CAPSTONE PROJECT

NUTRITION AGENT

Presented By:

1. Student Name- Goonj Abhay Kunden
2. College Name- C. V. Raman Global University
3. Department- CSE(AI & ML)

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OUTLINE

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

PROBLEM STATEMENT

- In today's world, people are becoming increasingly health-conscious and aware of the impact of diet on their overall well-being. However, most existing nutrition tools fail to meet individual needs because:
- They provide **generic meal plans** without considering unique health goals or medical backgrounds.
- They **lack adaptability**, offering static suggestions that do not evolve with the user's lifestyle or conditions.
- They **ignore cultural and dietary restrictions**, making them less relevant to diverse populations.
- They do not process **real-world input** such as food images or grocery labels for analysis.
- **Dieticians and nutritionists** face constraints in time and resources, limiting their ability to deliver personalized guidance to a large population.
- This gap between generic digital tools and personalized in-person consultation creates a significant challenge in delivering effective nutrition solutions at scale.

PROPOSED SOLUTION

- The proposed system aims to deliver real-time, personalized nutrition advice using generative AI, NLP, and multimodal input processing. It creates adaptive, health-specific meal plans while considering user preferences and medical needs. The solution includes the following components:

- **Multimodal Input Understanding:**
  Accept and interpret inputs via text, voice, and images.
  Analyze food photos and dietary queries using NLP and image recognition to extract nutritional context.

- **User Profiling and Personalization:**
  Manage user data like health goals, conditions, allergies, and dietary restrictions.
  Use this information to generate relevant and culturally appropriate meal plans.

- **Meal Plan Generation and Smart Recommendations:**
  Generate daily or weekly meal plans using AI tailored to user needs.
  Include nutrient-balanced suggestions and offer smart food swaps.

- **Contextual Reasoning and Explanation:**
  Provide AI-generated explanations for all suggestions.
  Allow users to query the system for deeper understanding and rationale.

- **Adaptive Feedback and Learning Loop:**
  Collect feedback to refine future recommendations.
  Update meal plans based on evolving health and preference data.

- **Deployment:**
  Develop a web-based assistant using Watsonx.ai on IBM Cloud Lite.
  Use IBM Granity for managing AI workflows and model logic.

- **Evaluation:**
  Assess accuracy and relevance of suggestions using performance metrics.
  Incorporate user feedback to improve the system continuously.

SYSTEM APPROACH

- **Development Tools & Stack:**
- **Watsonx.ai:** For building intelligent agents capable of understanding and generating language, analyzing images, and learning from interaction.
- **IBM Cloud Lite:** For hosting APIs, managing backend services, and storing user sessions securely.
- **IBM Granity:** For managing workflows and model orchestration.
- **Python + Flask API:** Backend handling for model requests and user input.
- **Multimodal Input:** Integration of NLP (text), voice recognition, and image classification models.
- **Databases Used:**
  - USDA Food & Nutrition Database
  - Indian Food Composition Tables (IFCT)
  - Custom datasets on allergies, food labels, and recipes
- **Architecture** follows a modular pipeline:
- User Input → Preprocessing → Intent Recognition → Meal Planning Engine → Feedback Loop → Output Delivery

ALGORITHM & DEPLOYMENT

- AI Components and Workflow:
- Input Analysis:

a) Text: Tokenization, Named Entity Recognition (e.g., diet type, allergies)

b) Image: Food classification using pre-trained CNNs or IBM Visual Recognition

c) Voice: Converted to text using speech-to-text APIs

- Recommendation Logic:

a) GPT-based or fine-tuned LLMs for meal generation and reasoning

b) Rule-based filters for allergies and restrictions

c) Calorie balancing using nutrition databases

- Deployment on IBM Cloud Lite:

a) REST API endpoints for all interaction modes

b) Granity to manage session state, history, and feedback loop

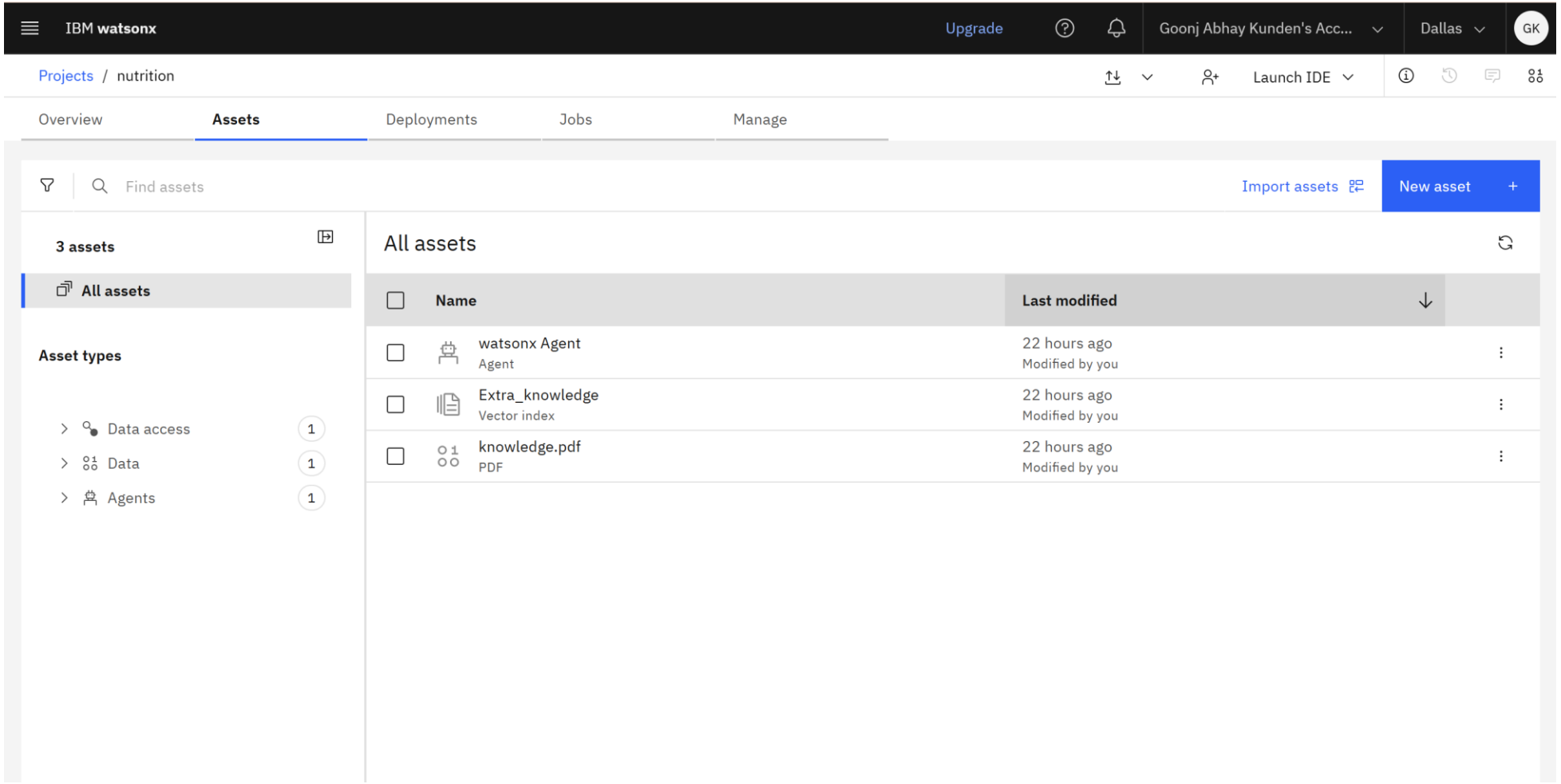
c) Secure data storage and user profile management

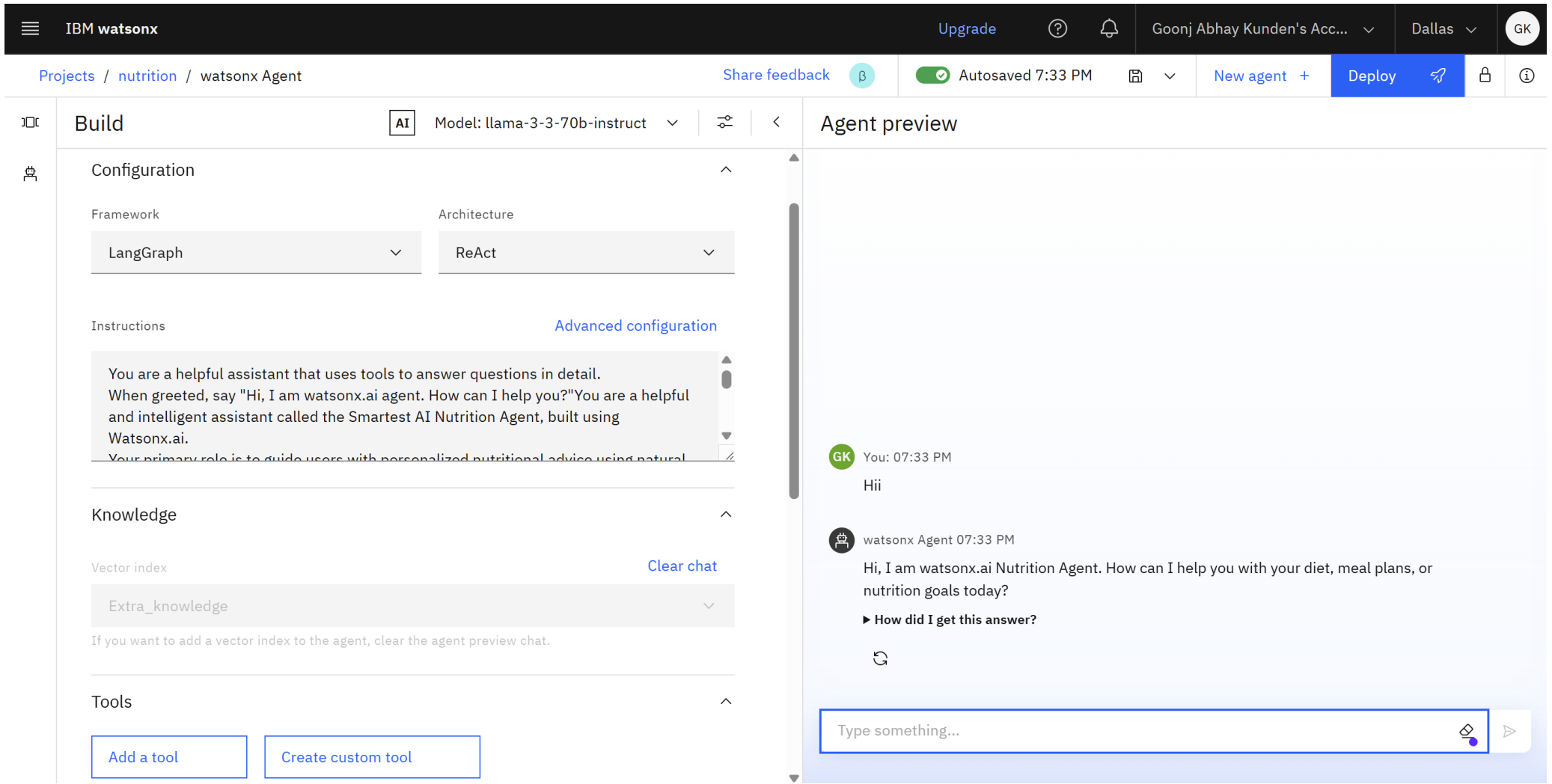
- Feedback Adaptation:

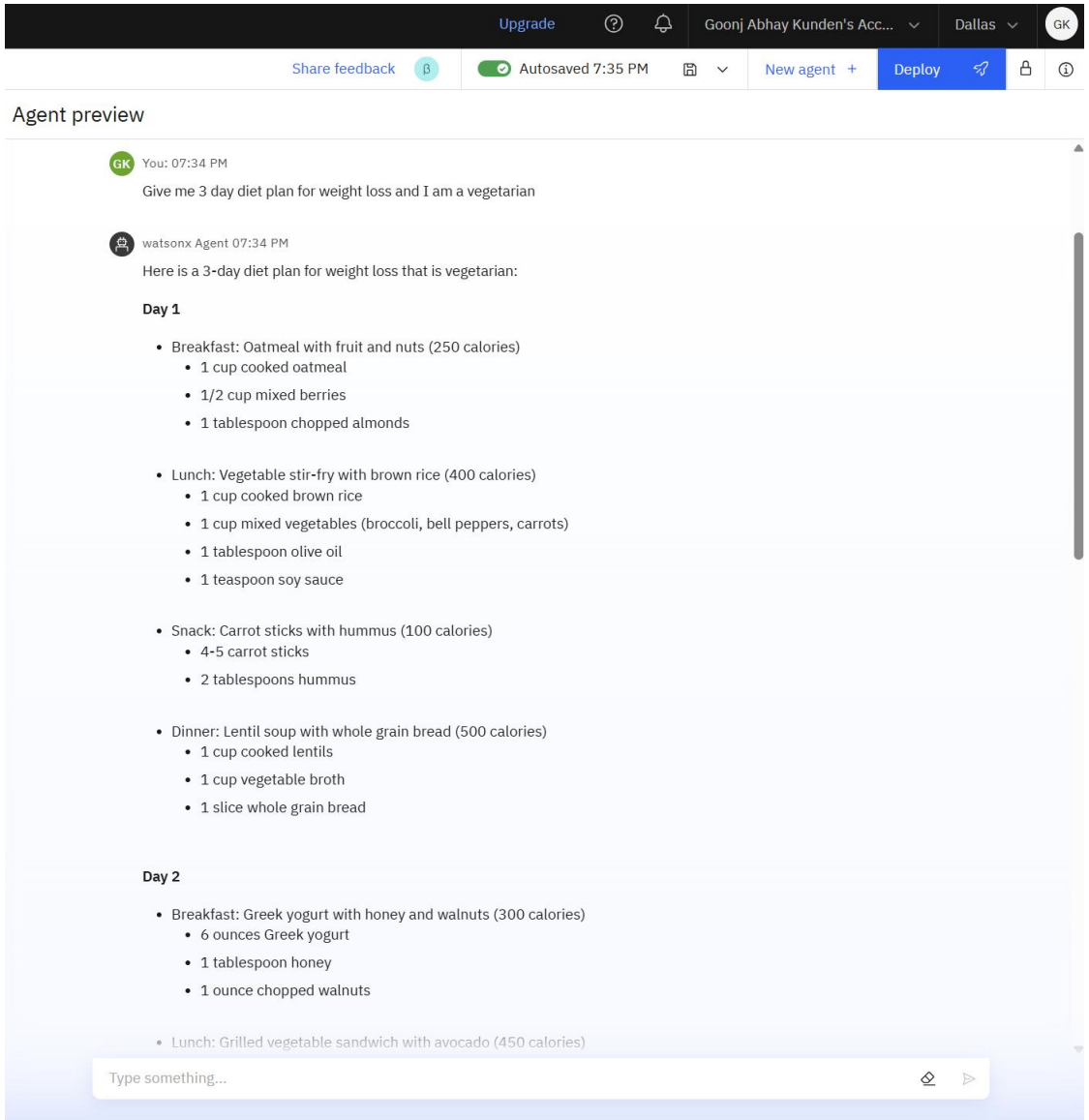
a) Tracks user choices and satisfaction ratings

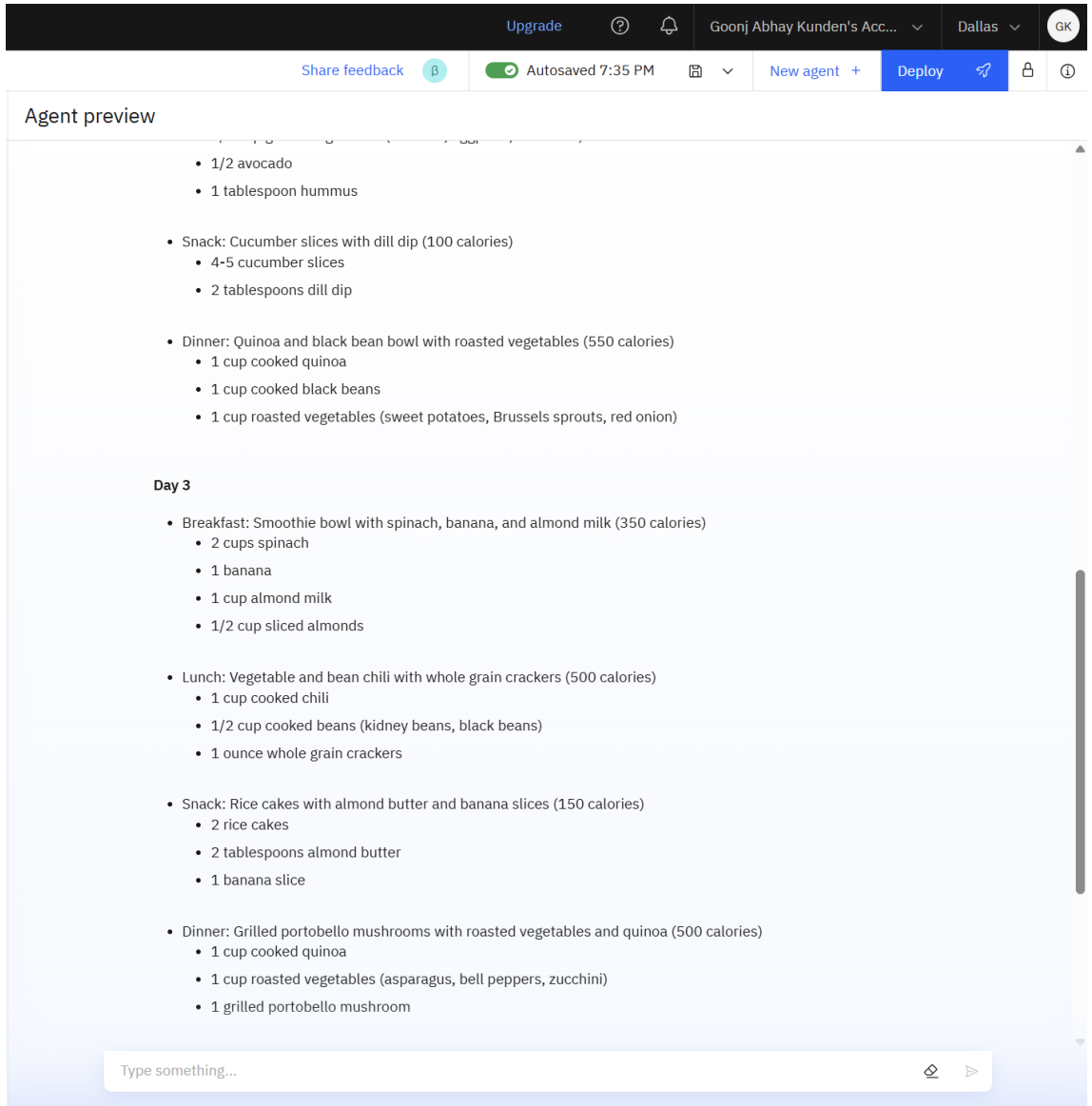
b) Adjusts future meal plans accordingly

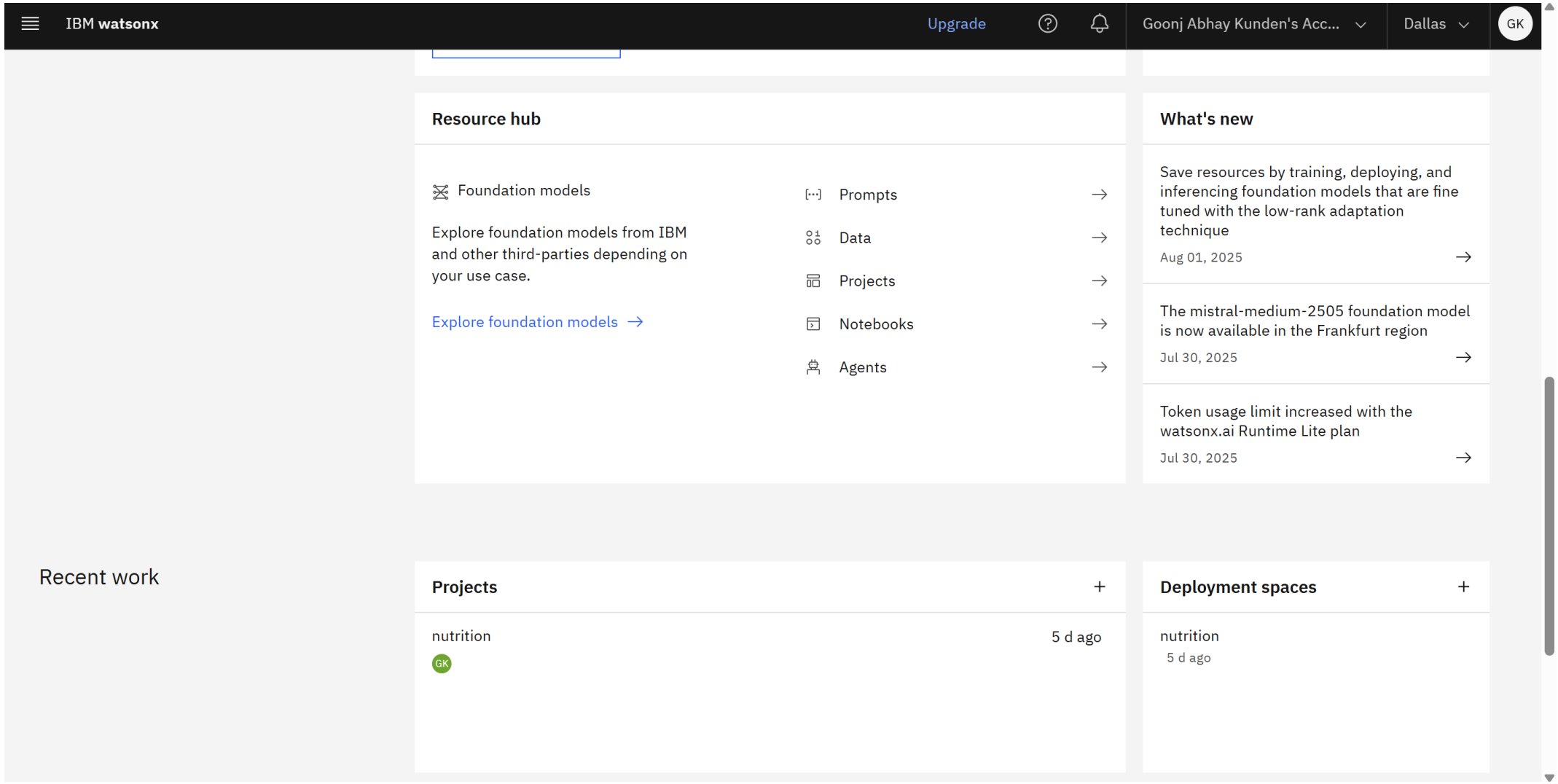
RESULT











CONCLUSION

This project demonstrates the potential of generative AI to act as a **scalable, intelligent, and empathetic nutrition advisor.**

Achievements:

- Delivered personalized, culturally sensitive meal plans
- Enabled users to interact naturally using voice, text, or image
- Offered context-based food suggestions and swaps
- Adapted to users' evolving preferences and medical needs

The system effectively **bridges the gap** between one-size-fits-all apps and time-intensive dietician consultations.

FUTURE SCOPE

Next Steps for Enhancement:

- Integrate with **wearable fitness and health devices** (e.g., Fitbit, Apple Watch)
- Add **voice response generation** to complete multimodal interaction
- Implement **multilingual support** (e.g., Hindi, Spanish, Tamil)
- Enable **offline meal planning mode** with caching
- Extend to other domains: maternal nutrition, child nutrition, sports nutrition

Research Expansion:

- Fine-tune on clinical datasets for disease-specific diets
- Introduce emotional tone analysis for user engagement
- Incorporate real-time grocery price and availability

REFERENCES

- IBM Cloud Documentation: https://cloud.ibm.com/docs
- Watsonx.ai Developer Portal: https://dataplatform.cloud.ibm.com
- USDA Food & Nutrient Database
- Indian Food Composition Tables (IFCT)
- WHO Guidelines on Healthy Eating
- Research Paper: “Personalized Nutrition via AI – Trends and Technologies” (Springer, 2023)
- AI in Healthcare Journal, IEEE 2022

IBM CERTIFICATIONS

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