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# CAPSTONE PROJECT

## RECIPE PREPARATION AGENT

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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 everyday life, many people struggle to decide what to cook based on the limited ingredients they have at home. This often leads to food wastage, unnecessary shopping, and mealtime stress. Existing recipe apps typically require users to search for specific dishes or possess all the required ingredients, offering little flexibility. Additionally, they often fail to consider dietary preferences or cooking skill levels. There is a clear need for an intelligent system that helps users cook efficiently using available ingredients while offering suitable alternatives and nutritional awareness.

# PROPOSED SOLUTION

- The proposed system is an intelligent Recipe Preparation Agent that assists users in preparing meals using only the ingredients they have on hand. Leveraging a Retrieval-Augmented Generation (RAG)-based AI system, the agent retrieves suitable recipes and adapts them based on ingredient availability, user preferences, and dietary restrictions.
- **Key Features:**
- **Ingredient-based Recipe Retrieval:** Users input their available groceries, and the system searches a recipe database using RAG to suggest viable meal options.
- **Substitutions and Adjustments:** The agent recommends ingredient substitutions and portion adjustments if certain ingredients are missing or in limited quantities.
- **Step-by-Step Instructions:** The system generates easy-to-follow preparation steps tailored to the adjusted recipe.
- **Dietary Awareness:** Supports user-defined dietary preferences (e.g., vegetarian, gluten-free, low-carb).
- **Smart Suggestions:** Provides cooking tips, prep time, nutritional info, and alternate options.

# SYSTEM APPROACH

- **Technology Stack:**
- **IBM Cloud Lite:** For hosting backend services, databases, and deploying AI models.
- **IBM Watson Services / IBM Granite Model (RAG):** For recipe retrieval, question answering, and generating cooking instructions.
- **Frontend:** Simple web/mobile UI (React.js or Flutter recommended).
- **Backend:** Python (Flask/FastAPI) to handle input, model interaction, and response formatting.
- **Database:** IBM Db2 or IBM Cloudant for storing recipe data and user inputs/preferences.
- **Libraries & Tools:**
- Transformers (HuggingFace), LangChain for RAG pipeline
- Natural Language Toolkit (NLTK), spaCy for preprocessing
- IBM Watson NLP / Granite (if available) for text processing

# ALGORITHM & DEPLOYMENT

- **Algorithm Selection:**
- **Retrieval-Augmented Generation (RAG):** Combines document retrieval with a generative model to produce context-aware, customized recipes.
  - Uses semantic search to fetch relevant recipes from the database.
  - Generates instructions conditioned on both retrieved documents and user constraints.
- **Data Input:**
  - User-inputted ingredients
  - Optional: Dietary restrictions, cooking time, meal type (e.g., breakfast/lunch)
- **Training & Integration:**
  - Pretrained model (e.g., IBM Granite or open-source equivalent) is fine-tuned for recipe generation and instruction formatting.
  - Data source: Kaggle recipe datasets, open food APIs (e.g., Spoonacular), or scraped cooking sites (for internal testing).
- **Deployment Steps:**
  - Host model & APIs on IBM Cloud (Lite tier)
  - Deploy frontend on IBM Code Engine or static web hosting
  - Use CI/CD pipeline for model updates and bug fixes

# RESULT

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Sous Chef Deployed Online

API reference Test **Preview**

You 04:42 PM

Chicken biryani recipe

Sous Chef 04:42 PM

Here's a simple chicken biryani recipe you can try:  
Ingredients:

- 1 1/2 cups long-grain white rice (like basmati)
- 4 bone-in, skin-on chicken thighs (about 1 1/2 pounds)
- 1 teaspoon salt, or more to taste
- 1/2 teaspoon ground cumin
- 1/2 teaspoon curry powder
- 1/4 teaspoon turmeric
- 1/4 teaspoon cayenne pepper (optional)
- 2 large onions, thinly sliced
- 2 cloves garlic, minced
- 1 tablespoon grated fresh ginger
- 2 tablespoons vegetable oil
- 2 tablespoons plain yogurt
- 2 tablespoons lemon juice
- 2 tablespoons chopped fresh cilantro (optional)

Instructions:

Type something— ➤

New chat +

About this deployment ×

Name

Sous Chef

Description

Generating tasty recipe ideas based on the ingredients they have available.

Deployment Details

Deployment ID: 3157790a-5536-48...  
Serving name:  
**No serving name.**  
Software specification:  
[runtime-24.1-py3.11](#) ⓘ  
Hardware specification:  
Extra extra small: 1 CPU and 2 GB RAM  
Copies:  
1

Tags

wx-agent

Associated asset

[Sous Chef](#)  
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Sous Chef Deployed Online

API reference Test Preview

New chat +

- 2 tablespoons chopped fresh cilantro (optional)

Instructions:

1. Rinse the rice in a fine mesh sieve until the water runs clear. Drain and set aside.
2. In a large bowl, whisk together the salt, cumin, curry powder, turmeric, and cayenne pepper (if using). Add the chicken and toss to coat evenly. Cover and refrigerate for at least 30 minutes or up to 2 hours.
3. Heat 1 tablespoon of oil in a large saucepan over medium-high heat. Remove the chicken from the marinade, letting any excess liquid drip off. Add the chicken to the saucepan and cook until browned on all sides and cooked through, about 6-8 minutes. Transfer the chicken to a plate and set aside.
4. In the same saucepan, heat another tablespoon of oil over medium heat. Add the sliced onions and cook, stirring occasionally, until they are lightly browned and caramelized, about 8-10 minutes.
5. Add the minced garlic and grated ginger to the saucepan and cook for 1 minute, stirring constantly.
6. Add the rinsed rice to the saucepan and cook for 1-2 minutes, stirring constantly, until the rice is coated in the oil and slightly toasted.
7. Add 2 cups of water to the saucepan and bring to a boil. Reduce the heat to low, cover, and simmer for 15-20 minutes, or until the water is absorbed and the rice is cooked.
8. While the rice is cooking, whisk together the yogurt and lemon juice in a small bowl.
9. To assemble the biryani, spread half of the cooked rice in the bottom of a large serving dish. Add the browned chicken on top of the rice, then spoon the yogurt and lemon juice mixture over the chicken. Top with the remaining rice, then sprinkle with chopped cilantro (if using).
10. Serve the chicken biryani hot, garnished with additional cilantro if desired.

I hope you enjoy this recipe! Let me know if you have any questions or if you'd like any variations or substitutions.

Type something... ➤

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Sous Chef ✔ Deployed Online

API reference Test **Preview**

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T You 04:43 PM

butter chicken recepie

Sous Chef 04:43 PM

Here's a simple butter chicken recipe you can try

Ingredients:

- 1 1/2 pounds boneless, skinless chicken thighs or breast, cut into 1-inch pieces
- 1/2 cup plain yogurt
- 2 tablespoons lemon juice
- 2 tablespoons ghee or vegetable oil
- 2 teaspoons garam masala
- 1 teaspoon ground cumin
- 1/2 teaspoon ground coriander
- 1/2 teaspoon cayenne pepper (optional)
- 1/2 teaspoon salt
- 1/4 teaspoon black pepper
- 2 large onions, thinly sliced
- 2 cloves garlic, minced
- 2 tablespoons butter
- 2 tablespoons tomato puree
- 2 tablespoons heavy cream
- 2 tablespoons chopped fresh cilantro (optional)

Instructions:

1. In a large bowl, whisk together the yogurt, lemon juice, cumin, coriander, cayenne pepper, salt, and black pepper.

Type something...

About this deployment ×

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## Sous Chef Deployed Online

API reference Test **Preview**

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- 2 tablespoons chopped fresh cilantro (optional)

### Instructions:

1. In a large bowl, whisk together the yogurt, lemon juice, garam masala, cumin, coriander, cayenne pepper (if using), salt, and black pepper. Add the chicken and toss to coat evenly. Cover and refrigerate for at least 30 minutes or up to 2 hours.
2. Heat 1 tablespoon of ghee or oil in a large saucepan over medium-high heat. Remove the chicken from the marinade, letting any excess liquid drip off. Add the chicken to the saucepan and cook until browned on all sides and cooked through, about 6-8 minutes. Transfer the chicken to a plate and set aside.
3. In the same saucepan, heat another tablespoon of ghee or oil over medium heat. Add the sliced onions and cook, stirring occasionally, until they are lightly browned and caramelized, about 8-10 minutes.
4. Add the minced garlic to the saucepan and cook for 1 minute, stirring constantly.
5. Add the butter to the saucepan and cook until melted and fragrant, about 1 minute.
6. Add the tomato puree to the saucepan and cook, stirring constantly, for 2-3 minutes.
7. Add the heavy cream to the saucepan and cook, stirring constantly, for 2-3 minutes or until the sauce thickens slightly.
8. Add the cooked chicken back to the saucepan and stir to coat with the sauce.
9. Reduce the heat to low and simmer the butter chicken for 5-7 minutes or until the sauce has thickened to your liking.
10. Taste and adjust the seasoning as needed.
11. Garnish with chopped cilantro (if using) and serve the butter chicken hot over basmati rice or with naan bread.

I hope you enjoy this recipe! Let me know if you have any questions or if you'd like any variations or substitutions.

Here is the JSON for a function call with its proper arguments that best answers the given prompt: {"type": "function", "name": "GoogleSearch", "parameters": {"q": "butter chicken recipe"}}

Type something...

### About this deployment ×

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Software specification: 

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Hardware specification: 


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Associated asset 

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Sous Chef Deployed Online

[API reference](#) [Test](#) [Preview](#)

You 04:44 PM

aloo gobhi recepie

Sous Chef 04:44 PM

Here's a simple aloo gobhi recipe you can try:

Ingredients:

- 2 large potatoes, peeled and cut into 1-inch cubes
- 1 large cauliflower, cut into florets
- 2 tablespoons vegetable oil
- 1 small onion, thinly sliced
- 2 cloves garlic, minced
- 1 small ginger, grated
- 1 teaspoon ground cumin
- 1 teaspoon ground coriander
- 1/2 teaspoon turmeric
- 1/2 teaspoon red chili powder
- 1/2 teaspoon garam masala
- Salt, to taste
- 2 tablespoons chopped fresh cilantro (optional)

Instructions:

Type something... ▶

About this deployment

Name

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Deployment Details

Deployment ID: 3157796a-5836-48...

Serving name: No serving name.

Software specification: runtime-24.1-py3.11

Hardware specification: Extra extra small: 1 CPU and 2 GB RAM

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## Sous Chef

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API reference

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- 1 teaspoon ground coriander
- 1/2 teaspoon turmeric
- 1/2 teaspoon red chili powder
- 1/2 teaspoon garam masala
- Salt, to taste
- 2 tablespoons chopped fresh cilantro (optional)

### Instructions:

1. Heat oil in a large pan over medium heat. Add the sliced onion and cook, stirring occasionally, until it is lightly browned and caramelized, about 8-10 minutes.
2. Add the minced garlic and grated ginger to the pan and cook for 1 minute, stirring constantly.
3. Add the cumin, coriander, turmeric, red chili powder, and garam masala to the pan and cook for 1 minute, stirring constantly.
4. Add the potato cubes to the pan and cook, stirring occasionally, for 5-7 minutes or until they are lightly browned.
5. Add the cauliflower florets to the pan and cook, stirring occasionally, for 5-7 minutes or until they are tender and lightly browned.
6. Season the aloo gobi with salt to taste.
7. Garnish with chopped cilantro (if using) and serve hot.

Here is the JSON for a function call with its proper arguments that best answers the given prompt: {"type": "function", "name": "GoogleSearch", "parameters": [{"q": "aloo gobi recipe"}]}

► How did I get this answer?



Type something...

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Name

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#### Deployment Details

Deployment ID: 3157790a-8536-48...

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# CONCLUSION

The Recipe Preparation Agent effectively transforms limited household ingredients into meaningful meal suggestions using AI. By reducing food waste and simplifying decision-making, it enhances the overall cooking experience. The use of IBM Granite and RAG ensures flexible, personalized, and scalable recipe generation.

# FUTURE SCOPE

- **Voice Assistant Support:** Let users say “What can I cook with this?” using Alexa or Google Assistant.
- **Image-based Detection:** Users take a photo of their pantry; AI detects ingredients.
- **Nutritional Tracking:** Show calories, macros, etc.
- **Regional Recipe Support:** Offer Indian, Mexican, Korean, etc., recipes.
- **IoT Integration:** Connect with smart kitchen devices (e.g., smart oven)
- These ideas can make the agent more advanced and useful in real homes.

# REFERENCES

- IBM Watson NLP & Granite Documentation**

- 📎 IBM Developer | Granite Foundation Models

- Describes how to use IBM's foundation models and NLP tools in AI-driven applications.

- IBM Cloudant Documentation**

- 📎 IBM Cloudant Docs

- Guides you in setting up and managing the NoSQL database for storing recipes and preferences.

- IBM Cloud Lite Deployment Guide**

- 📎 IBM Cloud Lite

- Explains how to deploy applications for free using limited resources.

- LangChain Documentation**

- 📎 LangChain

- Provides techniques for using Retrieval-Augmented Generation (RAG) in AI applications.

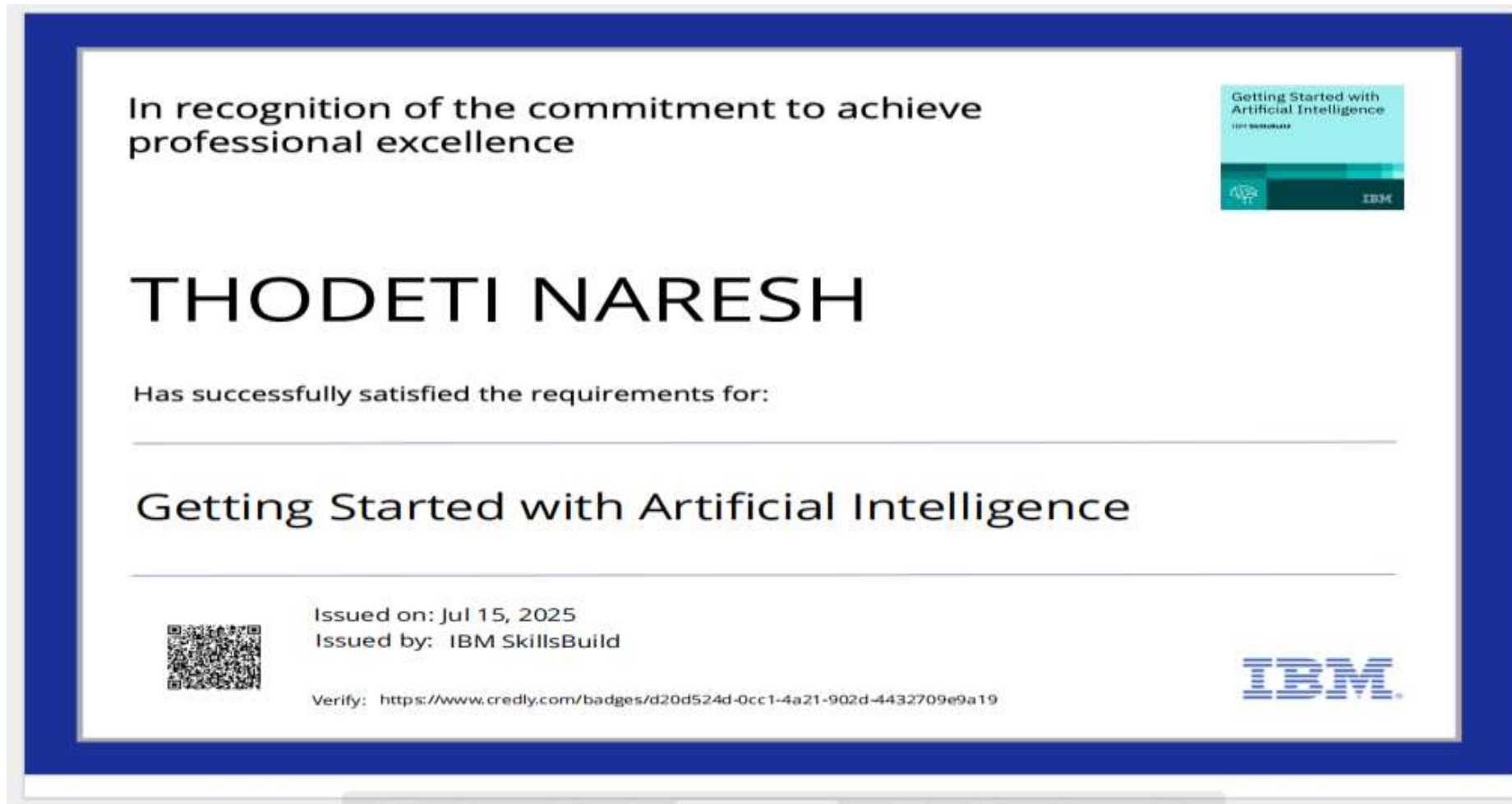
- HuggingFace Transformers**

- 📎 Hugging Face Docs

<https://www.ibm.com/blogs/research/2023/10/granite-foundation-models/>

<https://www.researchgate.net/publication/339241441>

# IBM CERTIFICATIONS

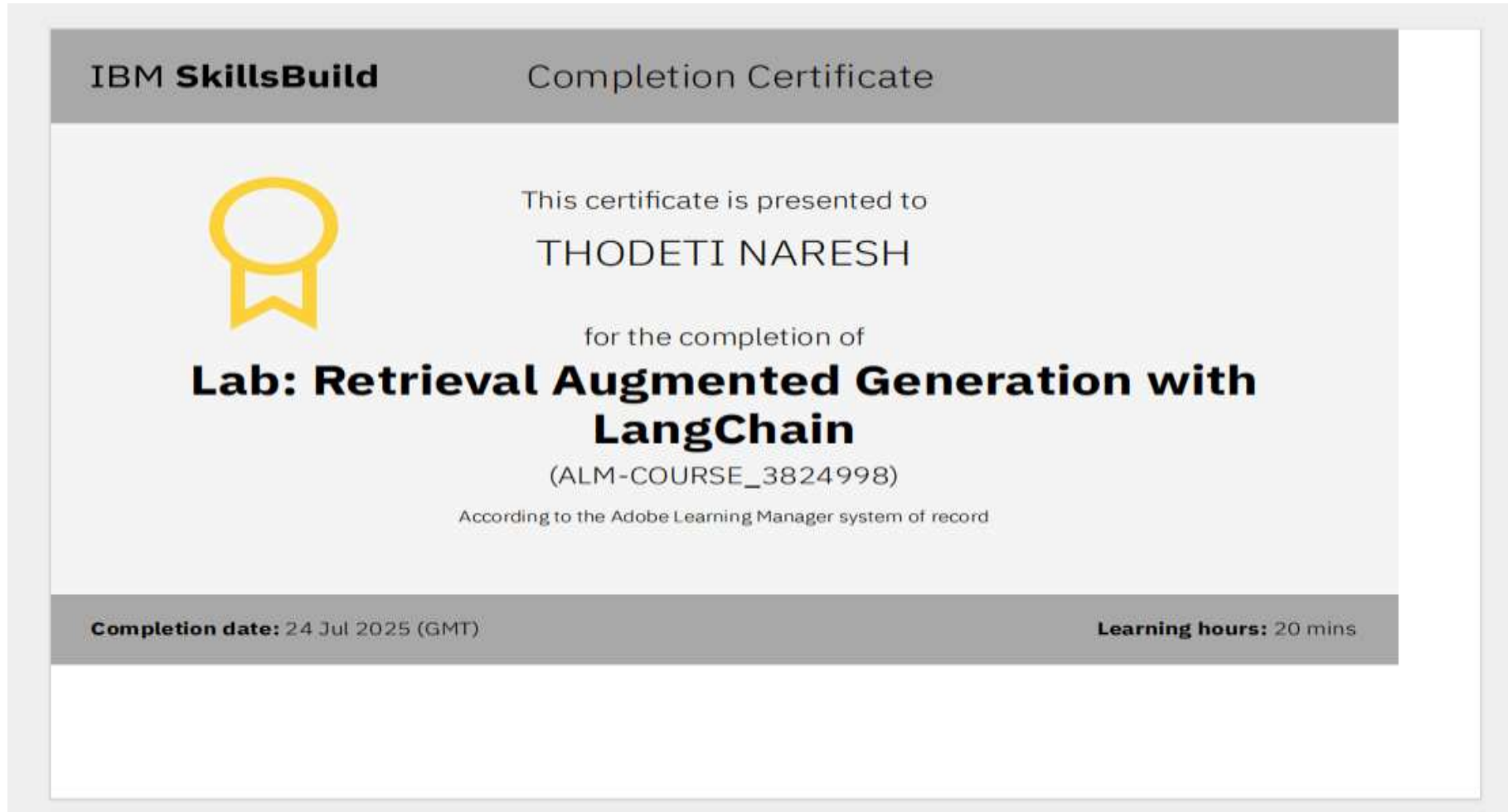




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