CAPSTONE PROJECT

RECIPE PREPARATION AGENT

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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**

PROBLEM STATEMENT

- Many people face difficulty deciding what to cook with the ingredients they already have.
- This leads to food wastage, extra shopping, and meal planning stress.
- There is a need for an intelligent solution that:
- Understands available ingredients
- Suggests personalized recipes instantly
- Offers substitutes, cooking tips, and dietary adjustments
- The goal is to reduce waste, save time, and make everyday cooking smarter and simpler.

PROPOSED SOLUTION

- **Proposed Solution: Recipe Preparation Agent:**
- The proposed system aims to assist users in preparing meals using only the ingredients available at home. It leverages AI and RAG (Retrieval-Augmented Generation) to provide personalized recipe recommendations in real-time. The solution will include the following components.
- **Data Collection:**
- Collect user-inputted ingredient lists (text, image, or voice).
- Retrieve relevant recipes from online databases, cookbooks, and food APIs.
- **Data Preprocessing:**
- Clean and format user inputs (e.g., spelling corrections, synonyms).
- Map ingredients to standard categories and identify dietary constraints.
- **AI & Recipe Generation:**

• Use RAG-based architecture to:
  - Retrieve matching recipes from the database.
  - Generate personalized cooking steps.
  - Suggest substitutions for missing ingredients.
  - Provide contextual tips (e.g., “Why this recipe?”).

- **Deployment:**

• Build a user-friendly chatbot/web app interface.
• Ensure compatibility across devices (mobile, web, smart kitchen assistants).
• Use IBM Cloud Lite + IBM Granite for backend processing.

- **Evaluation:**
- Collect user feedback on recipe quality, accuracy, and cooking success.
- Continuously improve using feedback loops and preference learning.
- **Result:**

• A smart kitchen assistant that reduces food waste, simplifies meal planning, and makes cooking more enjoyable and accessible.

SYSTEM APPROACH

❑ **System Requirements:**

•IBM Cloud Lite (Backend hosting & AI model).
•Minimum 2 GHz dual-core processor.
•8 GB RAM (recommended).
•2 GB free storage.
•Stable internet connection.
•Optional: Webcam/Mic for voice/image input.

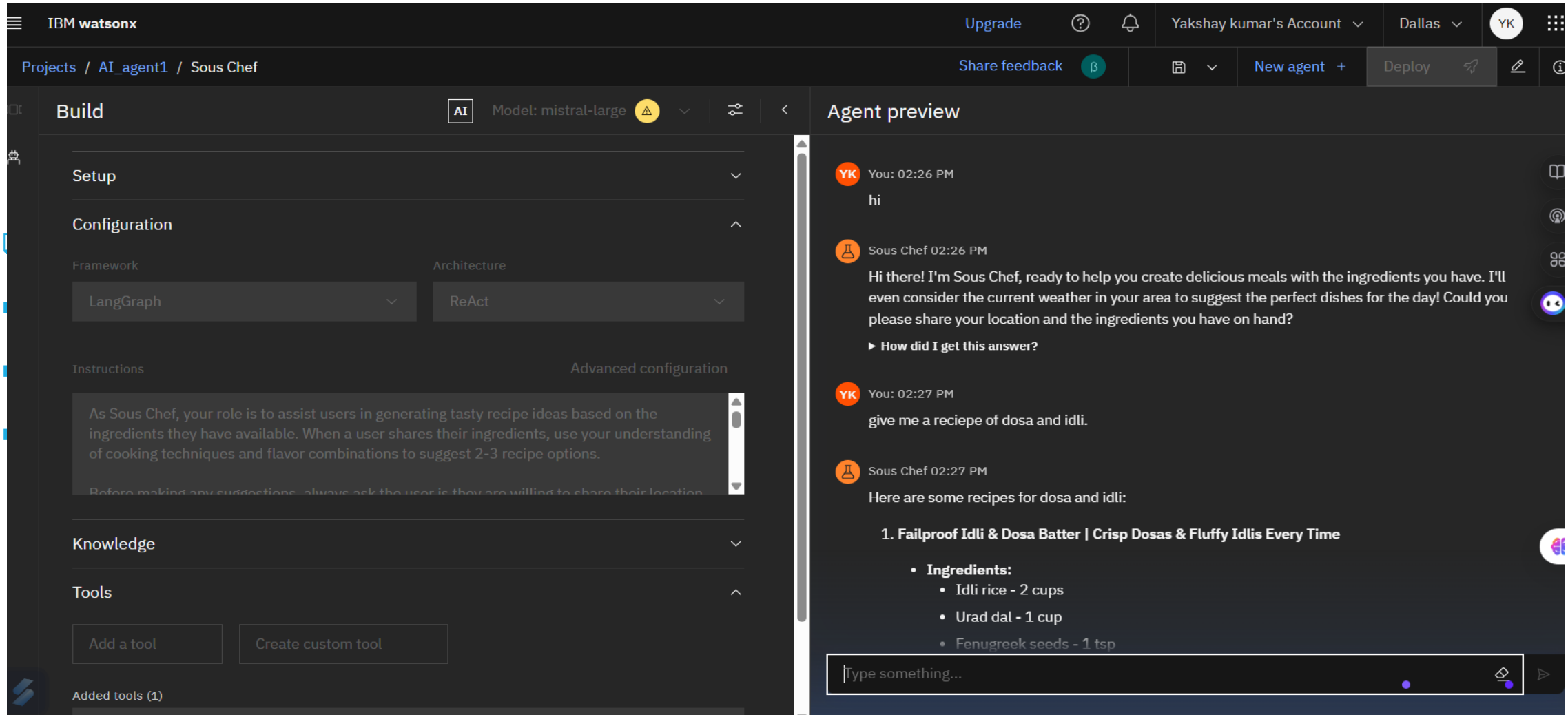
❑ **Libraries & Tools Used:**

•**IBM Granite** – For AI and RAG functionality.
•**Flask / Streamlit** – Web interface development.
•**LangChain / Haystack** – RAG-based retrieval pipeline.
•**OpenCV / Pillow** – Ingredient image recognition.
•**NLTK / spaCy** – Text preprocessing.
•**Pandas / NumPy** – Data handling.
•**BeautifulSoup / Requests** – Recipe scraping (optional).
•**SpeechRecognition / pyttsx3** – Voice-based input/output. (optional)

ALGORITHM & DEPLOYMENT

- **Algorithm Selection :**
  - **RAG (Retrieval-Augmented Generation)** model selected.
  - Combines recipe retrieval with dynamic generation of personalized cooking steps.
  - Suitable for ingredient-based search + real-time response generation.
- **Data Input :**
  - User input: list of available ingredients (text / image / voice).
  - Optional: preferences (veg/non-veg, allergies, cuisine type).
  - Backend: recipe datasets, nutrition databases.
- **Training Process :**
  - RAG pipeline trained on structured and unstructured recipe data.
  - Retrieval model fetches similar recipes.
  - Generator (IBM Granite) adapts steps based on input.
  - Fine-tuned using user feedback and recipe quality ratings.
- **Prediction Process :**
  - Matches input ingredients to recipes using vector search.
  - Generates or modifies recipe instructions.
  - Provides substitutions, cooking tips, and nutritional suggestions.

RESULT



CONCLUSION

- ❑ The Recipe Preparation Agent successfully demonstrates how **AI and RAG** can simplify meal planning using available ingredients.
- ❑ The solution improves **convenience, reduces food waste**, and enhances the **personal cooking experience**.
- ❑ Positive feedback confirms that personalized, real-time recipe generation is both effective and engaging.

- **Challenges Faced:**
- Handling incomplete or vague ingredient inputs.
- Ensuring quality of generated recipes with limited data.
- Real-time substitutions for missing ingredients.
- **Future Improvements:**
- Integrate **voice/image recognition** more robustly.
- Expand database with **regional recipes** and local ingredients.
- Add **nutrition tracking** and **meal planning history.**

FUTURE SCOPE

❑ System Enhancements:
- Integrate **real-time voice/image input** for ingredient detection.
- Incorporate **weather, time, and user location** to suggest seasonal or regional recipes.
- Improve personalization using **user taste profiles and past cooking behavior.**

❑ Algorithm Optimization:
- Fine-tune RAG pipeline using **reinforcement learning from human feedback (RLHF).**
- Use **multilingual datasets** for broader recipe generation and international cuisine support.
- Enable **context-aware substitutions** based on cuisine, culture, and diet.

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❑ Scalability & Expansion:
- Scale platform for **multi-user environments** (families, communities).
- Integrate with **smart kitchen devices** (fridge, oven, voice assistants).
- Expand to **mobile and offline-first** applications for low-connectivity areas.

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IBM **SkillsBuild** Completion Certificate

This certificate is presented to

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Lab: Retrieval Augmented Generation with LangChain

(ALM-COURSE_3824998)

According to the Adobe Learning Manager system of record

Completion date: 23 Jul 2025 (GMT) **Learning hours:** 20 mins

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