CAPSTONE PROJECT

Machine Fault Diagnosis Agent

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OUTLINE

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- **Result (Output Image)**
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Problem Statement

- An AI agent helps detect faults in machines like lathes, mills, or pumps based on vibrations, temperature, or unusual noises. It can answer: "Why is my CNC machine vibrating too much?" or "What could cause overheating in a hydraulic pump?". It suggests basic maintenance actions and safety precautions.

Proposed Solution

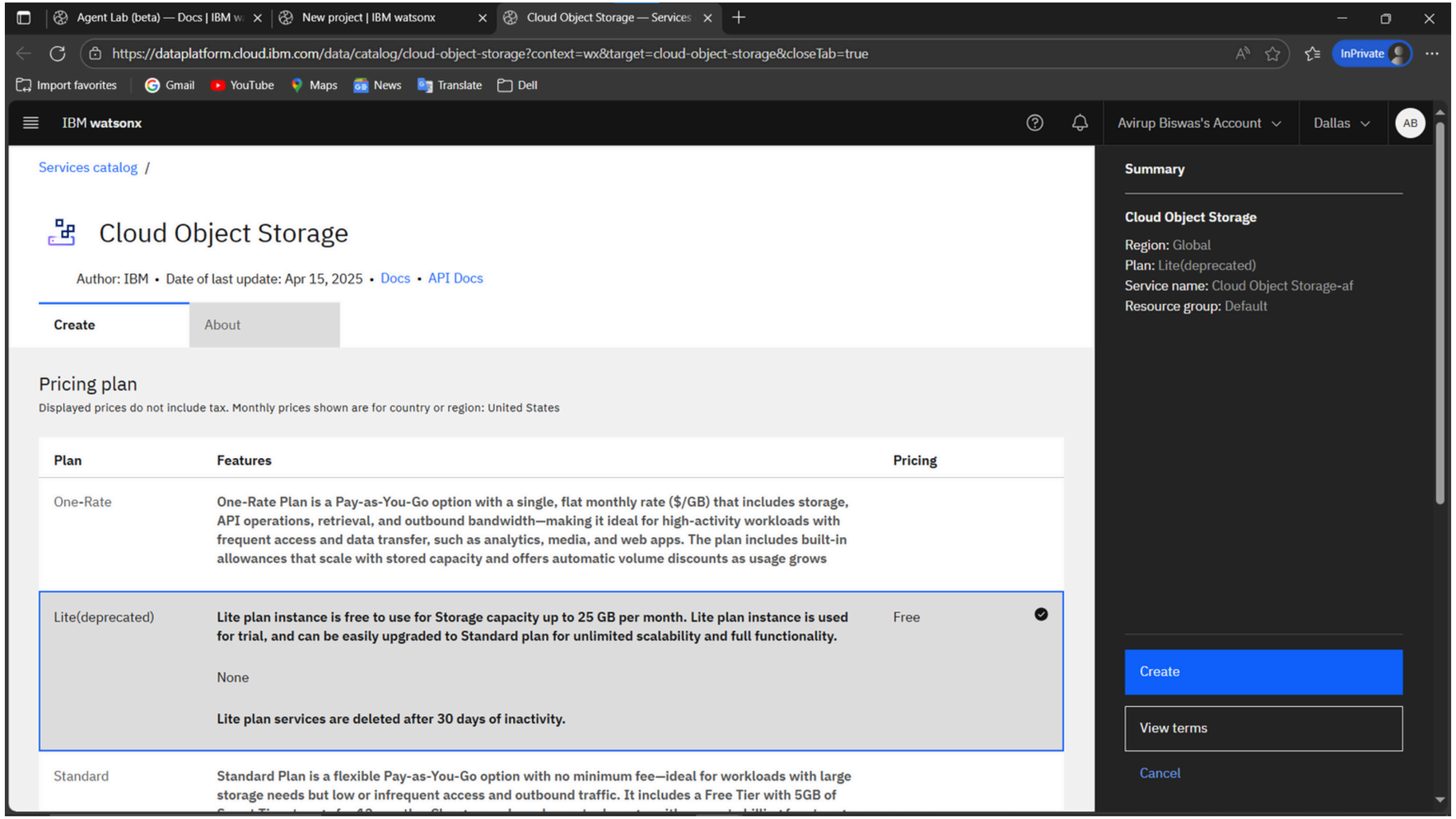
- The proposed AI agent helps detect faults in machines like lathes, mills, or pumps based on vibrations, temperature, or unusual noises. This system use agentic ai approach to give answers to our prompts. The solution will consist of the following components:
- **Data Collection:**
  - Sensors on the machinery (like lathes, mills, or pumps) collect real-time data on key indicators such as vibration, temperature, and noise.
  - Gave a initial prompt or direction to our agentic ai to identify the desired prompt.
- **Artificial Intelligence Model:**
  - Used IBM's "Granite-3-3-8b-instruct" model. An AI model to detect patterns and anomalies that are early signs of a potential fault.
- **Deployment:**
  - Deployed on IBM cloud, can use the public and private endpoint and preview to use the model.
- **Evaluation:**
  - This project addresses a critical need in industrial maintenance by enabling early fault detection in machinery using AI. Leveraging IBM Granite AI for natural language understanding makes the system user-friendly, while integration with sensor data ensures real-time diagnosis. The use of IBM Cloud Lite ensures scalability and accessibility.

System Approach

The proposed system follows a layered architecture that integrates sensor-based monitoring, intelligent fault analysis, and natural language interaction. It combines real-time machine data with AI-driven reasoning to diagnose faults and provide actionable maintenance suggestions. The entire system is deployed on IBM Cloud Lite using the IBM Granite AI model for seamless, scalable, and intelligent operations.

- **System requirements:**
  - Used DELL Inspiron with 16GB RAM with 250GB SSD and 1TB HDD.
  - Used windows 10 Operating System and Microsoft Edge browser.
- **Library required to build the model:**
  - Used IBM lite services.
  - Used IBM granite-3-3-8b-instruct model for AI services and watsonx ai runtime.
  - Used IBM storage services for storage purpose

Result



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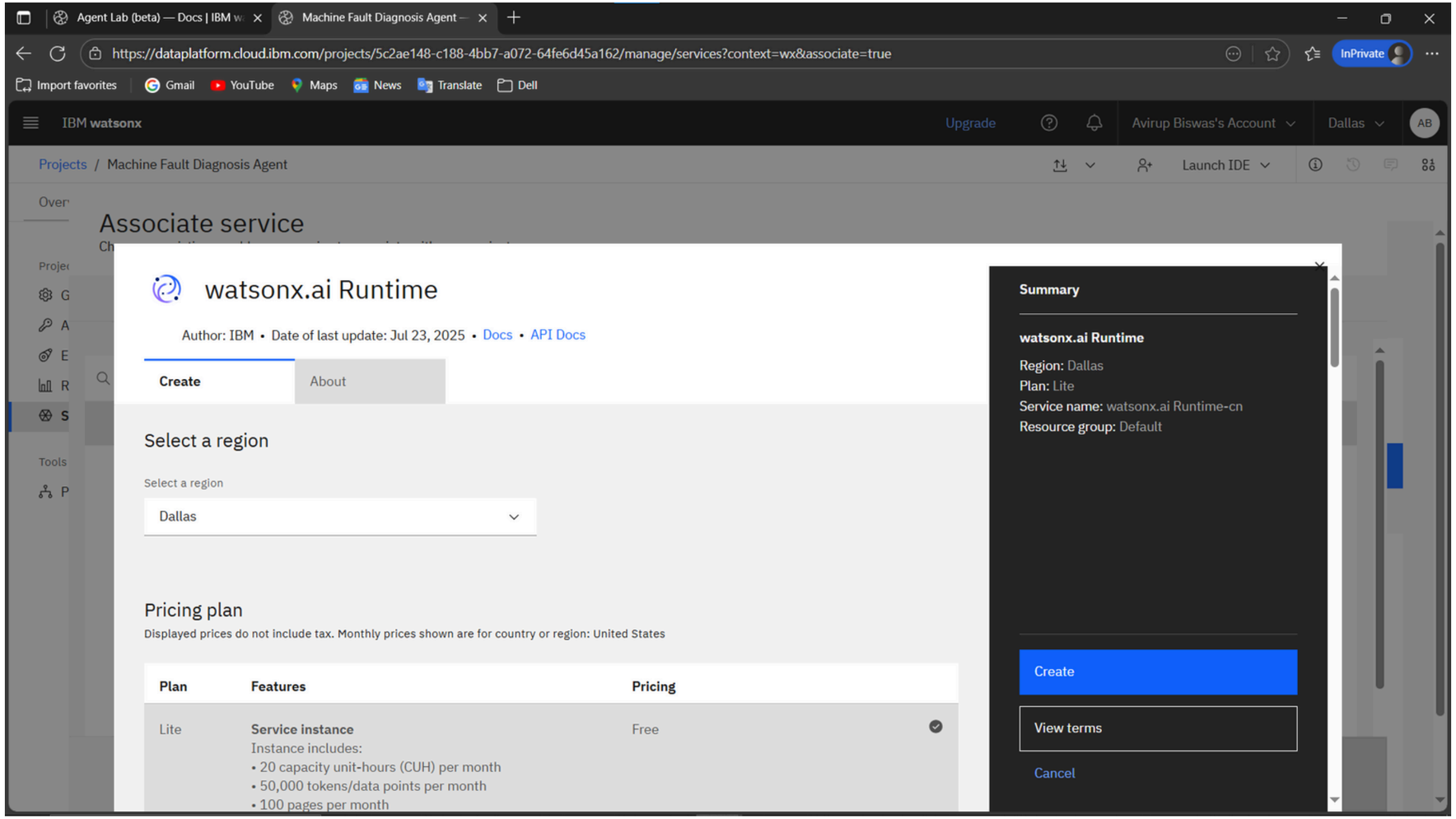
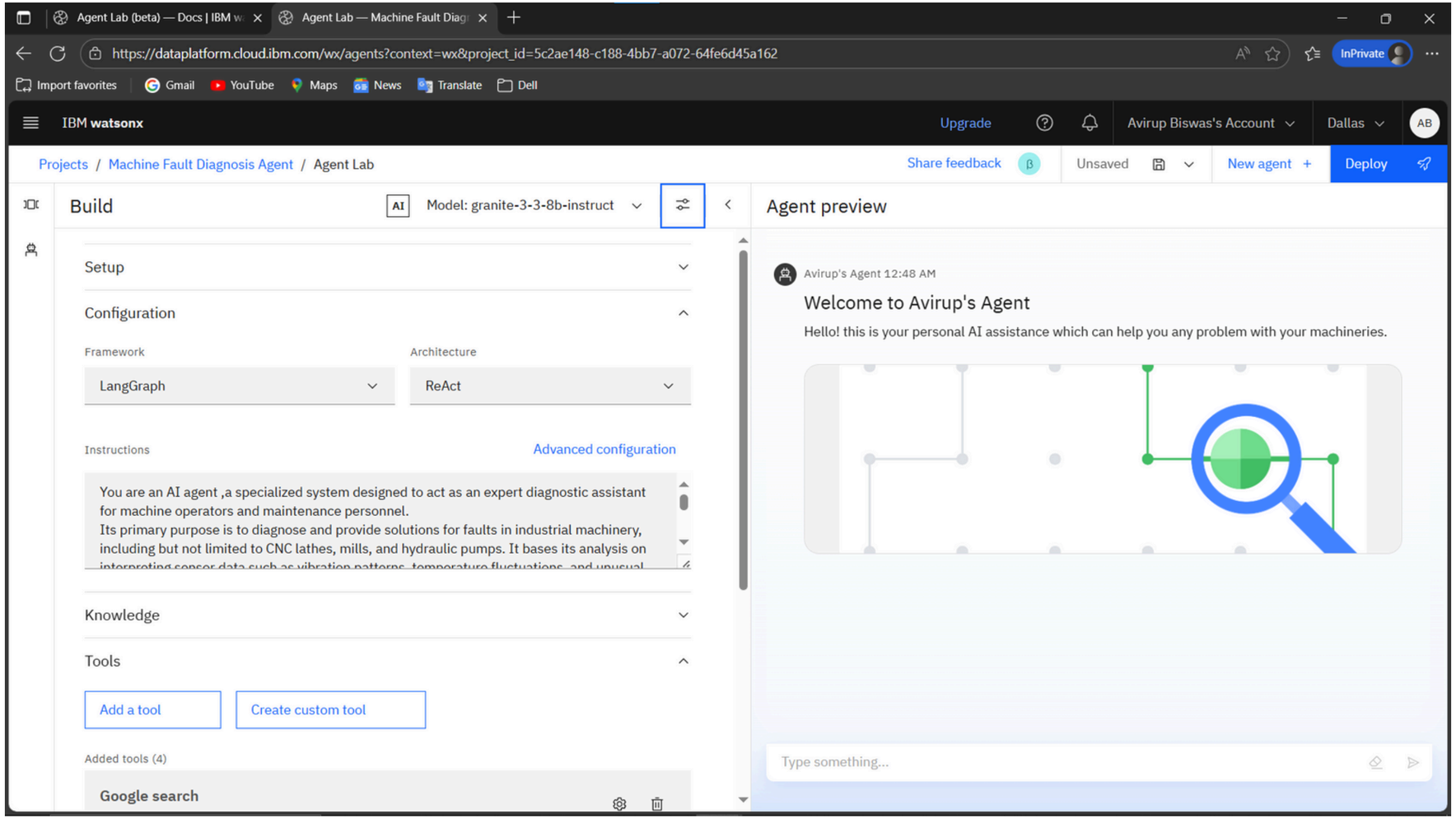
Result



Result



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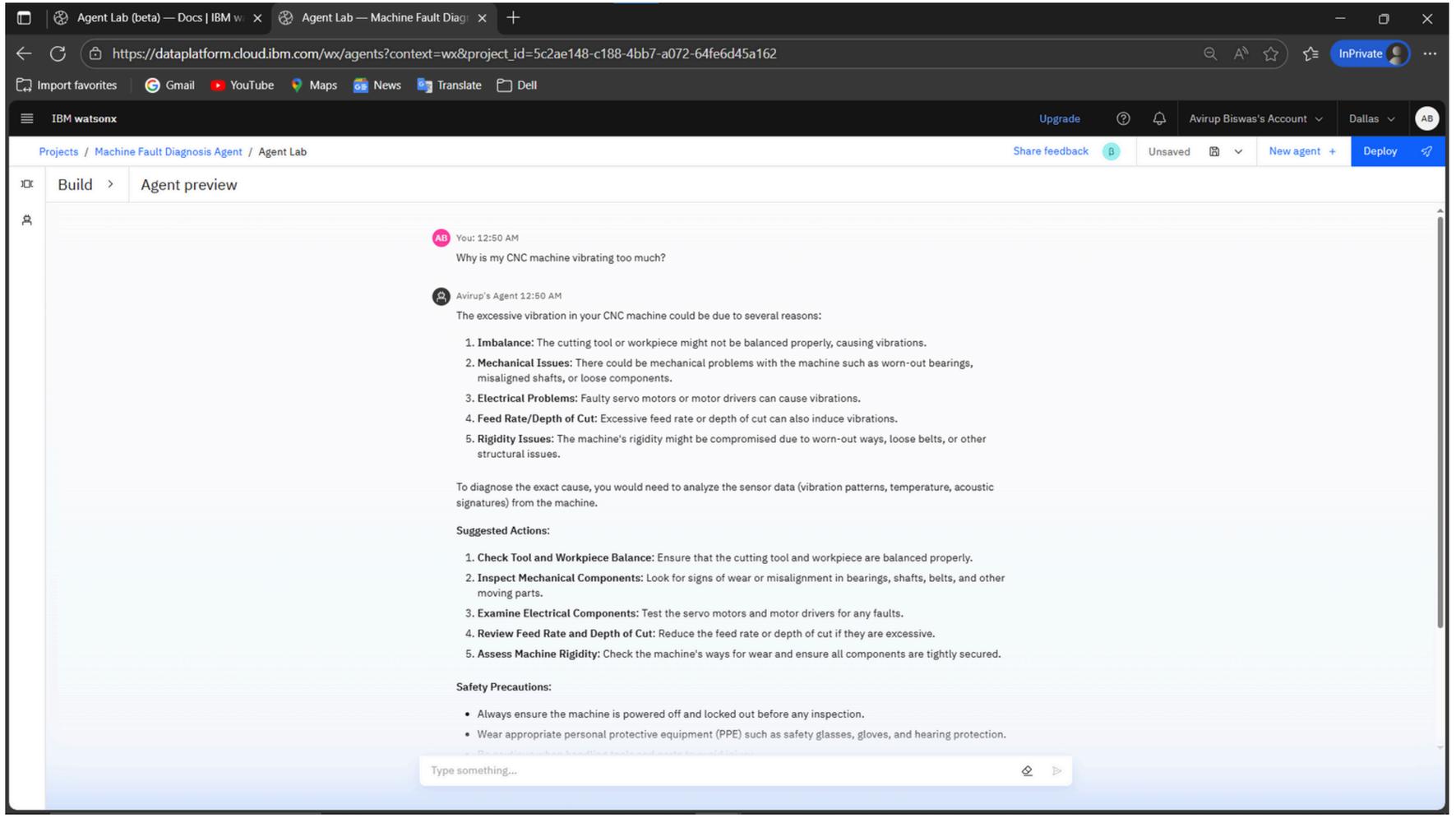
Result



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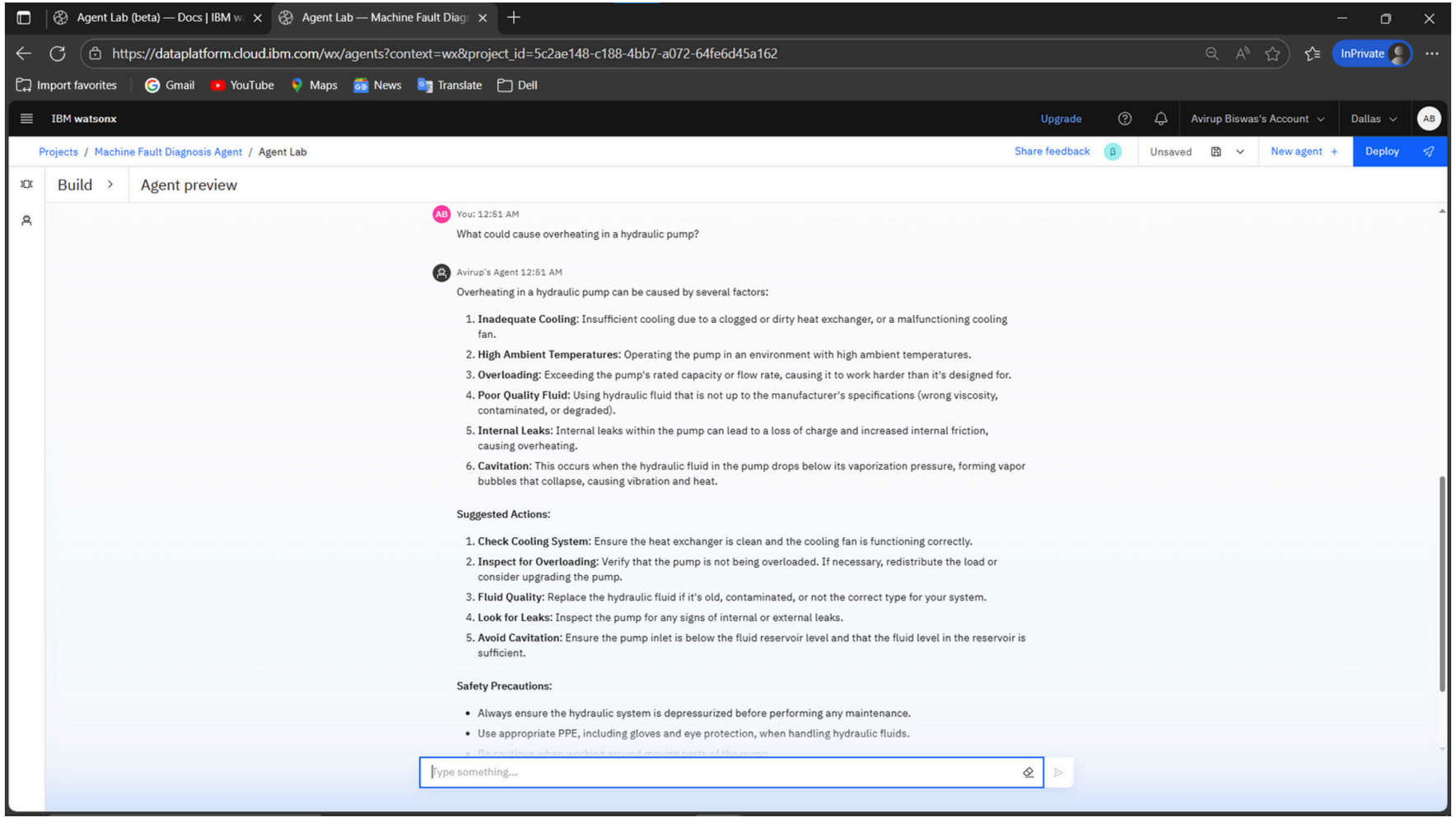

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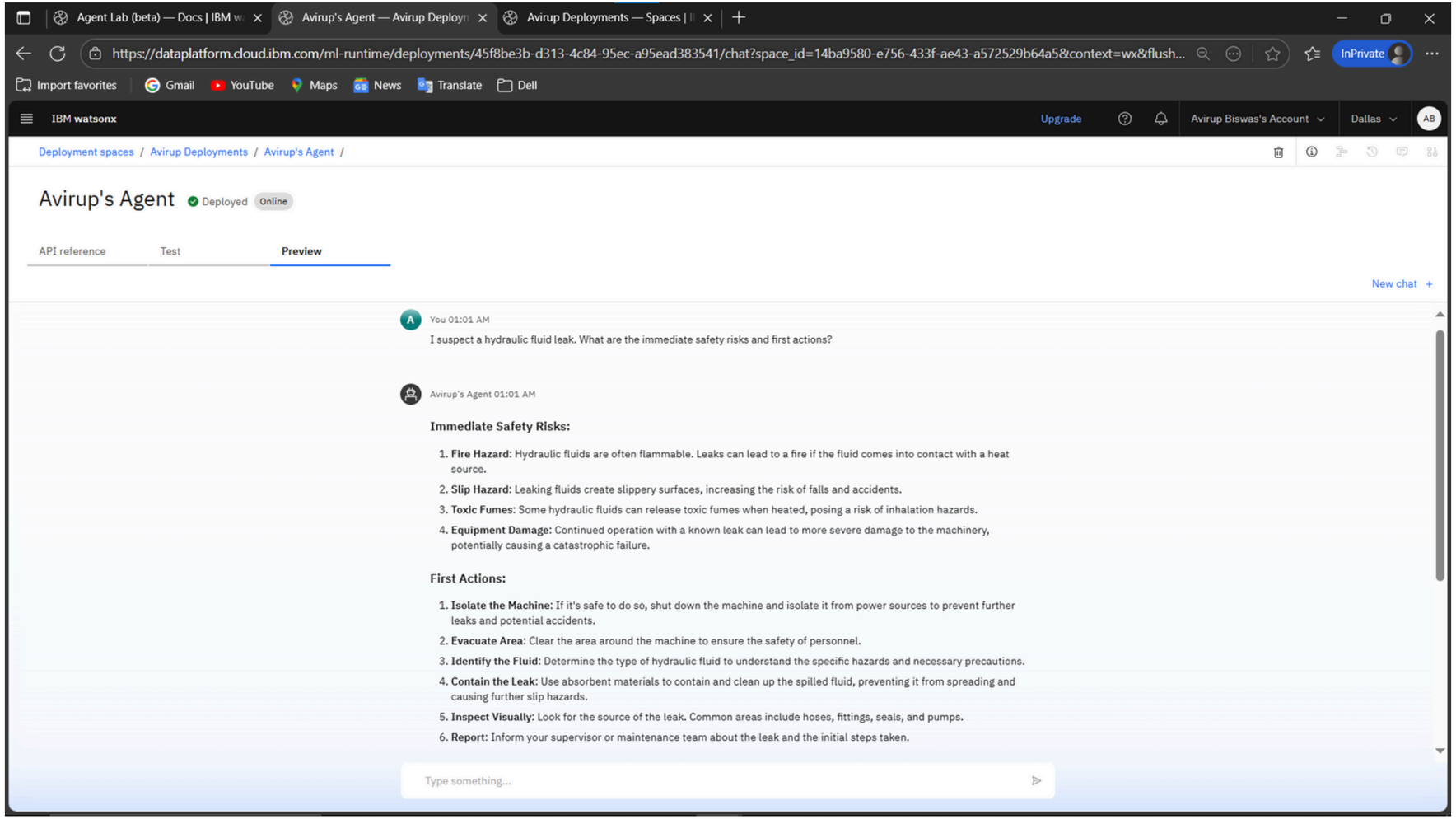


Conclusion

- The Machine Fault Diagnosis Agent successfully demonstrates how AI can enhance industrial maintenance by detecting faults in machinery based on real-time sensor data. By integrating the IBM Granite AI model with IBM Cloud Lite services, the system provides intelligent, user-friendly diagnostics through natural language interaction. This not only reduces machine downtime and maintenance costs but also improves operational safety and efficiency. The project highlights the practical potential of combining mechanical engineering knowledge with modern AI technologies.

Future scope

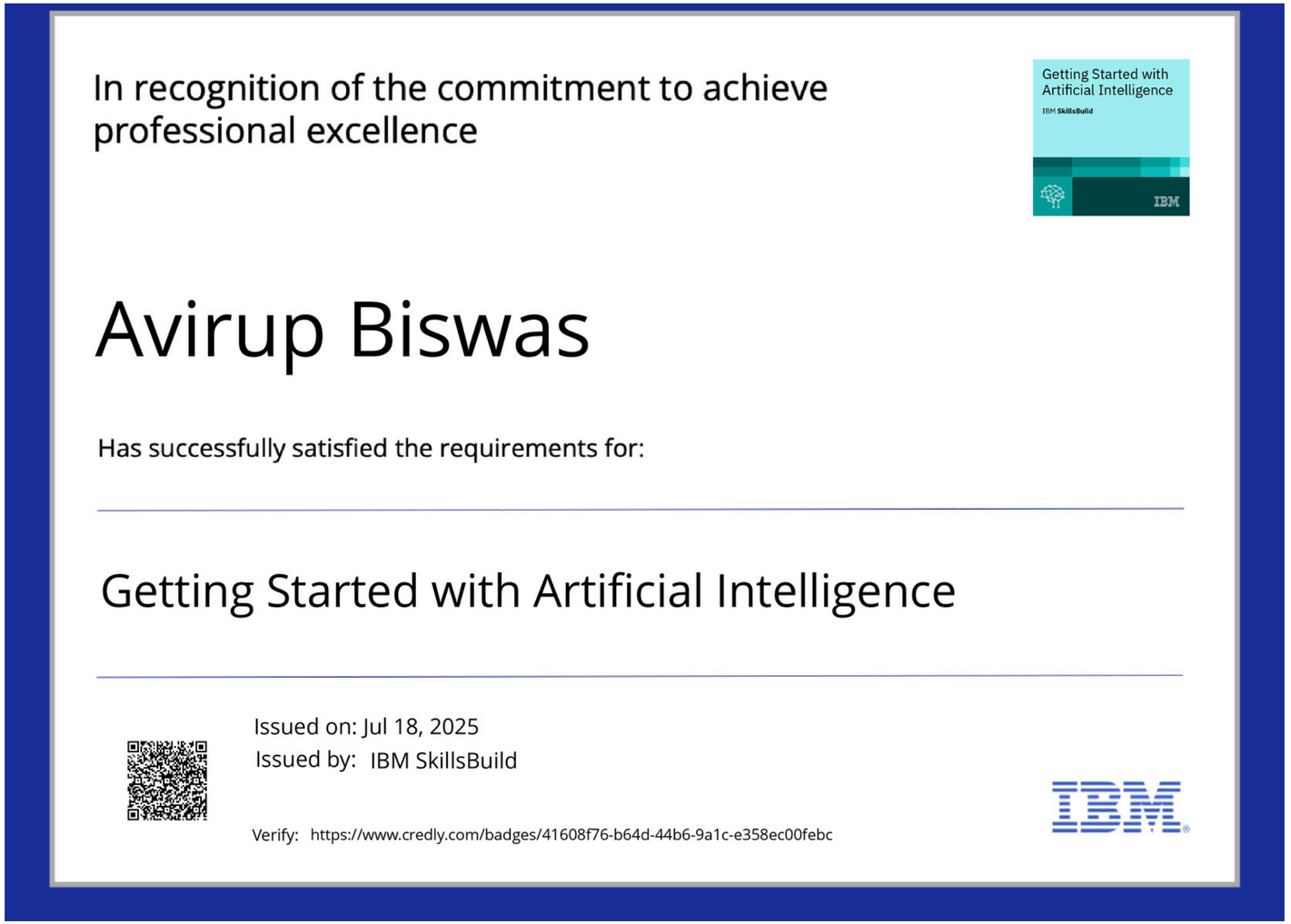
- In the future, the Machine Fault Diagnosis Agent can be enhanced by integrating predictive maintenance capabilities using historical data and machine learning, enabling it to forecast issues before they occur. The system can be expanded to support a wider variety of industrial machines and offer a mobile application for on-site access. Features like automated fault reporting, multilingual support, and self-learning from past diagnostics can further improve its usability, efficiency, and adaptability in diverse industrial environments.

References

- In this project, IBM's Granite-3-3-8B-Instruct AI model was used to enable intelligent natural language understanding and reasoning for machine fault diagnosis. IBM Cloud services provided the deployment infrastructure, while watsonx.ai facilitated seamless integration of the large language model. The IBM SkillsBuild platform supported learning and practical application of these technologies. All development, testing, and cloud access were carried out using the Microsoft Edge browser.

IBM Certifications

- **Getting started with AI:-**



IBM Certifications

- **Journey to Cloud: Envisioning your Solution**:-

IBM Certifications

- **Lab: Retrieval Augmented Generation with Lang chain**:-

IBM **SkillsBuild** Completion Certificate

This certificate is presented to

Avirup Biswas

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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