
CAPSTONE PROJECT

RECIPE PREPARATION AGENT

Presented By:

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OUTLINE

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

PROBLEM STATEMENT

The Challenge - A Recipe Preparation Agent helps users cook meals using only the ingredients they have on hand. By inputting available groceries, users receive tailored recipe suggestions using a **RAG-based AI system**. The agent retrieves relevant recipes and generates step-by-step instructions adapted to ingredient limitations. It offers substitutions, cooking tips, and dietary adjustments based on user preferences or restrictions. Designed to reduce food waste and save time, it turns pantry items into practical meal solutions. This AI assistant makes everyday cooking smarter, simpler, and more sustainable.

PROPOSED SOLUTION

- **Proposed Solution:** The proposed solution is a smart, RAG-based conversational AI agent designed to empower users to cook with confidence using their available ingredients. This system directly tackles the challenges of food waste and time-consuming meal planning by transforming a user's pantry into a personalized meal guide.
- **Core System Architecture:**
 - The solution is built on a Retrieval-Augmented Generation (RAG) framework, a highly effective pattern for grounding large language models (LLMs) in a specific knowledge base. This architecture ensures that the agent's output is not only creative and conversational but also accurate and relevant to a curated set of recipes.
- **User Input:** The agent begins by accepting a simple list of ingredients from the user (e.g., "chicken, rice, broccoli, soy sauce").
- **Information Retrieval:** The system queries a specialized recipe knowledge base—a database containing a wide variety of structured recipes. It intelligently retrieves the most suitable recipes that can be made using the user's input, prioritizing those with the highest ingredient overlap.
- **Contextual Augmentation:** The retrieved recipe data, which includes detailed ingredients, instructions, and potential variations, is combined with the user's initial request. This forms a rich, contextual prompt.
- **Generative AI Processing:** The augmented prompt is then passed to a powerful foundation model, such as one of the IBM Granite models available through **IBM watsonx.ai**. The model's task is to analyze the context and generate a tailored response.
- **Personalized Output:** The final output is a user-friendly, structured recipe that includes:
 - A step-by-step cooking guide adapted to the user's ingredients.
 - Intelligent substitutions for any missing items.
 - Practical cooking tips and techniques.
 - Dietary adjustments or alternative suggestions based on user preferences.

SYSTEM APPROACH

It outlines the overall strategy and methodology for developing and implementing the recipe preparation agent.

- **System requirements**

Category	Requirement / Tool	Purpose / Notes
Hardware	RAM: 4 GB (8 GB recommended)	Smooth browser and cloud tool usage
	CPU: Dual-core or higher	Basic processing needs
	Storage: 2 GB free	For local file handling
	Display: 720p+ resolution	Proper IBM Cloud interface view
	Internet: 2 Mbps+	Stable cloud access
Operating System	Windows 10/11	Supported
	Ubuntu/Linux	Supported
	macOS	Supported
	Android/iOS (mobile)	Limited Support

SYSTEM APPROACH

It outlines the overall strategy and methodology for developing and implementing the recipe preparation agent.

- Library required to build the model

Category	Requirement / Tool	Purpose / Notes
Main Platform	IBM Watsonx.ai	To build and run the AI agent
	Runtime Environment: watsonx.ai runtime	Executes AI tasks within Watsonx agent
	IBM Cloud Object Storage	Store .txt knowledge files
	Web Browser (Chrome, Firefox, Edge)	Access IBM services
	IBM Granite Model (e.g., Granite-3-3-8b-instruct)	Foundation model used for reasoning & generation
Optional Tools		
	VS Code / Notepad++	Edit knowledge files
	Python 3.x	Preprocessing recipes (optional)
	LangChain / LlamaIndex	External RAG handling (advanced)

SYSTEM FLOW & DEPLOYMENT

System Flow: The RAG Pipeline

- The agent operates on a Retrieval-Augmented Generation (RAG) pipeline, which ensures that its outputs are both creative and grounded in a reliable knowledge base.
- **User Request:** The process begins when a user inputs a list of ingredients into the application's interface.
- **Retrieval:**
 - The system immediately queries its recipe knowledge base (stored in IBM Cloudant).
 - It searches for recipes that match or are highly relevant to the provided ingredients. This step efficiently pulls the most promising source material for the generative model.
- **Augmentation & Generation:**
 - The retrieved recipe information is then packaged into a prompt for a large language model.
 - This prompt tells the model to use the retrieved text as a guide to create a new, tailored recipe.
 - The generative model (e.g., an IBM Granite model in **watsonx.ai**) then produces the final, personalized response, which includes adapted instructions, substitutions, and tips.

Deployment

- The agent is deployed as a containerized web application to make it scalable and easily accessible.
- **Containerization:** The entire application, including the front-end interface and the Python backend that manages the RAG pipeline, is packaged into a single Docker container. This creates a portable and self-contained unit.
- **IBM Cloud Code Engine:** This Docker container is deployed to **IBM Cloud Code Engine**. This service is chosen for its ability to seamlessly run containerized workloads and automatically manage scalability, ensuring the application can handle fluctuating user demand.
- **Public Endpoint:** Once deployed, Code Engine provides a public URL for the application. Users can access this link from any web browser to interact with the Recipe Preparation Agent, allowing the solution to be globally available and easily managed.

RESULT

- A sample output showing a generated recipe based on a user's input, including:
- **Recipe Name:** A clear title.
- **Ingredients:** A list of ingredients used.
- **Instructions:** A numbered list of cooking steps.
- **Substitutions:** Suggestions for any change in the ingredients.
- **Cooking Tips:** Additional advice from the agent.

RESULT

The screenshot displays the IBM watsonx Agent Lab interface. The top navigation bar includes the IBM watsonx logo, an 'Upgrade' button, a help icon, a notification bell, and user account information for 'CHINMOY MAJEE's Account' in 'Dallas'. The main breadcrumb trail is 'Projects / RecipePreparation_Agent / Agent Lab'. The interface is divided into two main panels: 'Build' on the left and 'Agent preview' on the right.

Build Panel:

- Setup:** A dropdown menu currently showing 'Setup'.
- Configuration:**
 - Framework:** A dropdown menu showing 'LangGraph'.
 - Architecture:** A dropdown menu showing 'ReAct'.
- Instructions:** A text area containing the following content:

You are a helpful recipe assistant.

The user will enter only a list of ingredients. Based on this list, suggest one recipe that uses those ingredients. Provide:

 1. A short recipe name
 2. Step-by-step instructions
 3. Any substitutions for missing common items
 4. Cooking tips, if needed

Be brief and use only the ingredients given by the user. If a full recipe is not possible, suggest a simple snack or partial dish.
- Knowledge:** A section for adding knowledge.
- Tools:** A section for adding tools.

Agent preview Panel:

- User Input:** 'paneer, onions, tomato, salt, water, capsicum'.
- Recipe Agent Response:**
 1. Recipe Name: Paneer Capriccio
 2. Instructions:
 - Cut paneer into cubes and set aside.
 - Finely chop onions and capsicum.
 - Heat oil in a pan, add chopped onions and sauté until golden brown.
 - Add chopped capsicum and cook for a few minutes.
 - Crush tomatoes and add them to the pan. Cook until the oil separates.
 - Add paneer cubes, salt, and water (as needed to achieve desired consistency).
 - Cook for 5 minutes or until the gravy thickens.
 3. Substitutions:
 - If capsicum is not available, bell peppers can be used.
 - Any vegetable oil or ghee can be used for cooking.
 4. Cooking Tips:

At the bottom of the 'Agent preview' panel, there is a text input field with the placeholder 'Type something...' and a send button.

Image-1a

RESULT

The screenshot displays the IBM watsonx Agent Lab interface. The top navigation bar includes the IBM watsonx logo, an 'Upgrade' button, a help icon, a notification bell, and user account information for 'CHINMOY MAJEE's Account' in 'Dallas'. The main breadcrumb trail shows 'Projects / RecipePreparation_Agent / Agent Lab'. The interface is divided into two main panels: 'Build' on the left and 'Agent preview' on the right.

Build Panel:

- Model:** Set to 'granite-3-3-8b-instruct'.
- Setup:** A dropdown menu is open, showing 'Setup' as the selected option.
- Configuration:**
 - Framework:** Set to 'LangGraph'.
 - Architecture:** Set to 'ReAct'.
- Instructions:** A text area contains the following content:

You are a helpful recipe assistant.

The user will enter only a list of ingredients. Based on this list, suggest one recipe that uses those ingredients. Provide:

 1. A short recipe name
 2. Step-by-step instructions
 3. Any substitutions for missing common items
 4. Cooking tips, if needed

Be brief and use only the ingredients given by the user. If a full recipe is not possible, suggest a simple snack or partial dish.
- Knowledge:** A section for adding knowledge.
- Tools:** A section for adding tools.

Agent preview Panel:

- Instructions:** A list of steps for preparing a dish:
 - Heat oil in a pan, add chopped onions and sauté until golden brown.
 - Add chopped capsicum and cook for a few minutes.
 - Crush tomatoes and add them to the pan. Cook until the oil separates.
 - Add paneer cubes, salt, and water (as needed to achieve desired consistency).
 - Cook for 5 minutes or until the gravy thickens.
- 3. Substitutions:**
 - If capsicum is not available, bell peppers can be used.
 - Any vegetable oil or ghee can be used for cooking.
- 4. Cooking Tips:**
 - For a spicier version, add crushed red pepper flakes or diced green chilies.
 - Adjust the amount of salt and water according to taste and desired consistency.
 - For a richer flavor, you can add cashews paste while cooking. Soak 10 cashews in warm water for 10 minutes, then blend to a smooth paste and mix into the gravy.
- Note:** This recipe is a simple one-pan dish and does not include any spices. Feel free to add them according to your preference (turmeric, coriander powder, garam masala, etc.).
- How did I get this answer?** A button to view the reasoning.
- Input field:** A text box with the placeholder 'Type something...' and a send button.

Image-1b

RESULT

The screenshot displays the IBM watsonx interface for building and previewing an AI agent. The top navigation bar includes the IBM watsonx logo, an 'Upgrade' button, a help icon, a notification bell, and user account information for 'CHINMOY MAJEE's Account' in 'Dallas'. The main breadcrumb path is 'Projects / RecipePreparation_Agent / Recipe Agent'. The interface is split into two main panels: 'Build' on the left and 'Agent preview' on the right.

Build Panel:

- Model:** Set to 'granite-3-3-8b-instruct'.
- Knowledge:** A 'Vector index' section shows 'RecipeList1' as the selected index. A 'Clear chat' link is present.
- Tools:** Two buttons are available: 'Add a tool' and 'Create custom tool'.
- Added tools (4):**
 - Google search:** Retrieve information from the internet with the Google search engine.
 - DuckDuckGo search:** Retrieve information from the internet with the DuckDuckGo search engine.
 - Wikipedia search:** Retrieve information from Wikipedia articles.
 - Document search - RecipeList1:** A custom tool for document search.

Agent preview Panel:

- User Input:** 'tomato, salt, pasta, olive oil, garlic'.
- Agent Response:**
 - Recipe Name:** Garlic Tomato Pasta
 - Instructions:**
 - Cook pasta according to package instructions. Reserve 1 cup of pasta water, then drain.
 - In a large pan, heat some olive oil over medium heat. Add minced garlic and sauté until fragrant.
 - Add diced tomatoes to the pan and season with salt. Cook until tomatoes soften.
 - Add the cooked pasta to the pan and toss to combine with the tomato-garlic sauce. If needed, add some reserved pasta water to loosen the sauce.
 - Serve hot, garnished with extra virgin olive oil and grated Parmesan cheese if available.
 - Substitutions:**
 - If you don't have garlic, you can skip it or replace it with garlic powder.
 - If you don't have olive oil, you can use another vegetable oil like canola or sunflower oil.
 - For salt, you can use other seasonings like pepper, Italian herbs, or red pepper flakes.
 - Cooking Tips:**

A text input field at the bottom of the preview panel contains the placeholder text 'Type something...'.

Image-2a

RESULT

The screenshot displays the IBM watsonx interface for building and previewing an AI agent. The top navigation bar includes the IBM watsonx logo, an 'Upgrade' button, a help icon, a notification bell, and user account information for 'CHINMOY MAJEE's Account' in 'Dallas'. The main breadcrumb path is 'Projects / RecipePreparation_Agent / Recipe Agent'. The interface is split into two main panels: 'Build' on the left and 'Agent preview' on the right.

Build Panel:

- Model:** Set to 'granite-3-3-8b-instruct'.
- Knowledge:** A 'Vector index' section shows 'RecipeList1' as the selected index. A 'Clear chat' link is present.
- Tools:** Two buttons are available: 'Add a tool' and 'Create custom tool'.
- Added tools (4):**
 - Google search:** Retrieve information from the internet with the Google search engine.
 - DuckDuckGo search:** Retrieve information from the internet with the DuckDuckGo search engine.
 - Wikipedia search:** Retrieve information from Wikipedia articles.
 - Document search - RecipeList1:** A custom tool for document search.

Agent preview Panel:

- Instructions:**
 - Add diced tomatoes to the pan and season with salt. Cook until tomatoes soften.
 - Add the cooked pasta to the pan and toss to combine with the tomato-garlic sauce. If needed, add some reserved pasta water to loosen the sauce.
 - Serve hot, garnished with extra virgin olive oil and grated Parmesan cheese if available.
- 3. Substitutions:**
 - If you don't have garlic, you can skip it or replace it with garlic powder.
 - If you don't have olive oil, you can use another vegetable oil like canola or sunflower oil.
 - For salt, you can use other seasonings like pepper, Italian herbs, or red pepper flakes.
- 4. Cooking Tips:**
 - For a creamier sauce, you can add a spoonful of tomato paste along with the diced tomatoes.
 - If using fresh tomatoes, blanching them briefly before dicing can make them easier to peel.
- Note:** The user provided a list of ingredients that can make a simple pasta dish. The suggested recipe is a basic Garlic Tomato Pasta, which requires no additional ingredients.
- How did I get this answer?** (Link)

At the bottom of the 'Agent preview' panel is a text input field labeled 'Type something...' with a send button.

Image-2b

RESULT

recipe_deploy

Overview Assets **Deployments** Jobs Manage

🔍 Search

Name	Type	Status	Asset	Asset type	Tags	Last modified
Recipe Agent	Online	⌚ Initializing	Recipe Agent	Ai service	wx-agent	3 seconds ago CHINMOY MAJEE (You)

Deployment spaces /

recipe_deploy

Overview Assets **Deployments** Jobs Manage

🔍 Search

Name	Type	Status	Asset	Asset type	Tags	Last modified
Recipe Agent	Online	✅ Deployed	Recipe Agent	Ai service	wx-agent	38 seconds ago CHINMOY MAJEE (You)

Image-3

RESULT

The screenshot displays the IBM Watsonx interface for a deployed agent named 'Recipe Agent'. The top navigation bar includes the IBM Watsonx logo, an 'Upgrade' button, a help icon, a notification bell, the user's account 'CHINMOY MAJEE's Account', the location 'Dallas', and a user profile 'CM'. The breadcrumb trail shows the path: 'Deployment spaces / recipe_deploy / Recipe Agent /'. Below the breadcrumb, the agent's name 'Recipe Agent' is shown with a green checkmark indicating it is 'Deployed' and a status badge 'Online'. Three tabs are visible: 'API reference', 'Test', and 'Preview', with 'Preview' being the active tab. The chat history shows a user input: 'paneer, butter, ginger-garlic paste, salt'. The agent's response is a structured recipe for 'Ginger-Garlic Paneer', including instructions, substitutions, and cooking tips. At the bottom, there is a text input field with the placeholder 'Type something...' and a send button.

IBM watsonx Upgrade ? CHINMOY MAJEE's Account Dallas CM

Deployment spaces / recipe_deploy / Recipe Agent /

Recipe Agent ✓ Deployed Online

API reference Test **Preview**

New chat +

C You 06:38 PM
paneer, butter, ginger-garlic paste, salt

Recipe Agent 06:38 PM

1. Recipe Name: Ginger-Garlic Paneer

2. Instructions:

- Cut paneer into cubes.
- Heat butter in a pan, add ginger-garlic paste and sauté until fragrant.
- Add paneer cubes and salt. Mix well and cook until paneer is lightly browned.
- Serve hot.

3. Substitutions:

- If you don't have butter, you can use oil or even refined (vegetable) ghee for cooking.

4. Cooking Tips:

- Make sure to not overcook the paneer to keep it firm and avoid it turning into crumbles.

This recipe makes a simple and delicious paneer dish that can be served with roti or rice.

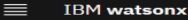
► How did I get this answer?

🔄

Type something...

Image-4

RESULT

 IBM watsonx

Upgrade ? 🔔

CHINMOY MAJEE's Account ▾

Dallas ▾

CM ⋮

Deployment spaces / recipe_deploy / Recipe Agent /      Recipe Agent ✔ Deployed OnlineAPI reference Test **Preview**

New chat +

 You 06:35 PM

paneer, onions, capsicum, salt, soya sauce, red chilli powder,

 Recipe Agent 06:35 PM

1. Recipe Name: Paneer Stir Fry

2. Instructions:

- Cut paneer into cubes and set aside.
- Finely chop onions and slice capsicum.
- Heat oil in a pan, add paneer and fry until golden brown. Remove and set aside.
- In the same pan, add chopped onions and sauté until translucent.
- Add sliced capsicum and cook until soft.
- Season with salt, soya sauce, and red chilli powder. Stir well.
- Add the fried paneer back into the pan and mix well. Cook for another 2-3 minutes.
- Serve hot with rice or noodles.

3. Substitutions:

- If you don't have soya sauce, you can use dark soy sauce or even light soy sauce.
- Red chilli powder can be replaced with any other hot sauce or even crushed red pepper flakes.

4. Cooking Tips:

- Make sure to fry the paneer until it's golden brown for the best texture.
- Adjust the amount of red chilli powder based on your spice preference.

[[{"arguments": {"query": "paneer stir fry recipe"}, "name": "DuckDuckGo"}]]

► How did I get this answer?



Image-5

CONCLUSION

- The Recipe Preparation Agent successfully addresses the challenges of food waste and meal planning by providing a practical, intelligent, and user-centric solution.
- The project demonstrates the power of the RAG pattern and the capabilities of IBM watsonx.ai and the Granite foundation models.
- The agent turns a user's pantry into a source of inspiration, making everyday cooking smarter and more sustainable.

FUTURE SCOPE

- **Voice Integration:** Allow users to speak their ingredients for a hands-free experience.
- **Multi-turn Conversations:** Enable the agent to answer follow-up questions.
- **Advanced Personalization:** Allow users to save preferences (allergies, diets, etc.) for a more customized experience.

REFERENCES

- **IBM Cloud Documentation**
 - Official guides and tutorials for all IBM Cloud services.
 - <https://cloud.ibm.com/docs>
- **IBM watsonx.ai**
 - Documentation for the watsonx.ai platform.
 - <https://dataplatform.cloud.ibm.com/docs/content/wsj/getting-started/welcome-main.html?context=wx&audience=wdp>
- **IBM Granite Foundation Models**
 - Details on the IBM Granite models and how to use them for various tasks.
 - <https://www.ibm.com/granite>
- **Retrieval-Augmented Generation (RAG) Framework**
 - A technical overview of the RAG pattern from a reputable source.
 - <https://dataplatform.cloud.ibm.com/docs/content/wsj/analyze-data/fm-rag.html?context=wx&audience=wdp>

IBM CERTIFICATIONS

In recognition of the commitment to achieve
professional excellence



CHINMOY MAJEE

Has successfully satisfied the requirements for:

Getting Started with Artificial Intelligence



Issued on: Jul 16, 2025
Issued by: IBM SkillsBuild

Verify: <https://www.credly.com/badges/57de8b79-8e3b-4485-8e9e-2ebb5603f02e>



Certificate: Getting started with AI

IBM CERTIFICATIONS

In recognition of the commitment to achieve
professional excellence



CHINMOY MAJEE

Has successfully satisfied the requirements for:

Journey to Cloud: Envisioning Your Solution



Issued on: Jul 20, 2025
Issued by: IBM SkillsBuild

Verify: <https://www.credly.com/badges/0e048dea-f2a1-4f04-a7b1-a51bee8310e7>



Certificate: Journey to Cloud

IBM CERTIFICATIONS

IBM **SkillsBuild**

Completion Certificate



This certificate is presented to

CHINMOY MAJEE

for the completion of

**Lab: Retrieval Augmented Generation with
LangChain**

(ALM-COURSE_3824998)

According to the Adobe Learning Manager system of record

Completion date: 20 Jul 2025 (GMT)

Learning hours: 20 mins

Certificate: RAG Lab

GITHUB LINK:

- https://github.com/chinmoym1/IBMSkillBuild_Project



THANK YOU