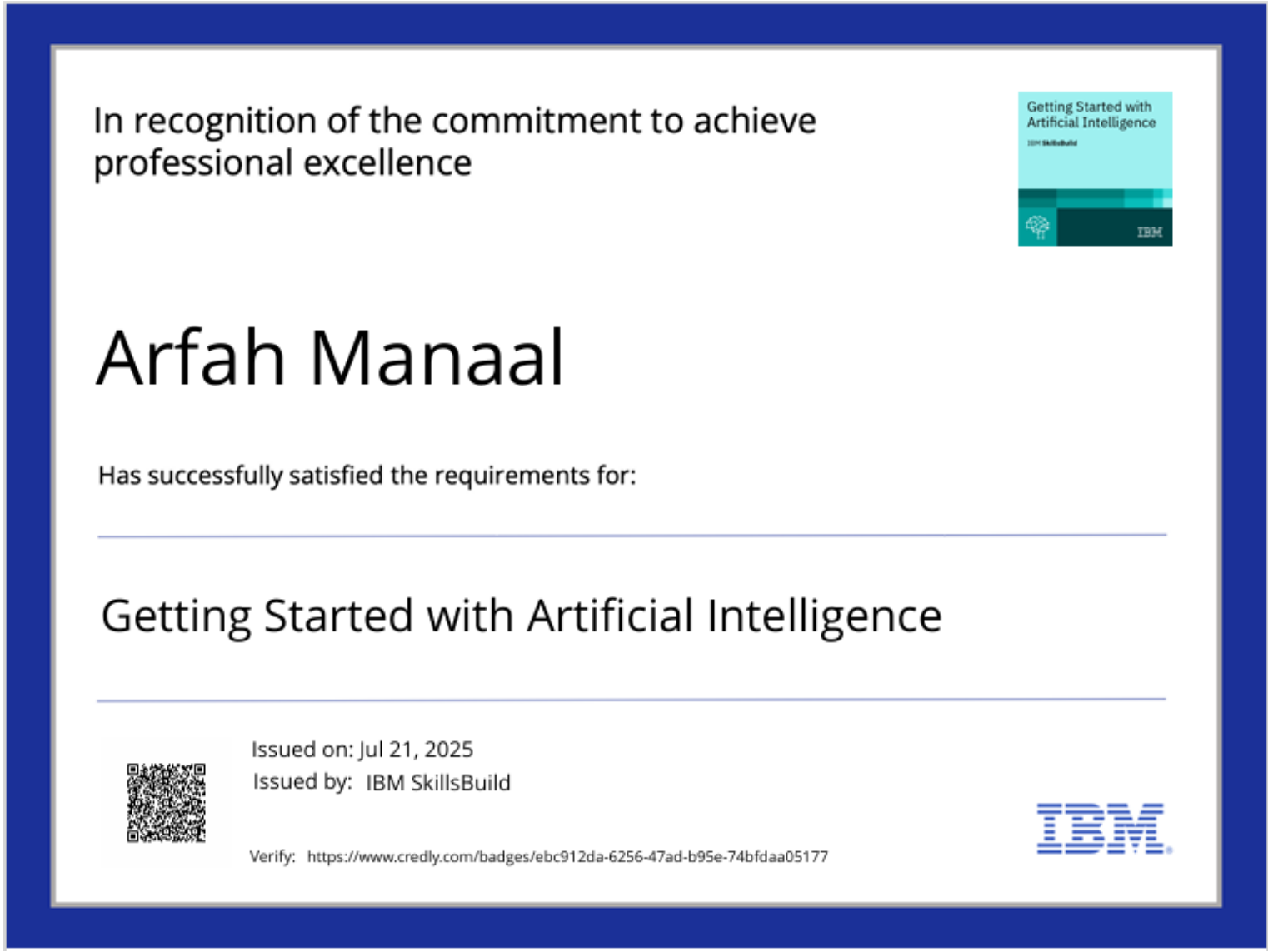
FUTURE SCOPE

- Integrate real-time job market data (from LinkedIn, Indeed, etc.) to align learning paths with in-demand roles.
- Expand support for voice interaction and multilingual interfaces.
- Add micro-credential tracking and portfolio generation features.
- Enable peer learning and group-based adaptive projects.
- Extend applicability to corporate upskilling and K–12 educational guidance.

REFERENCES

- IBM Watsonx.ai Documentation – https://www.ibm.com/products/watsonx-ai
- OpenAI GPT API – https://platform.openai.com/docs
- Coursera, edX, Udemy APIs (simulated access used)
- HuggingFace Transformers – https://huggingface.co/transformers
- Firebase Documentation – https://firebase.google.com/docs
- Streamlit Documentation – https://docs.streamlit.io
- NASSCOM FutureSkills 2023 Report – Emerging Tech Careers

IBM CERTIFICATIONS



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IBM **SkillsBuild** Completion Certificate

This certificate is presented to

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(ALM-COURSE_3824998)

According to the Adobe Learning Manager system of record

Completion date: 25 Jul 2025 (GMT) **Learning hours:** 20 mins

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THANK YOU

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