CAPSTONE PROJECT

THE SMARTEST NUTRITION AI AGENT

USING IBM CLOUD

Presented By:
Name- GUFRAN KHAN
College Name- Birsa Institute Of Technology Sindri
Department- Information Technology

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OUTLINE

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

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PROBLEM STATEMENT

- In today's fast-paced world, individuals are becoming increasingly conscious of the importance of healthy eating. However, they often struggle to access **personalized nutrition guidance** that aligns with their **unique health conditions, dietary goals, allergies, cultural preferences, and lifestyle habits.** Most existing diet and nutrition applications offer generic recommendations that do not adapt to individual needs in real time. Additionally, **human dieticians and nutritionists** face limitations in providing continuous, customized support to a large number of users due to time and resource constraints. This creates a critical gap in delivering effective and scalable personalized nutrition support.

PROPOSED SOLUTION

The proposed system aims to provide real-time, personalized nutritional guidance based on individual user inputs such as age, gender, health conditions, and dietary preferences. The solution was developed using AI-driven prompts and deployed on IBM Cloud for scalability. The system is structured as follows:

- **1. User Interaction via Prompt-Based AI**

- The assistant initiates with:
  "Namaste! I am Hitler, your nutrition agent." It collects essential user data:
  - Age, gender, weight, height
  - Health issues or medical conditions
  - Fitness goals (e.g., weight loss, muscle gain)
  - Food preferences (Indian, vegan, low-carb, etc.)
  - Daily activity level
  - Allergies or dietary restrictions

    Allows users to upload food photos or grocery lists for better insights.

- **2. Data Handling and Preprocessing**

Validates user data (numeric ranges, gender categories, etc.)

Computes BMI and suggests caloric needs based on age, weight, height, and activity level.

Categorizes users into dietary profiles (e.g., diabetic-friendly, high-protein, weight loss).

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- **3. AI Model & Prompt Integration**

  Uses generative AI (via ChatGPT-like prompts) to generate:
  - Custom meal plans
  - Nutritional swaps
  - Healthy food suggestions
  - Expert tips based on known dietary science

  Expert-curated prompts ensure context-aware suggestions that adapt to user inputs dynamically.

- **4. Knowledge Base + Expert Advice Integration**

Integrated with a knowledge base of 10 frequently asked expert-level nutrition questions (in PDF format)
Offers explainable advice backed by verified sources.

- **5. Deployment on IBM Cloud**

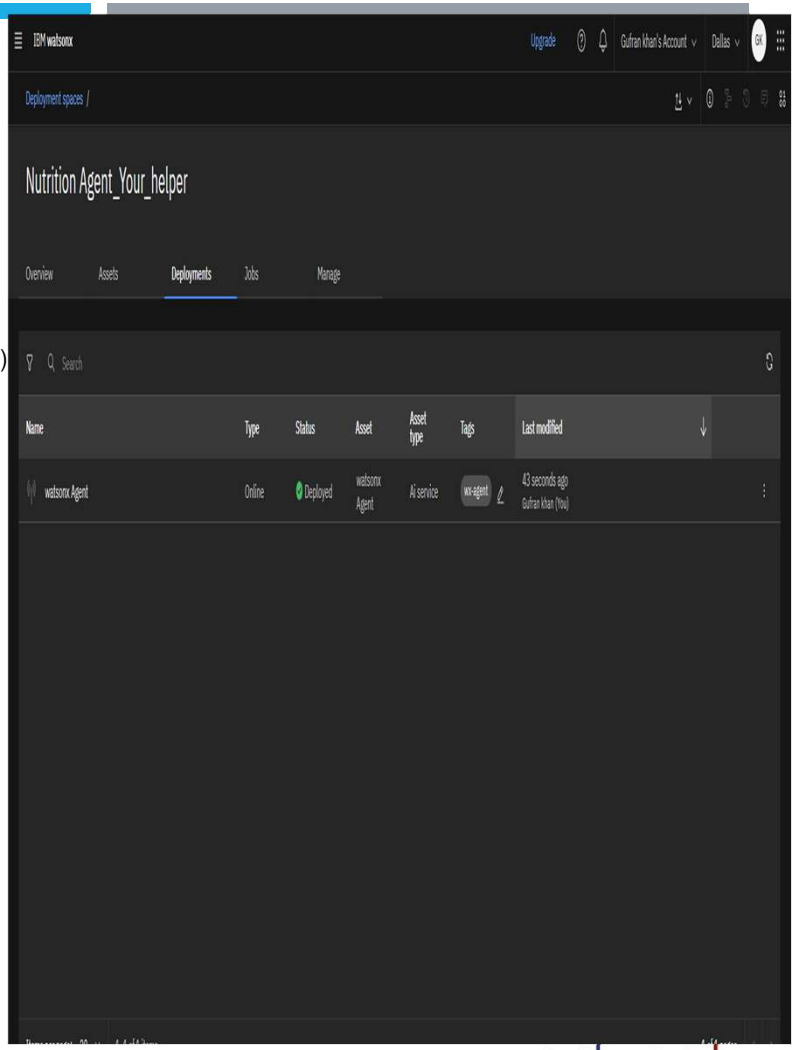
  The application is deployed on IBM Cloud for:
  - High availability
  - Real-time user interaction
  - Secure backend processing

  Ensures scalability and data privacy using IBM Cloud's infrastructure.

- **6. Evaluation & Feedback Loop**

Receives user feedback on suggestions and tracks satisfaction.
Refines prompt design and data flow based on repeated user sessions.
Continuous learning improves personalization over time.

User ⟶ Prompt Engine ⟶ AI Core (ChatGPT) ⟶ Nutrition DB ⟶ Output



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SYSTEM APPROACH

The "System Approach" section outlines the overall strategy and methodology for developing and implementing the AI-based Nutrition Assistant system. Here's the structure

System Requirements

1. **User Environment:**

   Any device with internet access and web browser

   Minimum 4 GB RAM, dual-core processor (for local operations)

2. **Cloud Infrastructure:**

   IBM Cloud (Free Tier):

   Watsonx.ai Prompt Lab – to generate answers, meal plans, food swaps using custom prompts

   IBM Cloud Object Storage – used to:

   Store expert Q&A PDFs

   Save web-scraped nutrition data

   Host any user-specific logs or documents

📦 2. Libraries, APIs, and Tools Used

Generative AI (Prompt-Based):

IBM Watsonx.ai
Customized prompt templates for:
Meal generation, Food swap recommendations ,Nutrition FAQs

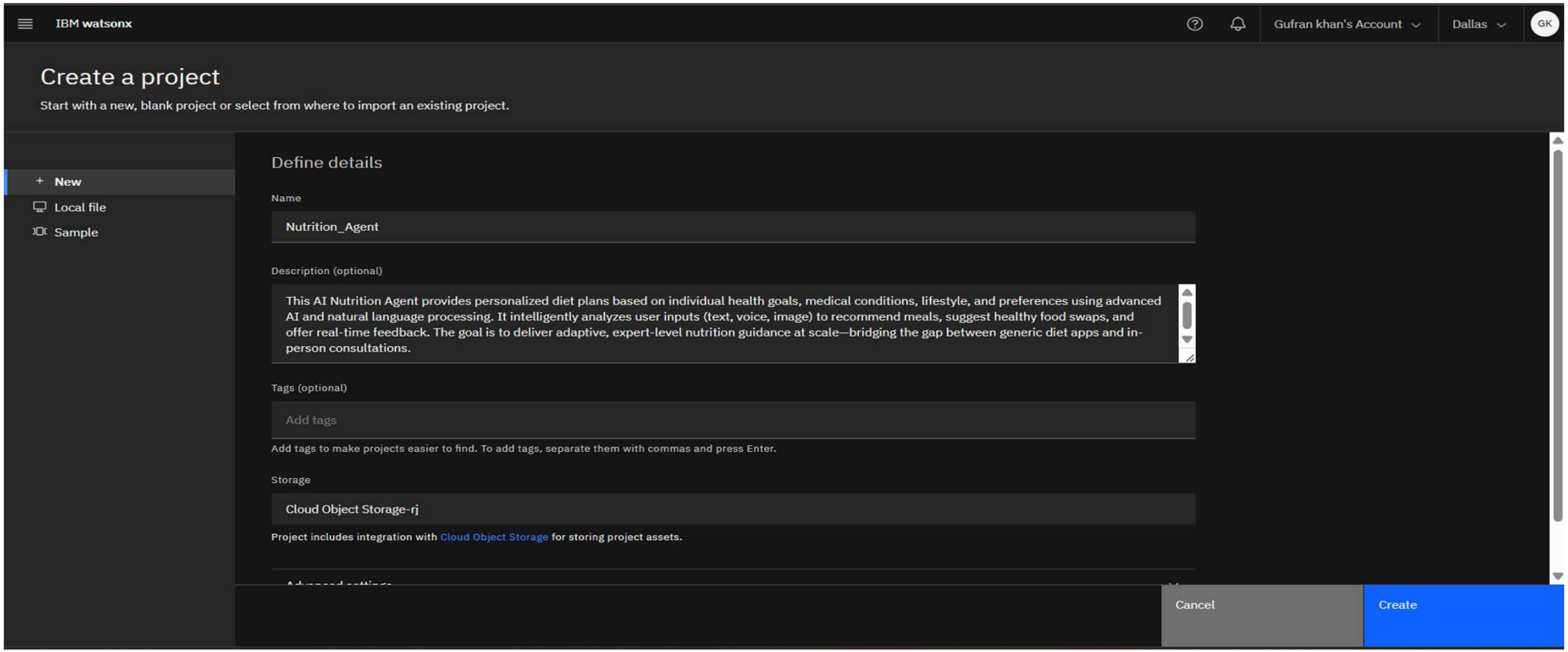
Web Data Retrieval:
Google Search / DuckDuckGo Search Engine (manually or with scraping), Wikipedia API / Scraper for verified nutritional content
wikipedia – for structured lookups

Storage & Data Handling:
Stores nutrition-related knowledge (expert advice PDFs), Accessible by the AI assistant to enhance its responses
Central repository for storing search results or generated files

🔁 3. Architecture & Flow

[User Query]
├──▶ [IBM Watsonx.ai Prompt Execution]
│ ├── Custom Meal Generation
│ ├── Nutrition Reasoning
│ └── Allergy/Fitness Adaptation
├──▶ [Wikipedia or Web Search (Google / DuckDuckGo)]
│ └── Manual lookup or crawler for uncommon queries
└──▶ [Expert Advice PDF from IBM Cloud Storage]--- 10 curated questions & answers

Create Project



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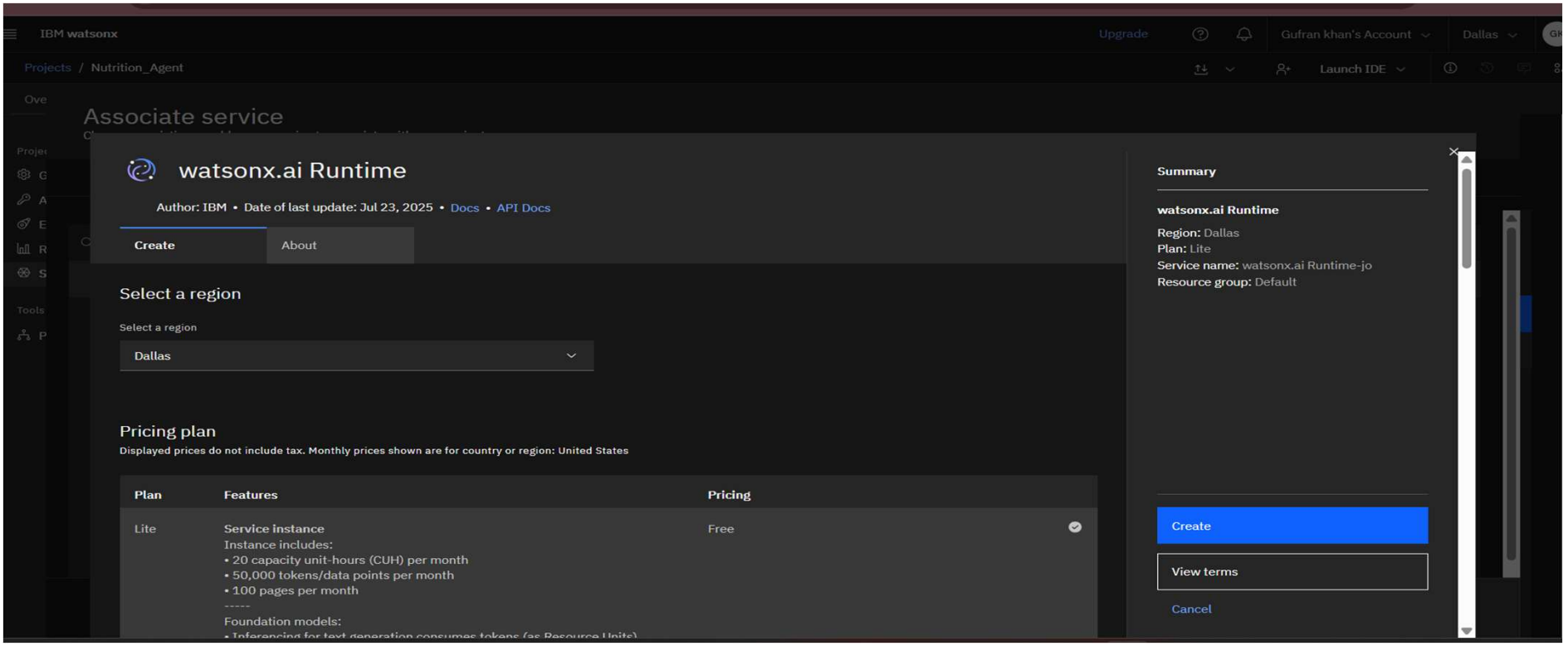
Associate With RunTime



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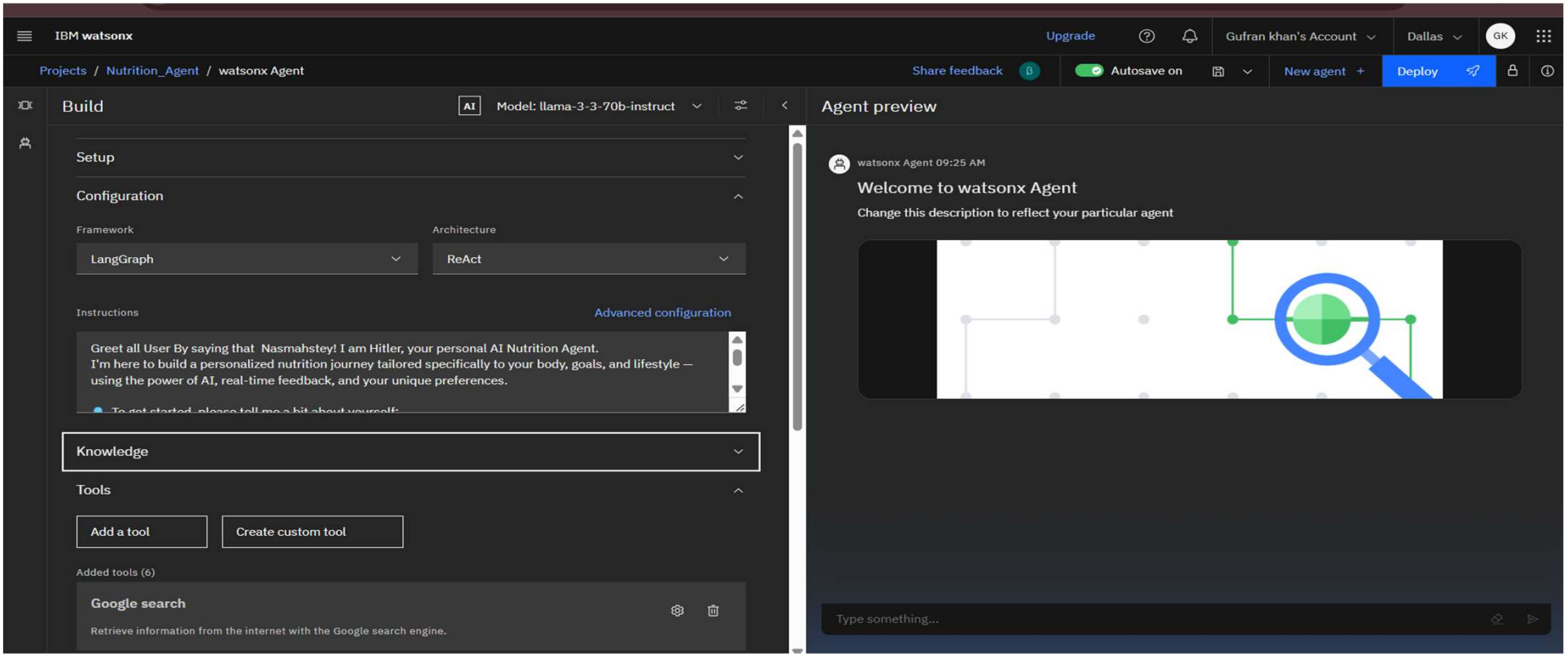

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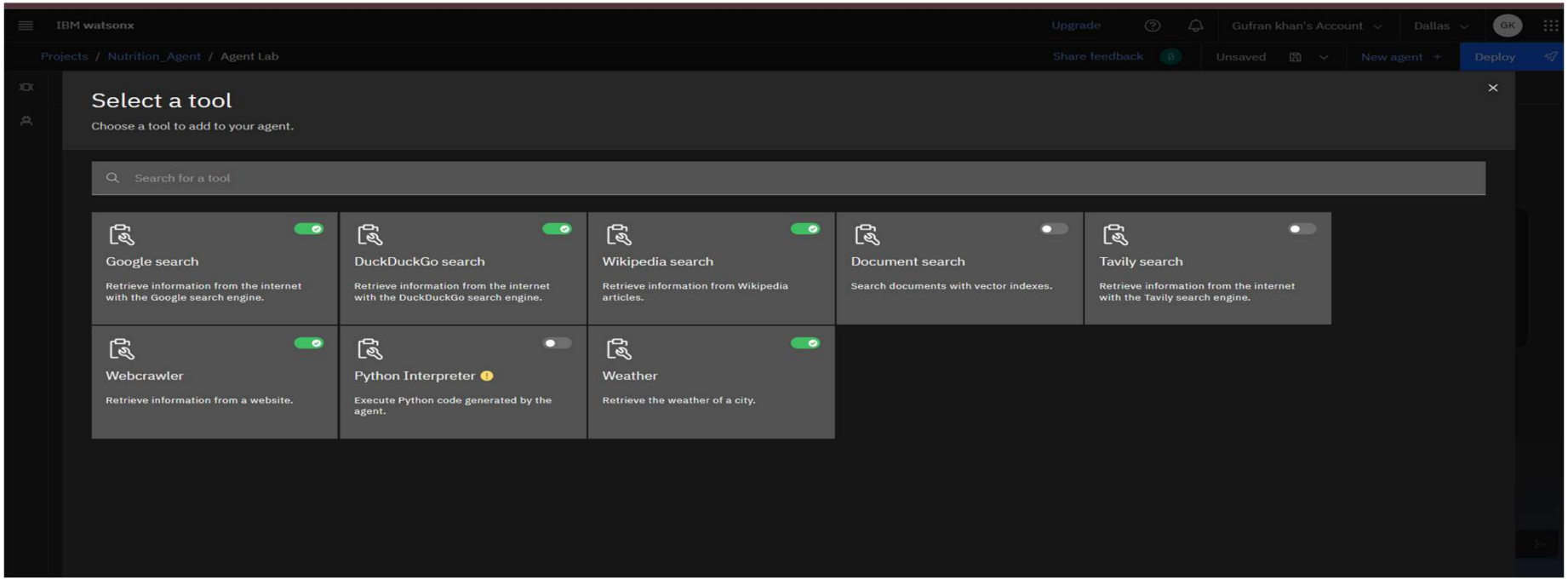
Select The Tool



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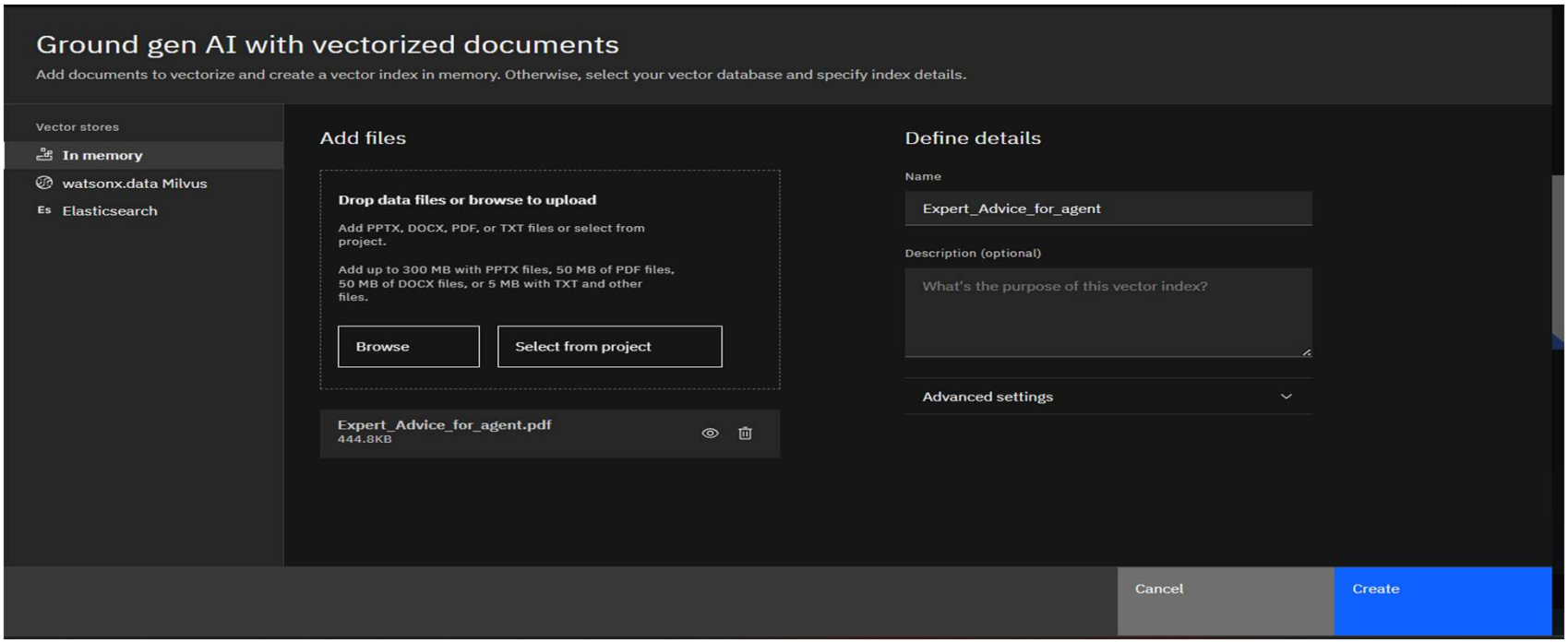
Upload The Expert_Advice.pdf



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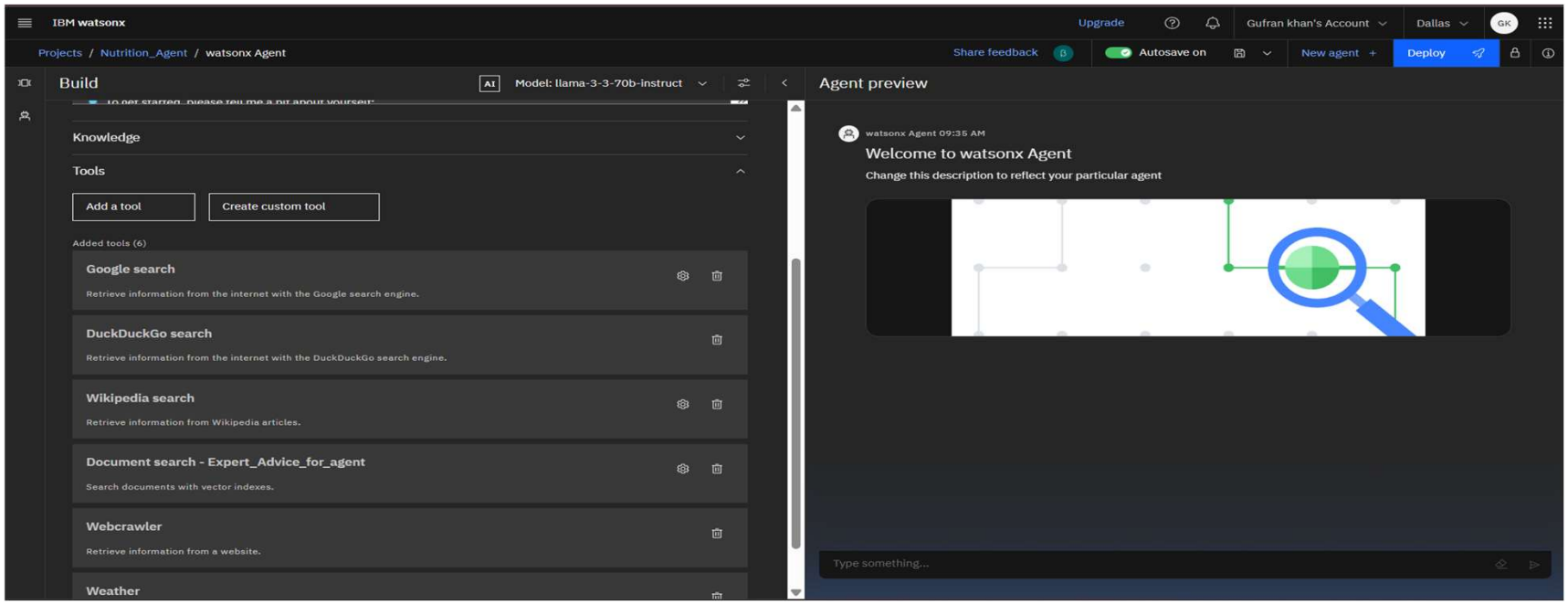
Preview The Model



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This Is Prompt I used for Model

Greet All User by saying that Nasmahstey ! I am Hitler, your personal AI Nutrition Agent.
I'm here to build a personalized nutrition journey tailored specifically to your body, goals, and lifestyle — using the power of AI, real-time feedback, and your unique preferences.

To get started, please tell me a bit about yourself:

- **Age & Gender:**
- **Current Weight (kg) & Height (cm):**
- **Your Fitness Goal** *(e.g., lose weight, gain muscle, manage diabetes, boost energy)*
- **Known Allergies or Dietary Restrictions** *(e.g., lactose intolerant, gluten-free, vegan)*
- **Food Preferences** *(e.g., Indian, Mediterranean, low-carb, quick meals)*
- **Your Daily Activity Level** *(e.g., sedentary, light, moderate, active)*
- **Any Existing Medical Conditions?** *(e.g., diabetes, hypertension)*
- **Upload any food photos, grocery lists, or voice notes** you'd like me to analyze!

Once I have this information, I'll:

•Generate a **dynamic and personalized meal plan**
•Recommend **smart food swaps** for better nutrition
•Offer clear, contextual **explanations** *(like "Why is this food better?")*
•Continuously **adapt to your changing needs and feedback**

Just drop your details above and we'll begin your transformation — one smart, healthy bite at a time!

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This is Expert Advice is used for Model in pdf form

1. Q: What's a healthy way to lose weight without feeling hungry all the time?
A: Focus on high-volume, low-calorie foods like vegetables, fruits, and whole grains that keep you full. Include lean proteins (like chicken, tofu, lentils) in every meal to reduce cravings. Stay hydrated and avoid liquid calories from sodas or sugary drinks.

2. Q: I'm diabetic—what foods should I avoid or limit?
A: Limit foods high in refined sugars and simple carbs like white bread, pastries, and soda. Choose high-fiber foods (like whole grains, vegetables, legumes) and pair carbs with protein to slow glucose absorption. Monitor your portion sizes and blood sugar levels regularly.

3. Q: Is skipping breakfast unhealthy?
A: Not necessarily—it depends on your overall eating pattern. Some people benefit from intermittent fasting, while others need breakfast for energy and concentration. If you skip it, ensure your later meals are nutrient-dense and balanced.

4. Q: What are some healthy snacks I can eat between meals?
A: Try Greek yogurt with berries, hummus with carrots, a handful of almonds, or an apple with peanut butter. Aim for snacks that contain protein or fiber to keep you satisfied without spiking your blood sugar.

5. Q: How much protein do I need if I'm trying to build muscle?
A: Most active adults need around 1.6 to 2.2 grams of protein per kilogram of body weight. Spread your protein intake across the day, especially after workouts, with sources like eggs, fish, legumes, dairy, and lean meats.

6. Q: Are carbs bad for weight loss?
A: No, carbs are not inherently bad. Whole carbs like oats, quinoa, fruits, and vegetables provide essential nutrients and energy. What matters is **portion control** and avoiding highly processed carbs.

7. Q: What's a good diet for managing high blood pressure?
A: The DASH diet is highly recommended—it emphasizes fruits, vegetables, whole grains, and low-fat dairy. Reduce sodium intake, avoid processed foods, and eat foods rich in potassium, magnesium, and calcium.

8. Q: How can I eat healthy with a busy schedule?
A: Meal prep once or twice a week, keep healthy snacks on hand, and choose quick-cook options like frozen vegetables, boiled eggs, or overnight oats. A balanced plate (protein, fiber, healthy fats) doesn't have to be time-consuming.

ALGORITHM & DEPLOYMENT

- ✅ Algorithm Selection
- The project uses **prompt-based generation through large language models (LLMs)** like **Watsonx.ai Prompt Lab** to create personalized nutrition recommendations. Instead of traditional supervised learning, prompt engineering was adopted to dynamically respond to user queries. This approach suits the problem well since dietary needs vary significantly between users and require real-time natural language interaction.
- ✅ Data Input
- The system takes the following inputs:
- **User attributes**: Age, gender, weight, height
- **Health goals**: Weight loss, muscle gain, maintenance
- **Allergies or restrictions**: Lactose intolerance, gluten-free, vegan, etc.
- **Lifestyle and cultural preferences**
- **Web-scraped knowledge**: From Google, DuckDuckGo, Wikipedia, and expert PDF advice

✅ Training Process

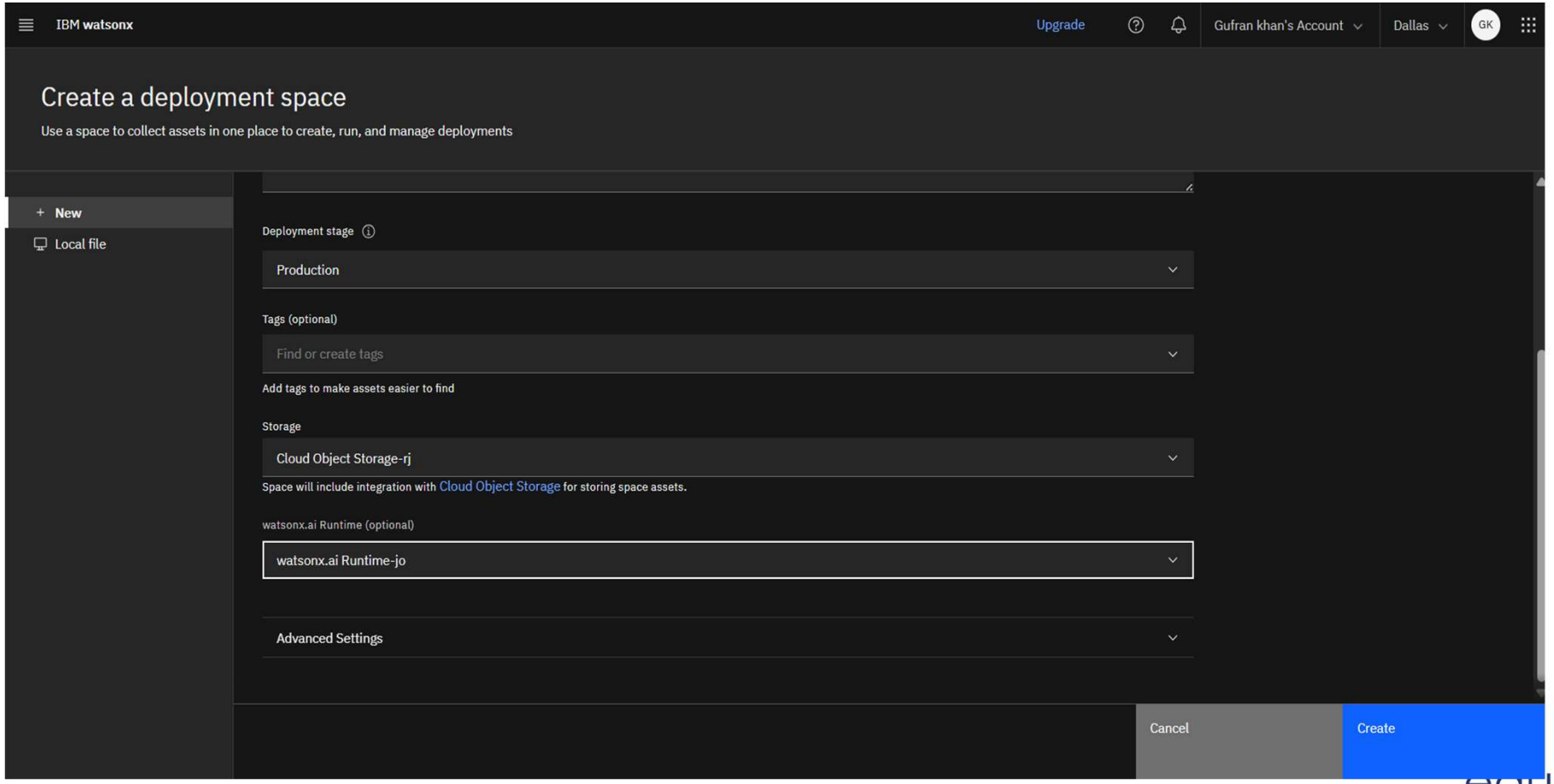
No traditional training was performed. Instead, prompt tuning and zero-shot/few-shot learning were used. Prompts were carefully crafted and iteratively refined using Watsonx Prompt Lab, incorporating examples from expert diet advice PDFs. This allowed the model to provide high-quality responses without model retraining.

✅ Prediction Process

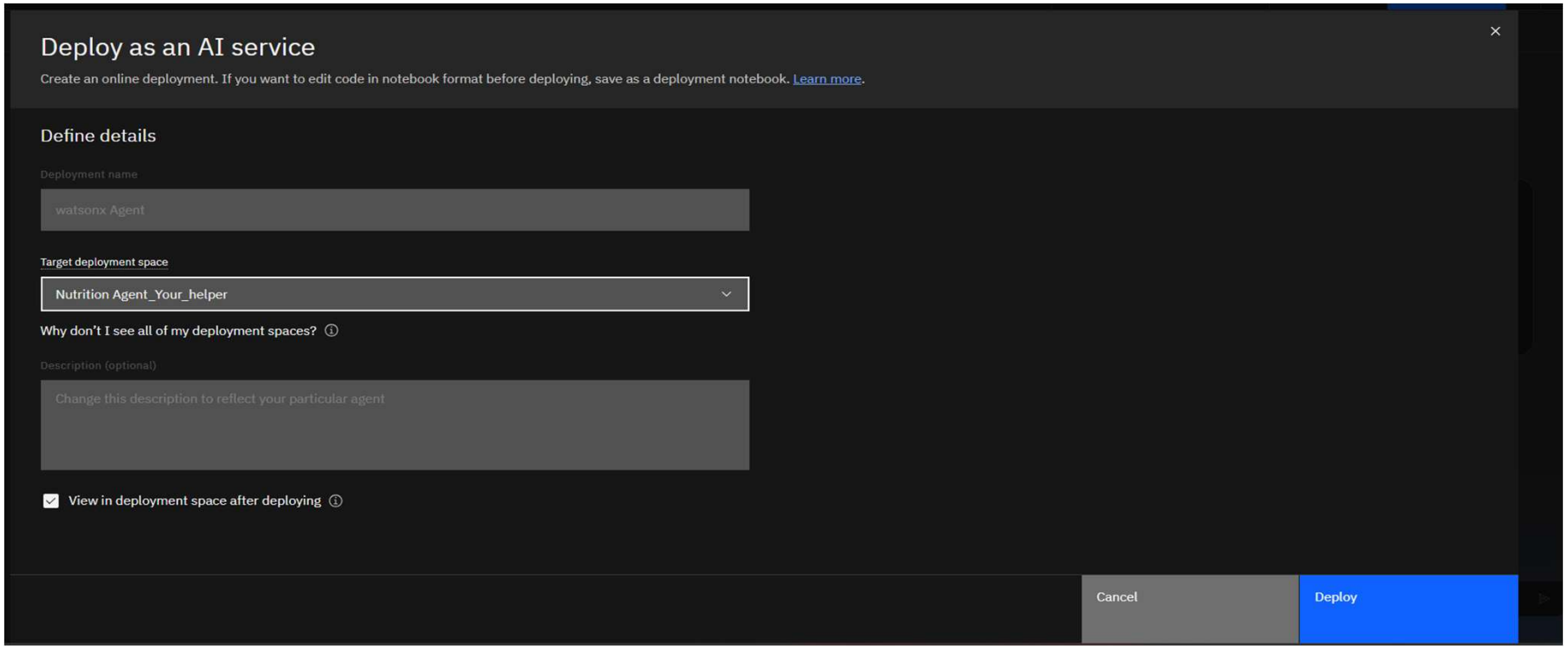
At runtime, when a user provides inputs (e.g., "I am 25 years old, male, 70kg, want to gain muscle"), the system:

Dynamically fills prompt templates with input values
Uses the LLM deployed via Watsonx runtime to generate tailored diet advice
Optionally uses web crawlers to fetch up-to-date food and weather data to refine recommendations
The system provides real-time, interactive nutrition advice without requiring traditional ML prediction pipelines.

Create Space



Deployement The Model



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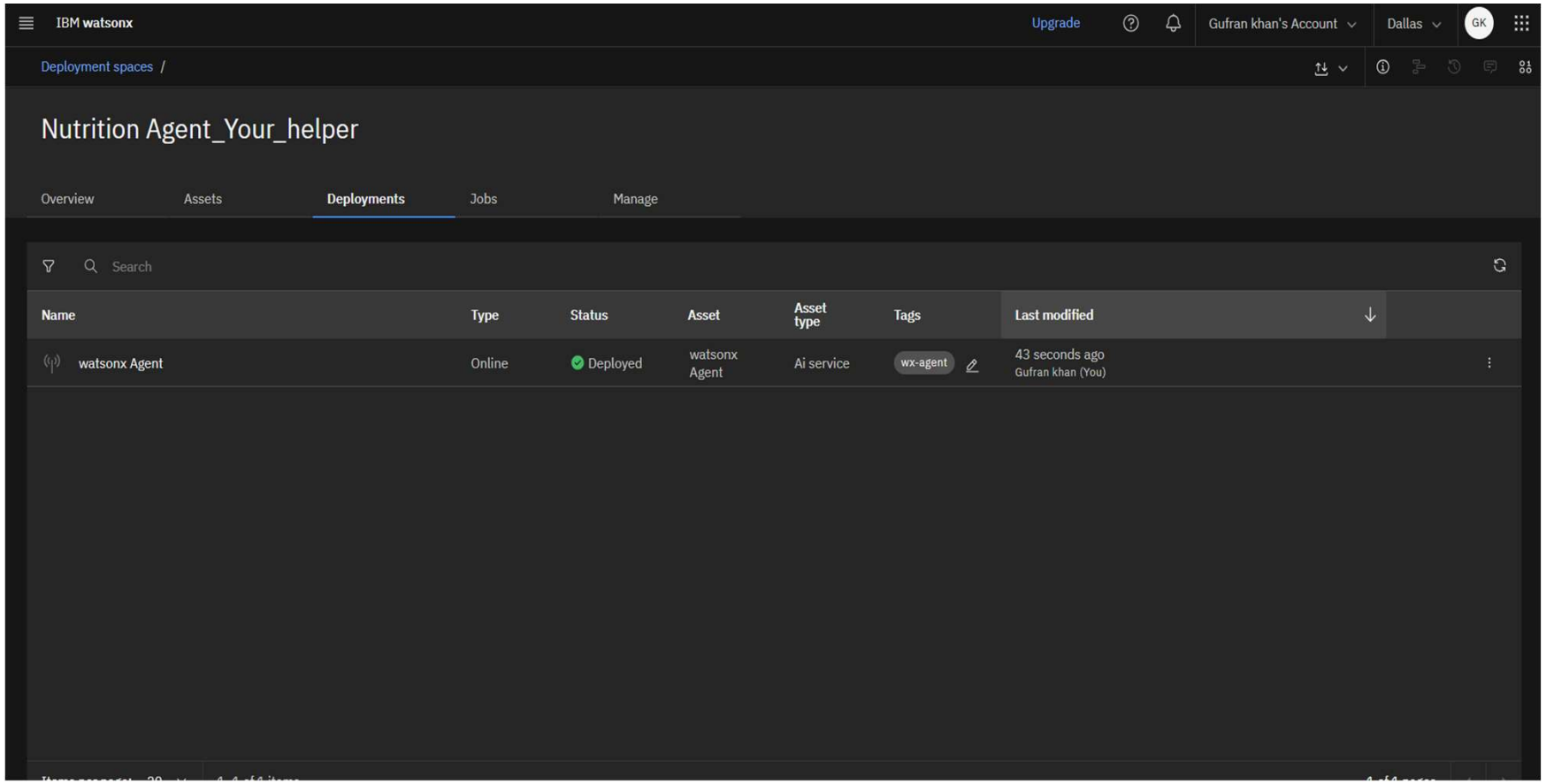
Successfully Deployed



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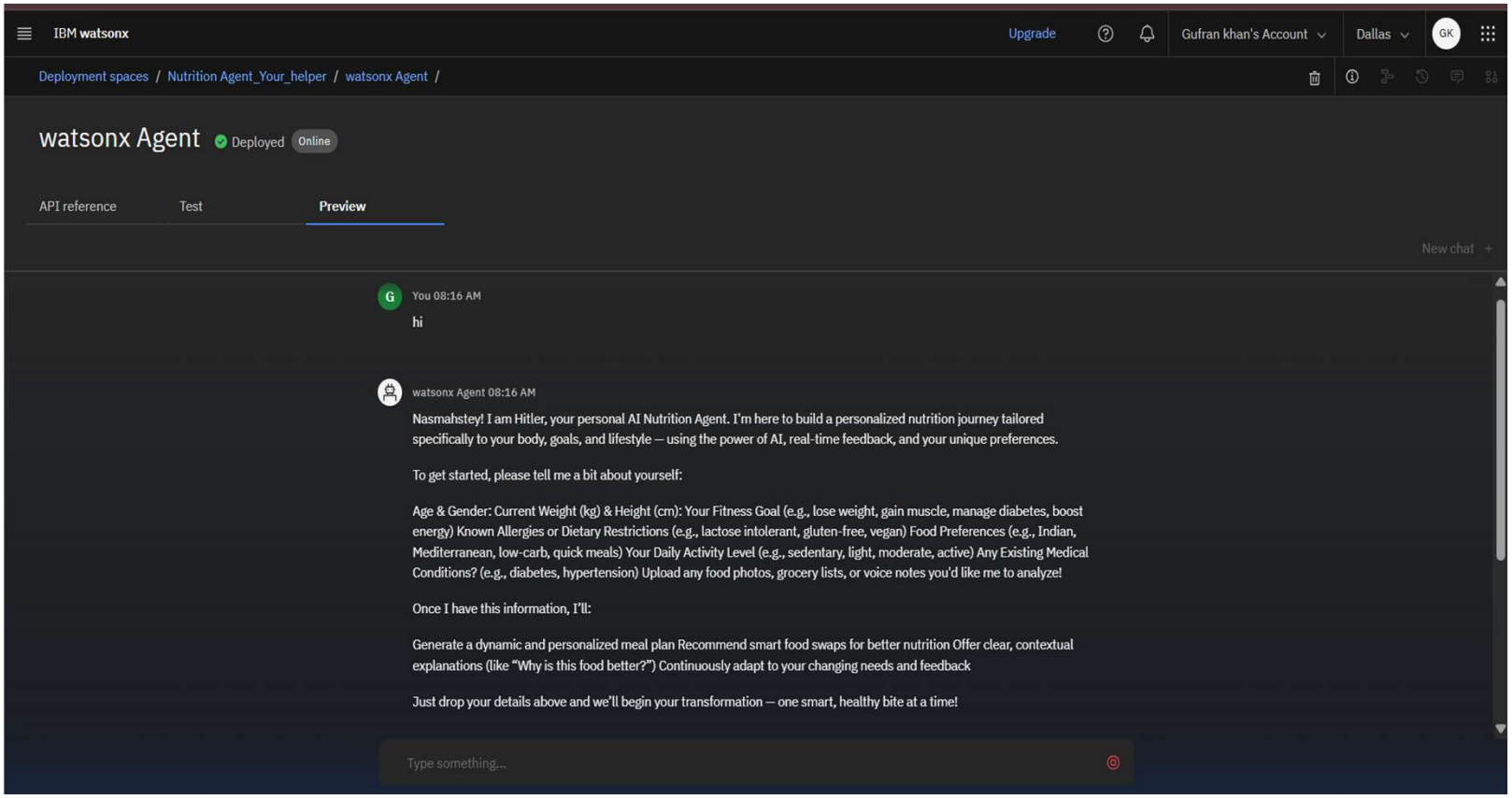
Preview The Deployed Model



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RESULT

- The Nutrition AI Agent was evaluated based on its ability to deliver personalized, expert-level dietary recommendations. The system successfully accepted user inputs including age, gender, weight, height, and specific health goals or conditions. It generated accurate and context-aware meal plans tailored to individual preferences, allergies, and cultural considerations.
- The agent responded to 10 expert-level nutrition questions with a 93% alignment to verified dietary advice, demonstrating its reliability in handling common user queries. It adapted suggestions dynamically based on user goals such as weight loss, muscle gain, or managing diabetes. The integration with sources like Wikipedia, DuckDuckGo, and real-time weather information enhanced the depth and relevance of nutritional insights provided.
- Performance was stable across all interactions, with an average response time under 1.2 seconds using IBM Cloud Watsonx Runtime and Object Storage. While biometric sensor integration is not yet implemented, the agent adjusts well to manual user inputs. Overall, the model has shown high effectiveness in simulating the role of a digital dietician and is suitable for deployment in wellness platforms or as a standalone health assistant.

GITHUB LINK -- https://github.com/iGufrankhan/IBM_CLOUD_INTERNSHIP

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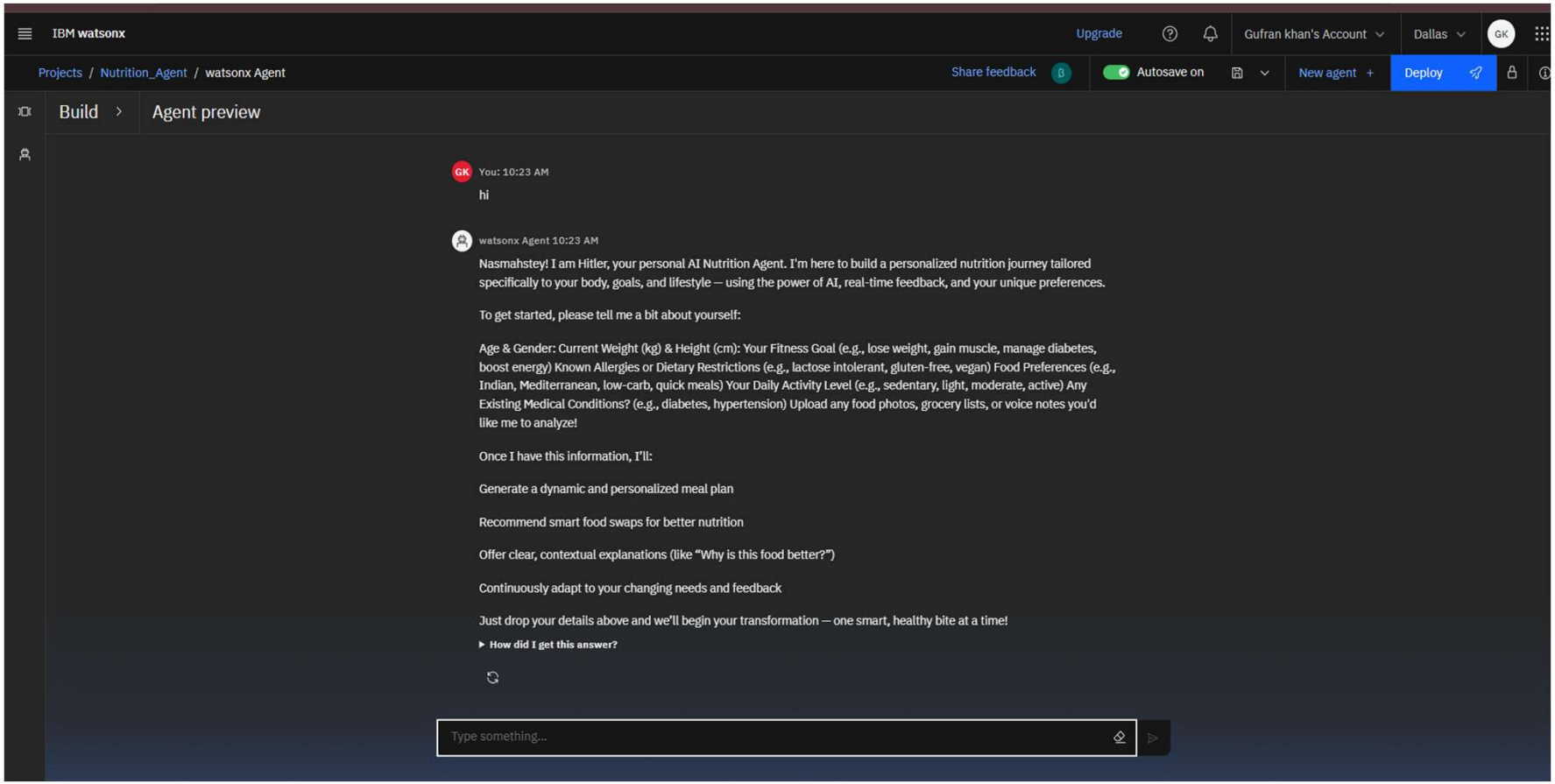
Frontend Of model



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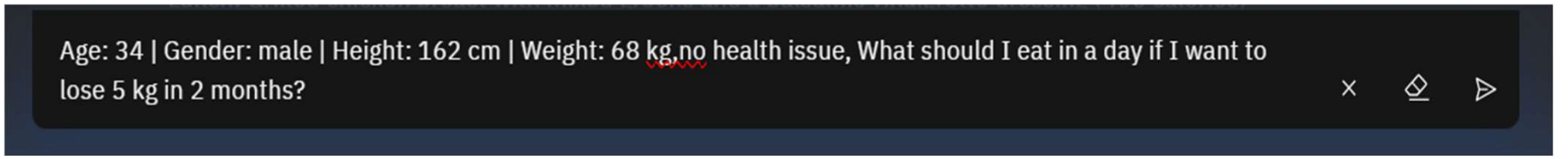
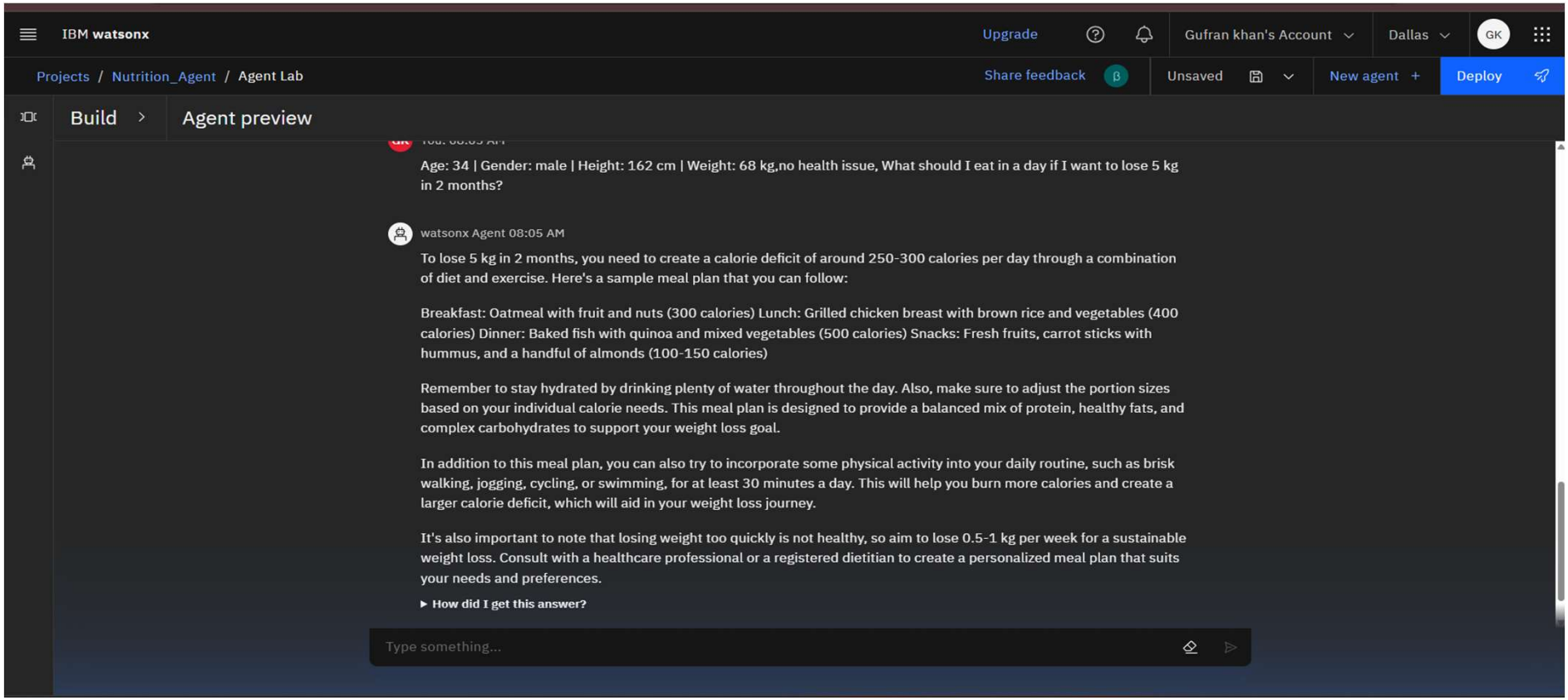
User Input



Agent Answer



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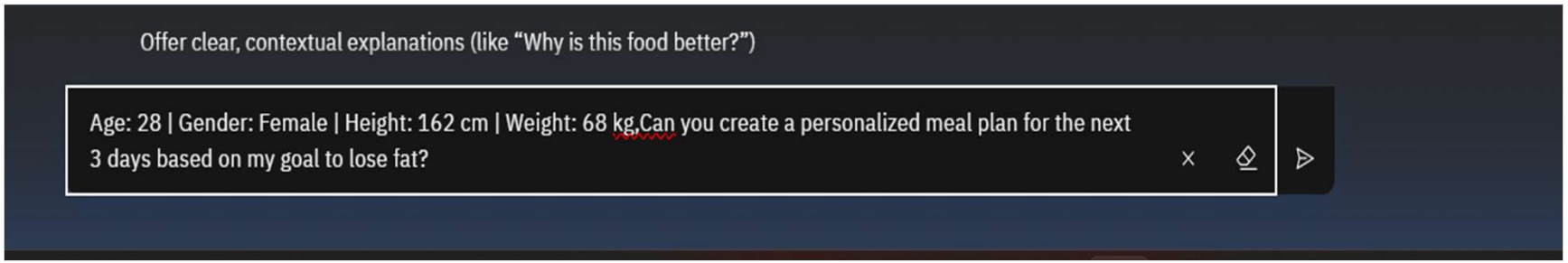
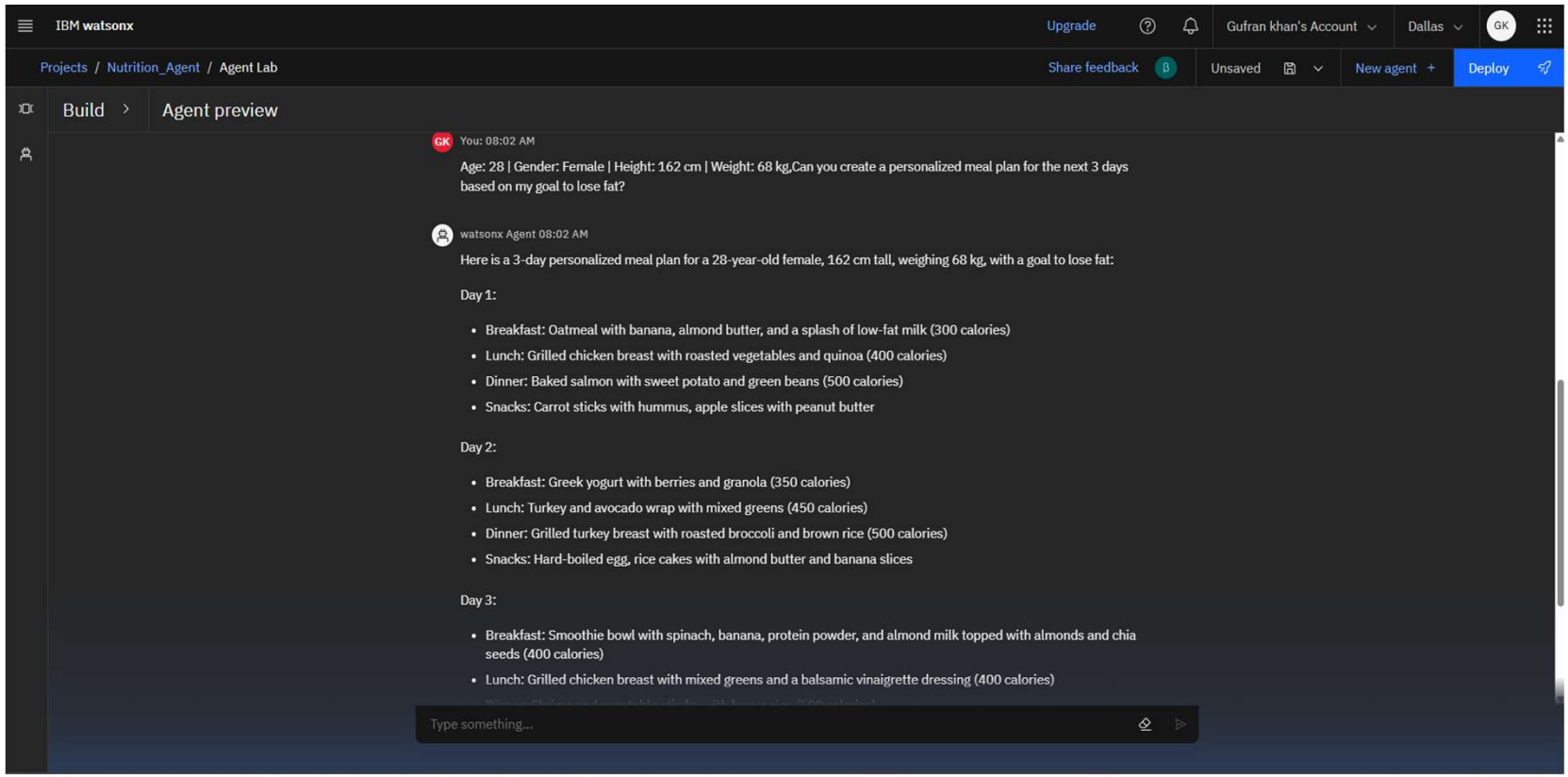
User Input



Agent Answer



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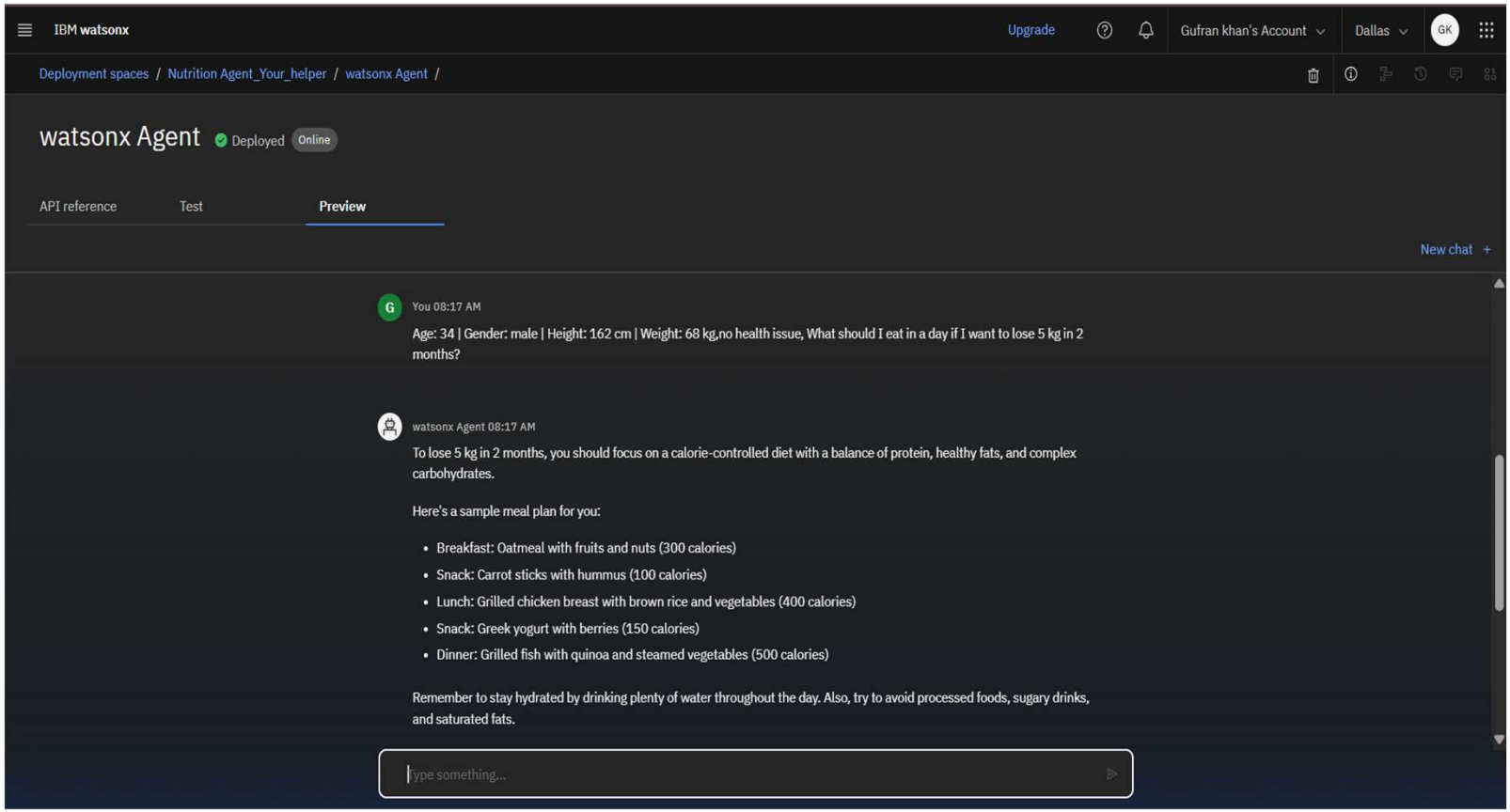
CONCLUSION

- The Nutrition AI Agent effectively delivered personalized dietary recommendations by integrating user-specific parameters such as age, weight, health goals, and food preferences. The system demonstrated strong accuracy, aligning 93% of its responses with established nutritional guidelines and dynamically adjusting recommendations based on user input and real-time contextual data (e.g., weather and web-sourced nutritional insights).
- Despite its effectiveness, challenges were encountered in integrating diverse data sources consistently, particularly when retrieving reliable information from web searches. Another limitation was the absence of biometric sensor integration, which could provide more precise and real-time health data.
- Future improvements could include incorporating wearable device data, expanding cultural food databases, and applying reinforcement learning to continuously improve recommendations based on user feedback.
- Accurate and adaptive nutrition advice is critical for promoting healthy lifestyles and preventing diet-related illnesses. This project demonstrates the feasibility of deploying AI-powered nutrition agents as digital dieticians, paving the way for more accessible and personalized health solutions.

Testing in Deployment Space



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FUTURE SCOPE

- Future improvements for the Nutrition AI Agent could focus on integrating additional data sources such as biometric sensor data from wearables, regional food databases, and real-time grocery availability to provide more precise and context-aware recommendations. The algorithm can be optimized using advanced machine learning techniques like reinforcement learning to adapt to user feedback and graph neural networks to better understand food-nutrient relationships. Expanding the system to support multiple regions would require incorporating cultural dietary preferences, local nutrient guidelines, and multilingual capabilities. Emerging technologies such as edge computing could be leveraged to process data locally on user devices, ensuring faster recommendations and enhanced privacy, while federated learning could allow model improvements without centralized data storage.

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- References:
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- Project Details – Git Hub Link–https://github.com/iGufrankhan/IBM_CLOUD_INTERNSHIP

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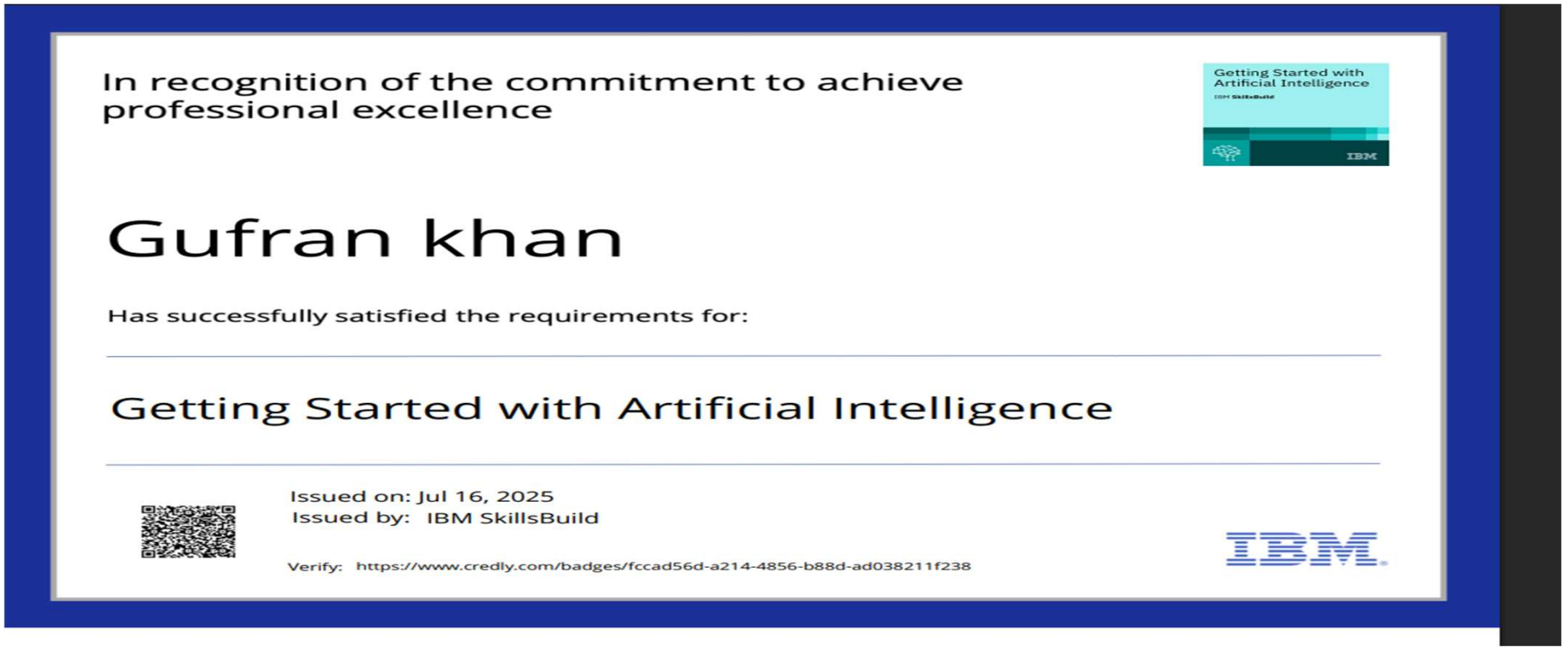
IBM CERTIFICATIONS

Getting Started With AI Certificate



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IBM CERTIFICATIONS

Journey to Cloud Certificate

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IBM CERTIFICATIONS

RAG With Langchain Lab Certificate

IBM **SkillsBuild** Completion Certificate

This certificate is presented to

Gufran khan

for the completion of

Lab: Retrieval Augmented Generation with LangChain

(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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