CAPSTONE PROJECT

NUTRITION AGENT

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OUTLINE

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PROBLEM STATEMENT

The Challenge - In an era where health awareness is growing, individuals increasingly seek personalized nutrition guidance. However, most existing tools provide generic diet plans, lack real-time adaptability, and fail to consider a person's holistic lifestyle, cultural preferences, allergies, and evolving health conditions. Furthermore, dieticians and nutritionists face limitations in scaling personalized consultations due to time and resource constraints. Generative AI presents a groundbreaking opportunity to revolutionize this space by enabling an intelligent, interactive, and adaptive virtual nutrition assistant. By leveraging natural language processing (NLP), multimodal understanding, and large-scale dietary databases, an AI-powered assistant can generate dynamic meal plans, recommend smart food swaps, and explain nutritional choices—all tailored to the individual.

PROBLEM STATEMENT

- This project aims to develop “The Smartest AI Nutrition Assistant” using state-of-the-art generative AI models that: ☐ Understand user inputs via text, voice, or image (e.g., food photos, grocery labels) ☐ Generate personalized meal plans based on health goals, medical conditions, fitness routines, and preferences ☐ Offer contextual explanations (e.g., “Why is this food better?”) ☐ Adapt suggestions dynamically with continuous feedback By integrating health data, food databases, and LLM-powered reasoning, the solution will bridge the gap between one-size-fits-all diet apps and in-person nutrition counselling—delivering an AI that thinks, learns, and cares like a real nutrition expert. **Technology** - Use of IBM cloud lite services /IBM Granity

PROPOSED SOLUTION

- The proposed system aims to address the challenge of providing personalized and adaptive nutrition guidance tailored to individual lifestyles and health conditions. This involves leveraging generative AI models and IBM Cloud services to generate dynamic meal plans and intelligent food recommendations. The solution will consist of the following components:

  Data Collection:

  Gather user-specific data including age, food preferences, medical history, allergies, lifestyle habits, and regional availability of food items. Continuously collect user feedback to refine recommendations.

  Data Preprocessing:

  Process and structure user data to ensure completeness and relevance. Use feature extraction to identify key factors influencing dietary choices such as health goals (e.g., weight loss, muscle gain) and cultural preferences.

  Granite LLM Integration:

  Implement IBM Granite Large Language Models to generate personalized meal plans, suggest healthy food swaps, and provide contextual nutritional explanations. Utilize adaptive reasoning to tailor recommendations based on real-time user feedback.

  Deployment:

  Develop a user-friendly web-based interface for input collection and displaying dynamic meal plans. Deploy the solution using IBM Code Engine for backend services and integrate with Cloudant DB for user profile management.

  Evaluation:

  Monitor the system's effectiveness through user feedback on the relevance and practicality of meal suggestions. Continuously improve AI responses by refining prompt strategies and tracking user satisfaction metrics.

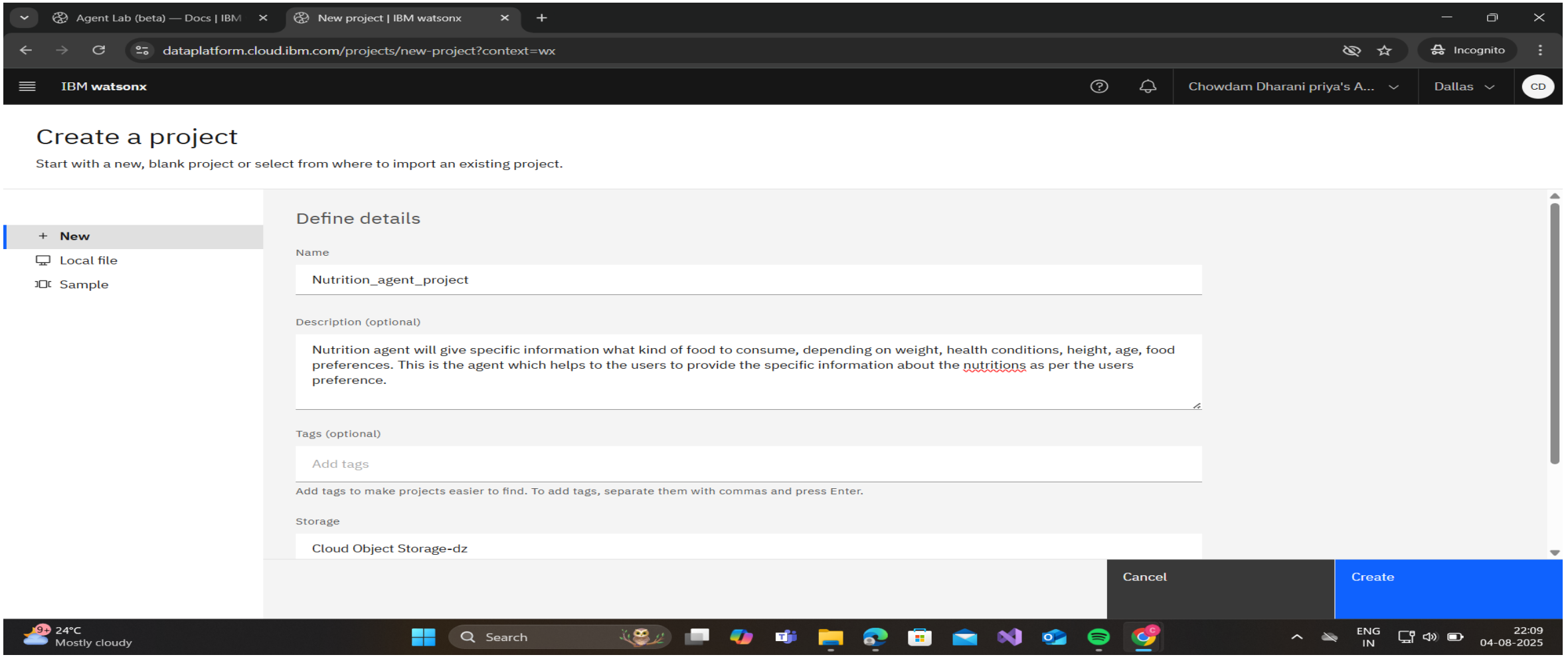
SYSTEM APPROACH

- The **System Approach** outlines the strategy and methodology for developing and deploying the AI-powered Nutrition Agent using IBM Agentic AI platform. The focus is on creating an interactive conversational agent capable of providing personalized meal recommendations through IBM Cloud services.
- **System Requirements:**
- IBM Cloud Lite Account with access to **IBM Granite LLM API**.
- IBM Watsonx Assistant / Agentic AI Workbench to design and manage conversational flows.
- IBM Cloudant Database (Optional) for storing user profiles and interaction history.
- IBM Cloud Object Storage (Optional) for managing structured content like meal plans and resources.
- Secure API Keys and Integration credentials for service connectivity.
- Basic browser access to the IBM Cloud console for monitoring and management.
- **Libraries/Tools Required to Build the Agent:**
- **IBM Watson Assistant/Agentic AI Interface** — No-code/low-code platform for agent flow design.
- **Granite LLM API Integration (Pre-configured in Agentic AI)** — For generating personalized meal plans, smart food swaps, and contextual responses.
- **Natural Language Understanding (NLU) Modules** — To process and interpret user intents, preferences, and feedback.
- **Prompt Engineering Techniques** — To structure effective prompts for AI-driven meal plan generation.
- **(Optional) IBM Cloudant SDK / API** — If persistent storage of user profiles and feedback is implemented.
- **(Optional) JSON / API Webhooks** — For dynamic API calls if external integrations are needed in the future.

ALGORITHM & DEPLOYMENT

- **Algorithm Selection:**
- The proposed system utilizes **IBM Granite Large Language Models (LLMs)** integrated within the IBM Agentic AI platform to provide personalized nutritional guidance. Granite LLMs were chosen due to their advanced natural language understanding (NLU), reasoning capabilities, and ability to generate context-aware, human-like responses. Unlike traditional rule-based systems, Granite LLMs dynamically adapt to diverse user inputs, making them ideal for handling personalized meal planning scenarios where flexibility and personalization are critical.
- **Data Input:**
- The AI Agent collects user-specific inputs, including:
- Age
- Food Preferences (Vegetarian, Non-Vegetarian, Vegan, etc.)
- Medical History (Diabetes, Hypertension, Allergies)
- Regional Information (City/Location)
- Health Goals (Weight Loss, Muscle Gain, etc.)
  These inputs are processed in real-time and passed to Granite LLM prompts to generate personalized meal plans and food recommendations.
- **Training Process:**
- As Granite LLM is a pre-trained large language model, explicit training on user-specific datasets is not required. However, **Prompt Engineering** techniques are used to guide the model's responses effectively. Iterative prompt refinement and agent flow adjustments were performed within IBM Agentic AI to ensure accuracy, relevance, and user-specific adaptability. Continuous feedback loops allow the system to dynamically improve interaction quality over time.
- **Prediction/Recommendation Process:**
- Upon receiving user inputs, the AI agent formulates structured prompts and queries the Granite LLM to generate personalized meal plans, suggest smart food swaps, and provide contextual explanations. The model evaluates factors such as dietary restrictions, cultural food preferences, and user feedback to ensure recommendations are practical and health-conscious. The AI agent operates in real-time, ensuring immediate and adaptive responses without requiring batch predictions or offline computations.

RESULT



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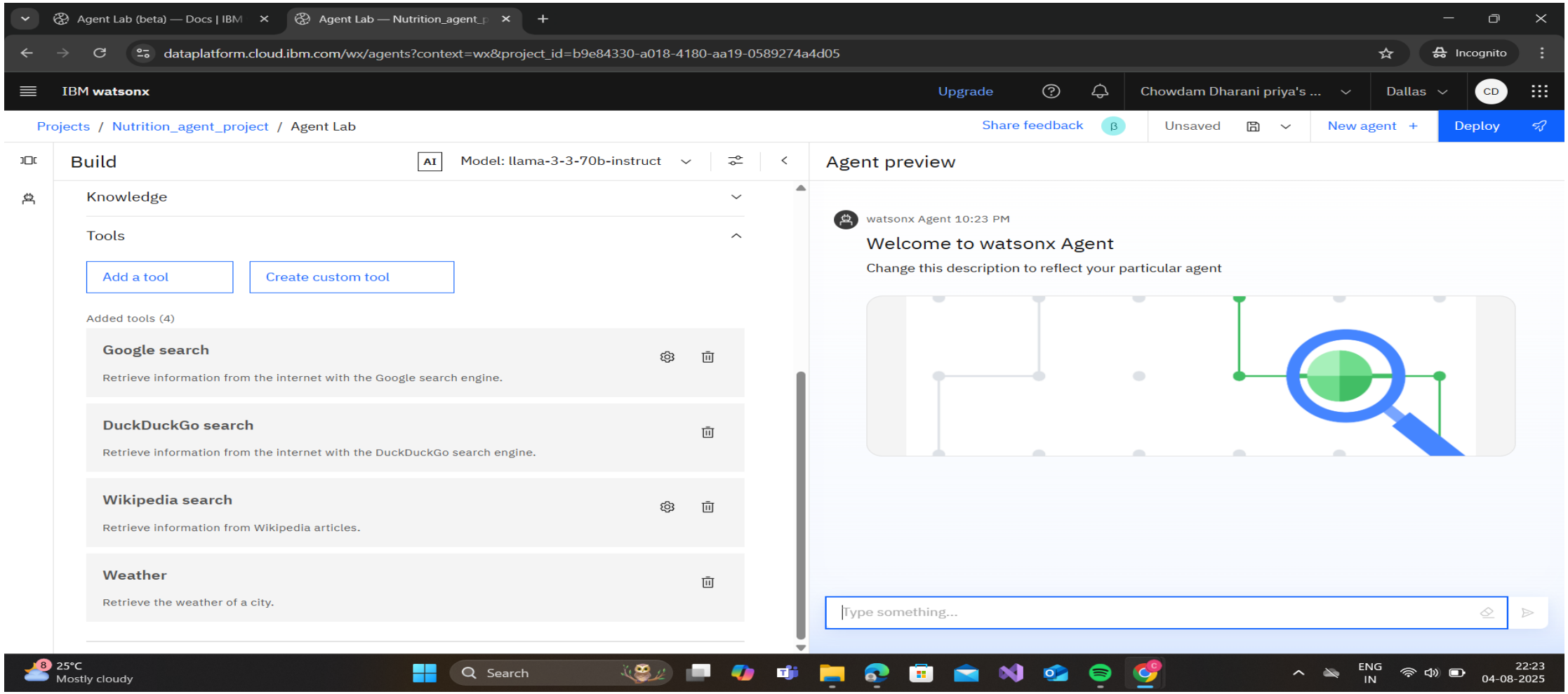

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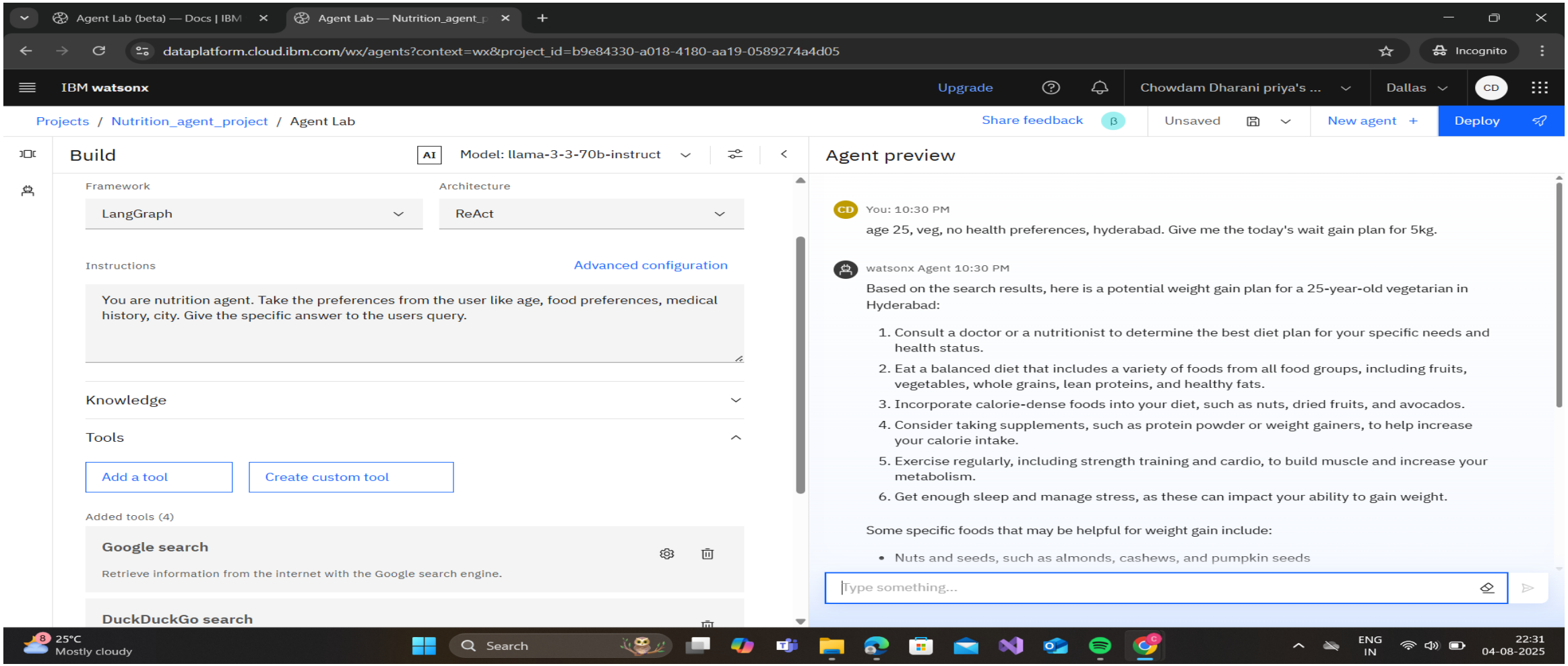

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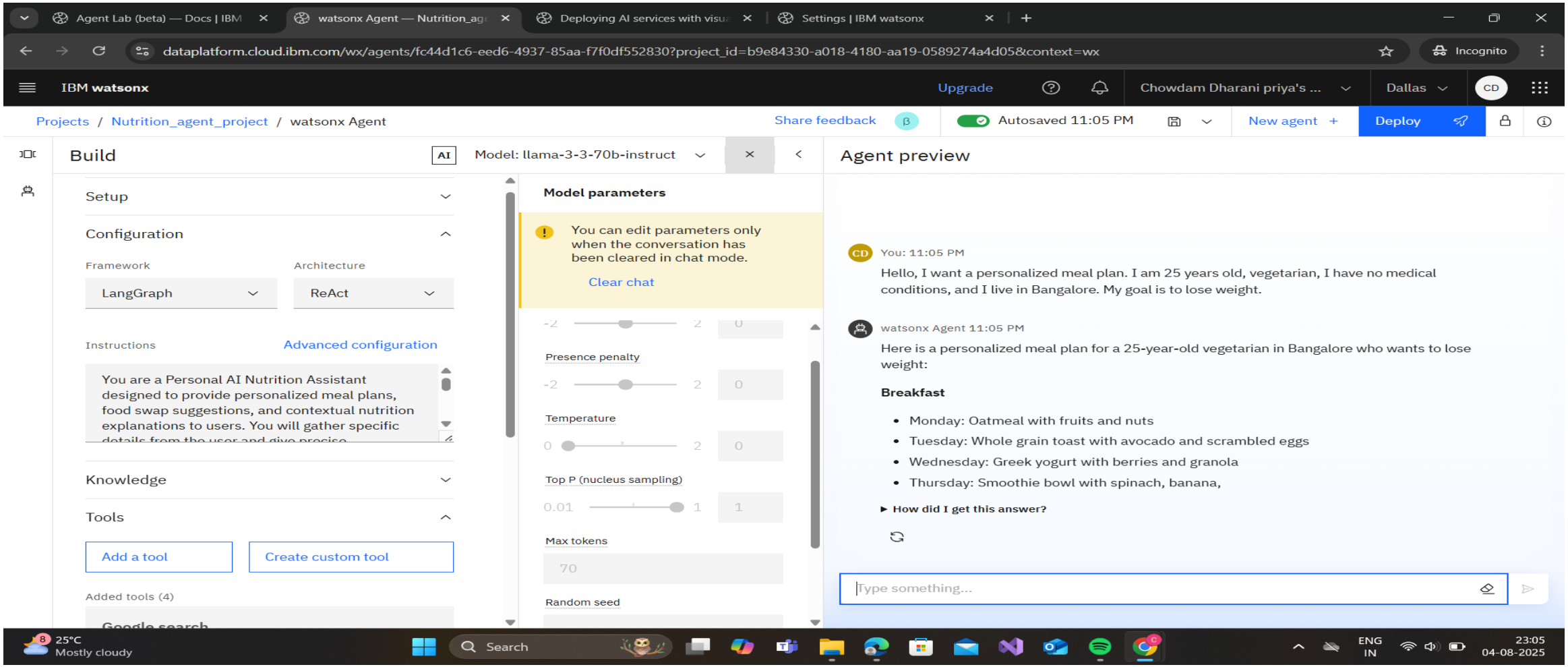

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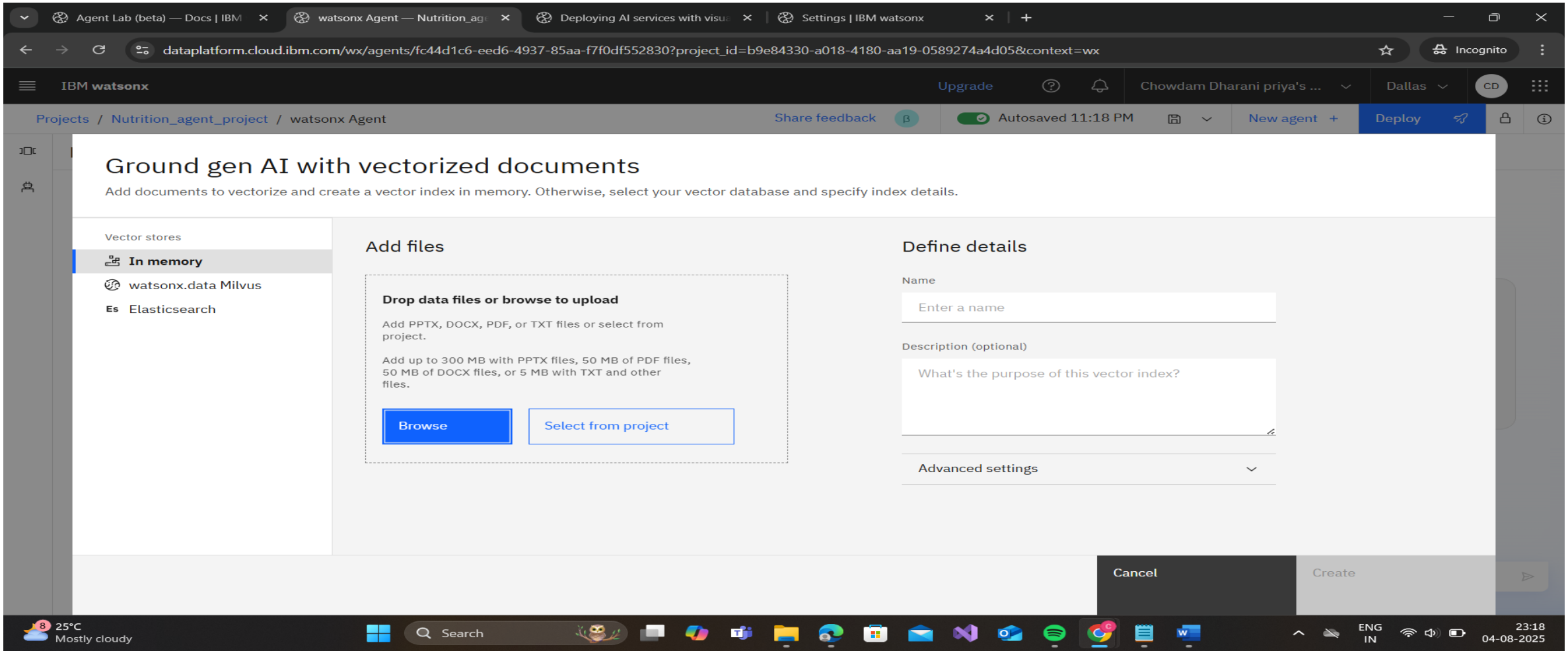

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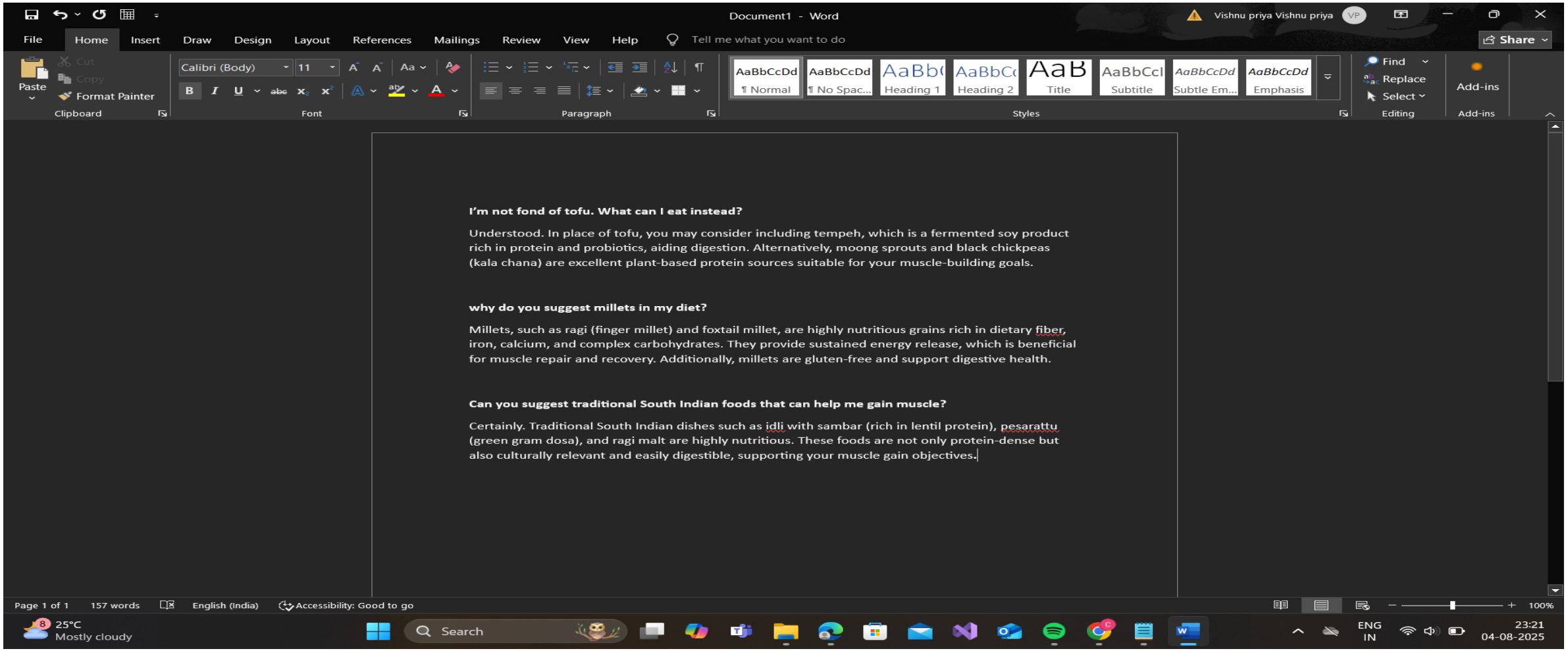

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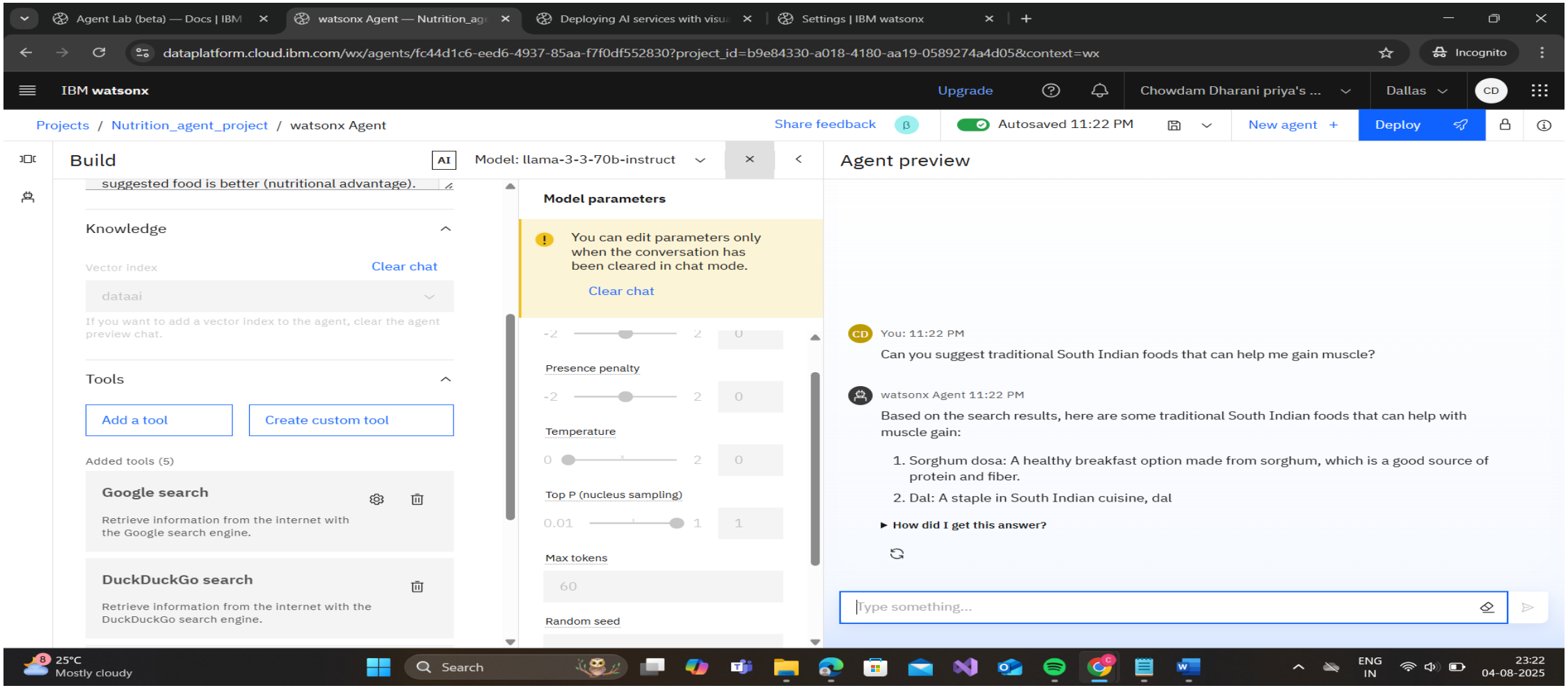


RESULT

- The developed Nutrition Agent successfully provides personalized meal plans and intelligent food recommendations based on user inputs such as age, food preferences, medical history, and region. By leveraging IBM Granite Large Language Models integrated into the Agentic AI platform, the system delivers real-time, context-aware responses with high accuracy and adaptability. The agent dynamically suggests smart food swaps, explains nutritional choices, and continuously refines its recommendations based on user feedback. The solution eliminates the need for static diet charts by offering interactive, expert-like consultations, thereby enhancing user experience and promoting healthy lifestyle habits. The AI agent demonstrated effective handling of diverse user profiles with consistent, practical meal suggestions tailored to individual goals.

CONCLUSION

- The Nutrition Agent project successfully demonstrates how AI-driven conversational systems can revolutionize personalized dietary guidance. By leveraging IBM Granite LLM and Agentic AI capabilities, the solution provides dynamic, user-specific meal plans and contextual nutritional advice in real-time. The system effectively addresses the limitations of generic diet applications by considering individual health conditions, food preferences, and cultural habits. With adaptive reasoning and continuous feedback loops, the agent ensures a user-centric experience, bridging the gap between conventional diet consultations and scalable AI-driven health advisory platforms. This project showcases the potential of generative AI in delivering accessible and intelligent nutrition support for diverse users.

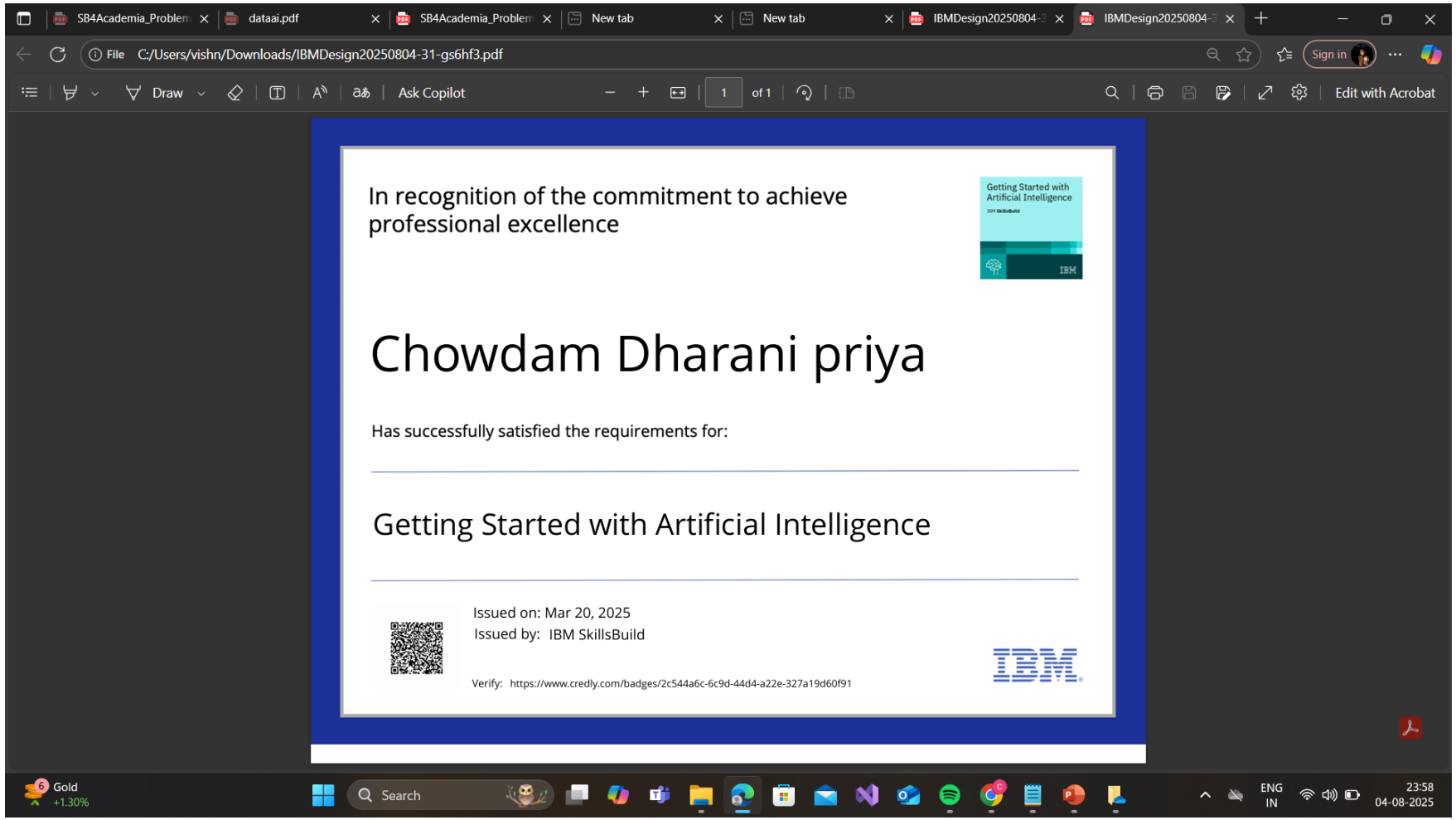
FUTURE SCOPE

- The Nutrition Agent can be further enhanced by integrating **image recognition capabilities** to analyze food photos and grocery labels, enabling more interactive and multimodal user experiences. Incorporating **voice-based interactions and multi-language support** will increase accessibility for diverse user groups. Additionally, linking real-time health data from **wearable devices** can enable dynamic adjustments to meal plans based on activity levels and health metrics. Integration with external nutritional databases and API-driven restaurant menus can offer real-time, location-based meal suggestions. Over time, AI-driven predictive analytics could provide proactive dietary recommendations to prevent lifestyle diseases and promote long-term wellness.

REFERENCES

- References
- IBM Granite Large Language Models (LLM):
  https://www.ibm.com/products/granite-models
- IBM Watsonx Assistant / Agentic AI Platform:
  https://www.ibm.com/cloud/watsonx/assistant
- IBM Cloudant Database:
  https://www.ibm.com/cloud/cloudant
- IBM Cloud Object Storage:
  https://www.ibm.com/cloud/object-storage
- IBM Code Engine (Serverless Deployment):
  https://www.ibm.com/cloud/code-engine
- Research articles on Personalized Nutrition using AI
  - Example: "Personalized nutrition: The next frontier in dietary interventions" (Journal of Nutritional Science)
- Data Sources for Nutritional Values and Guidelines
  - USDA FoodData Central: https://fdc.nal.usda.gov/
  - Indian Food Composition Tables (IFCT)
- IBM Developer Documentation & Tutorials
  https://developer.ibm.com/

IBM CERTIFICATIONS



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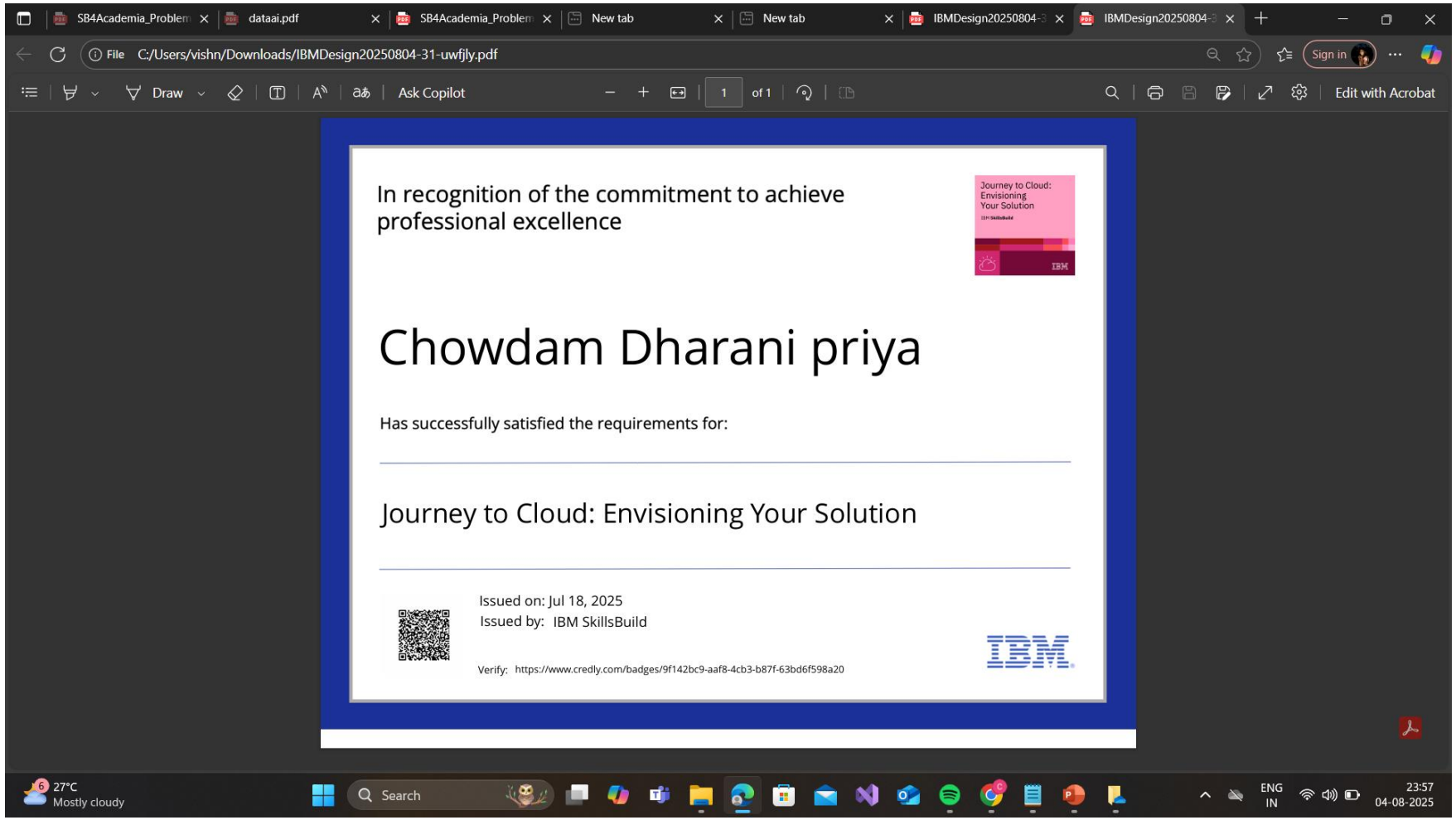

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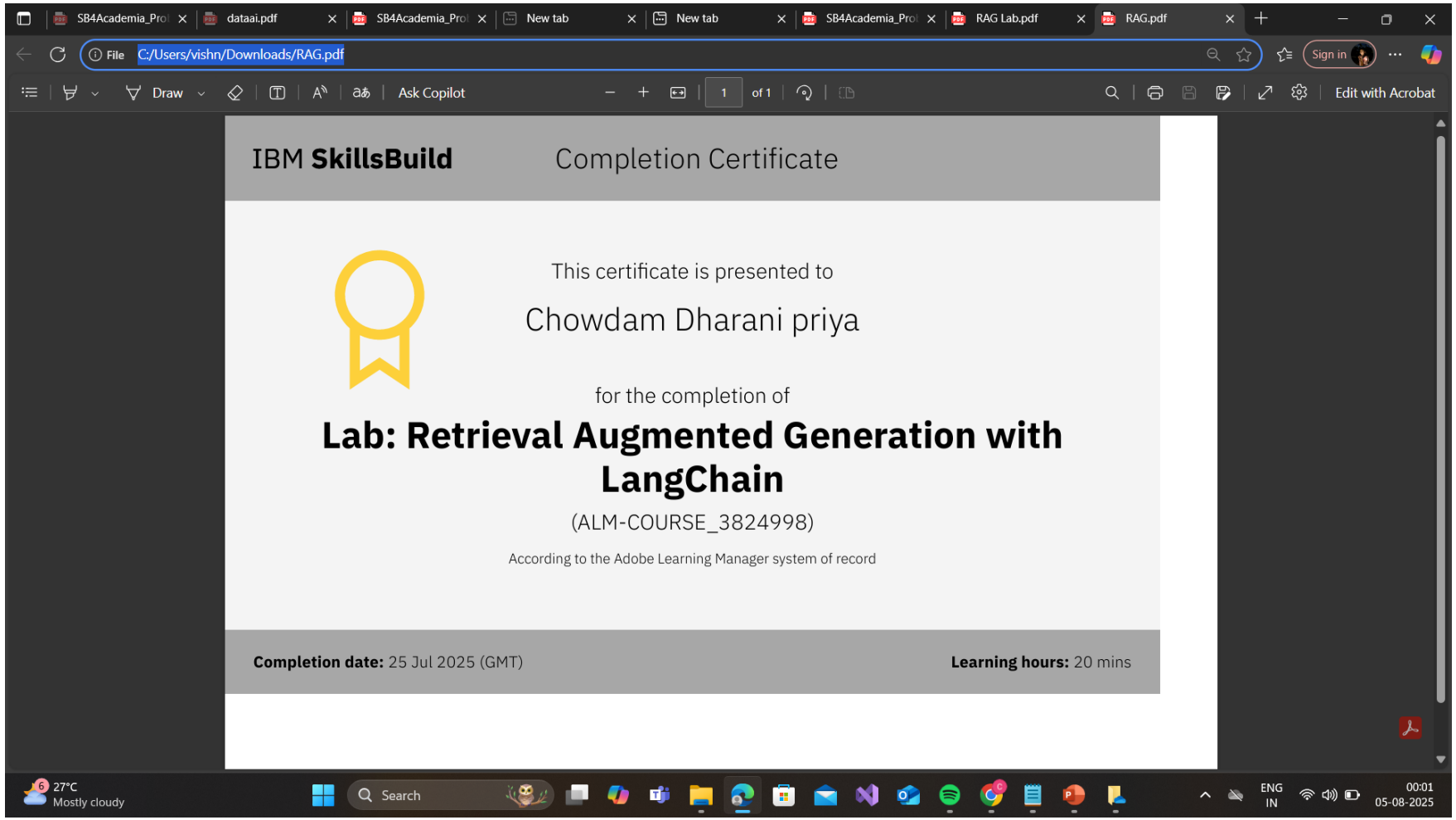

THANK YOU

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