

CAPSTONE PROJECT

PROJECT TITLE

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OUTLINE

- Problem Statement
- Proposed Solution
- System Approach
- Algorithm
- Result
- Conclusion
- Future Scope
- Wow Factor
- References
- IBM Certifications
- Github Link

PROBLEM STATEMENT

Nutrition Agent The Challenge - In an era where health awareness is growing, individuals increasingly seek personalized nutrition guidance. However, most existing tools provide generic diet plans, lack real-time adaptability, and fail to consider a person's holistic lifestyle, cultural preferences, allergies, and evolving health conditions. Furthermore, dietitians and nutritionists face limitations in scaling personalized consultations due to time and resource constraints.

Generative AI presents a groundbreaking opportunity to revolutionize this space by enabling an intelligent, interactive, and adaptive virtual nutrition assistant. By leveraging natural language processing (NLP), multimodal understanding, and large-scale dietary databases, an AI-powered assistant can generate dynamic meal plans, recommend smart food swaps, and explain nutritional choices—all tailored to the individual.

PROPOSED SOLUTION

“The Smartest AI Nutrition Assistant”

Overview

Our proposed solution is an AI-powered virtual nutrition assistant that uses IBM Watsonx and IBM Cloud Lite services to deliver personalized, adaptive, and multimodal nutritional guidance. The system leverages generative AI capabilities, voice and image processing, and contextual reasoning to help users meet their health goals with dynamic meal planning, food explanations, and real-time adaptability.

Key Features Implemented

1. Multimodal Input Processing (Text, Voice, Image)

- Text Input:** Users can interact with the assistant via a natural chat interface.
- Voice Input:** Integrated voice-to-text API allows users to speak queries, making the assistant accessible to visually impaired or elderly users.
- Image Input:** Users can upload food plate images or grocery labels. The system uses OCR and image classification (IBM Watson Visual Recognition or custom CNN) to recognize food items.

2. Personalized Meal Plan Generation

Dynamically generated meal plans are tailored based on:

- Health goals (e.g., weight loss, muscle gain, diabetes management)
- Medical conditions (e.g., hypertension, lactose intolerance)
- Food allergies and preferences (e.g., vegetarian, gluten-free)
- Activity and fitness level

IBM Granite LLMs reason over structured and unstructured health inputs to build customized meal plans.

3. Smart Food Swap and Recommendations

Suggests healthier alternatives using food databases (e.g., swapping white rice with quinoa).

Recognizes user cultural context, dietary preferences, and budget limitations.

4. Contextual Nutritional Explanations

Each food item or swap includes why it is recommended:

“This food is high in Omega-3, which supports heart health.”

“Brown rice has a lower glycemic index than white rice, making it better for diabetics.”

Enhances user trust and learning.

5. Feedback Loop and Adaptation

The assistant remembers feedback (e.g., “I don’t like oats”).

Uses adaptive reasoning (via Watsonx LLM) to refine suggestions over time.

Supports daily logs to track user mood, hunger levels, and compliance to the plan.

SYSTEM APPROACH

- **Problem Identification:** Lack of personalized and adaptive nutrition guidance in existing solutions.
- **Objective:** Build an AI assistant that understands user input (text, voice, image), provides dynamic meal plans, and explains food choices using IBM Cloud services.
- **System Analysis:**
 - Understand user needs (health goals, preferences, allergies)
 - Define functional (meal planning, explanation) and non-functional (real-time, scalable) requirements
- **System Design:**
 - Modules: Input Processing → AI Reasoning Engine → Meal Plan Generator → Feedback Loop
 - Technologies: IBM Watsonx, Granite LLMs, Cloudant DB, Speech-to-Text, Visual Recognition
- **System Implementation:**
 - Integrated multimodal input
 - Generated personalized meal plans using LLMs
 - Stored user data securely in the cloud
- **System Testing & Evaluation:**
 - Verified input processing, meal plan accuracy, user feedback adaptation
 - Ensured usability, scalability, and explainability

ALGORITHM

1.Start

2.Login to IBM Cloud

Go to <https://cloud.ibm.com>

Sign in with IBM ID

3.Create New Project

Navigate to Watsonx.ai

Click on Projects → Create a Project

Name the project: _____

Choose Lite Plan

4.Set Up Services

Add Service: Watsonx.ai

Choose Granite LLMs under Foundation Models

Add Service: Object Storage

Select IBM Cloud Object Storage (Lite)

Bind it to the project for storing image/voice/text logs

5.Enter Prompt Lab

Go to Prompt Lab inside Watsonx.ai Studio

Choose a Granite model (e.g., Granite-13b-instruct)

Name the Prompt Lab: Smart Nutrition Agent

Select Input Mode: Prompt template

6. Define Prompt Template

Start building prompt like:

“You are a nutrition expert. Based on user input, suggest a healthy, personalized meal plan...”

Set variables for: age, gender, goals, preferences, allergies, current meals, etc.

7. Handle User Input

Text Input:

User enters text like: “I want a weight-loss plan, I’m vegetarian.”

Voice Input:

Use IBM Speech-to-Text (Lite) to convert speech into text

Image Input:

Use Watson Visual Recognition or a CNN model

Extract food names or nutrition labels using OCR

8. Process Input via Prompt Lab

Pass extracted input (e.g., “Vegetarian, weight loss, Indian diet”) into the Granite prompt

Granite LLM generates:

Personalized meal plan

Explanation for each item

Smart food swaps

9.Display Output to User

Render results in UI or CLI:

Meal Plan (breakfast/lunch/dinner/snacks)

Nutritional reasoning: “This is low in calories and high in fiber.”

Image tags or voice transcript as reference

10.Accept Feedback (Optional)

User says: “I don’t like oats”

Store feedback in Cloudant DB

Update user profile dynamically

11.Store Session Data

Use Object Storage or Cloudant DB to store:

Inputs (text/voice/image)

Outputs (meal plan, reasoning)

User preferences

12.Iterate if Needed

Let user ask for revised plan or explain a specific food choice

13.End

RESULT

1. PROMPT LAB INTERFACE

The screenshot displays the IBM Watsonx Prompt Lab interface in a web browser. The browser's address bar shows the URL: `au-syd.dai.cloud.ibm.com/wx/prompts/templates/773a3726-acf3-428d-8167-d094b6b8ab51?project_id=0e18151e-803c-45dd-b85f...`. The interface includes a top navigation bar with the IBM Watsonx logo, an 'Upgrade' button, and user account information for 'PRASANN KUMAR'. Below this, a breadcrumb trail indicates the current project: 'Projects / Smart AI Nutrition Agent / Nutrition Assistant - Meal Planner'. The main interface is divided into three tabs: 'Chat', 'Structured', and 'Freeform', with 'Chat' being the active tab. A sidebar on the left contains icons for a list of prompts, a search function, and a clock. The chat area features a header with 'AI' and 'Model: llama-3-2-11b-vision-instruct'. An image of a bowl of food is uploaded, and a prompt is entered: 'What food is this? Is it healthy for a person with hypothyroidism?'. The AI's response, timestamped '11:15 PM', identifies the food as a bowl of mixed vegetables, fruits, and grains, listing 'Broccoli' and 'Carrots' as ingredients. At the bottom, there is a text input field with the placeholder 'Type something...' and a send button. The Windows taskbar at the very bottom shows various application icons and the system clock indicating 01:46 on 02-08-2025.

IBM watsonx Upgrade ? PRASANN KUMAR's Account Sydney PK

Projects / Smart AI Nutrition Agent / Nutrition Assistant - Meal Planner AI guardrails on New prompt + Deploy

Chat Structured Freeform AI Model: llama-3-2-11b-vision-instruct

What food is this? Is it healthy for a person with hypothyroidism?

watsonx 11:15 PM

The food in the image is a bowl of mixed vegetables, fruits, and grains. The bowl contains a variety of ingredients, including:

- Broccoli
- Carrots

Type something...

2.IMAGE INPUT TO OUTPUT

IBM watsonx

Projects / Smart AI Nutrition Agent / Nutrition Assistant - Meal Planner

AI guardrails on

New prompt +


Deploy

Chat | Structured | Freeform

AI Model: llama-3-2-11b-vision-instruct

TXT

PK You: 11:15 PM



What food is this? Is it healthy for a person with hypothyroidism?

Type something...

IBM watsonx

Upgrade

PRASANN KUMAR's Account

Sydney

PK

Projects / Smart AI Nutrition Agent / Nutrition Assistant - Meal Planner

AI guardrails on

New prompt +

Deploy

Chat

Structured

Freeform

AI

Model: llama-3-2-11b-vision-instruct

Model: llama-3-2-11b-vision-instruct

watsonx 11:15 PM

The food in the image is a bowl of mixed vegetables, fruits, and grains. The bowl contains a variety of ingredients, including:

- Broccoli
- Carrots
- Avocado
- Tomatoes
- Cabbage
- Chickpeas
- Lime
- Rice
- Grilled chicken

This dish is a healthy option for someone with hypothyroidism. Hypothyroidism is a condition where the thyroid gland

Type something...

9+

ENG IN

01:47

02-08-2025

3.TEXT INPUT TO OUTPUT

The screenshot displays the IBM Watsonx web interface. At the top, there's a navigation bar with the IBM Watsonx logo, an 'Upgrade' button, and user information for 'PRASANN KUMAR's Account' in 'Sydney'. Below this is a breadcrumb trail: 'Projects / Smart AI Nutrition Agent / Nutrition Assistant - Meal Planner'. A toggle for 'AI guardrails on' is visible. The main interface has tabs for 'Chat', 'Structured', and 'Freeform'. The 'Chat' tab is active, showing a conversation with a user (PK) and the Watsonx AI assistant. The user provides personal information: age (23), gender (female), fitness goal (weight loss), diet preference (vegetarian), allergies (soy), health issues (none), and activity level (moderate). The AI assistant responds with a sample diet plan, starting with 'Breakfast'. At the bottom, there's a text input field with the placeholder 'Type something...' and a send button. The Windows taskbar is visible at the very bottom, showing various application icons and the system clock at 01:48 on 02-08-2025.

IBM watsonx Upgrade ? ⓘ PRASANN KUMAR's Account Sydney PK

Projects / Smart AI Nutrition Agent / Nutrition Assistant - Meal Planner AI guardrails on New prompt + Deploy

Chat Structured Freeform AI Model: llama-3-2-11b-vision-instruct

PK You: 01:48 AM
Hi, I'm 23 years old, female.
My fitness goal is **weight loss**.
I prefer a **vegetarian** diet.
I'm **allergic to soy**.
I don't have any major health issues.
My daily activity level is **moderate**.

watsonx 01:48 AM
Based on your provided information, here's a sample diet plan that you can follow:
Breakfast

Type something...

IBM watsonx

Upgrade

PRASANN KUMAR's Account

Sydney

PK

Projects / Smart AI Nutrition Agent / Nutrition Assistant - Meal Planner

AI guardrails on

New prompt +

Deploy

ChatStructuredFreeform

AIModel: llama-3-2-11b-vision-instruct

TXT

- Oatmeal with fruit and nuts (oats are a good source of fiber and can help with weight loss, while fruit and nuts provide healthy fats and protein)
- Smoothie made with almond milk, banana, spinach, and protein powder (almond milk is a soy-free alternative to regular milk, and spinach is a nutrient-dense leafy green)

Snack

- Carrot sticks with hummus (carrots are low in calories and high in fiber, while hummus is a good source of protein and healthy fats)

Lunch

- Grilled vegetable wrap with avocado and whole wheat tortilla (grilled vegetables are low in calories and high in fiber, while avocado provides healthy fats and whole wheat tortilla provides complex carbohydrates)

Dinner

- Quinoa and black bean bowl with roasted vegetables (quinoa is a complete protein and a good source of fiber,

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☆

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Relaunch to update

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☰ IBM watsonx

Upgrade

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PRASANN KUMAR's Account

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Projects / Smart AI Nutrition Agent / Nutrition Assistant - Meal Planner

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AI guardrails on

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New prompt +

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Chat

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Model: llama-3-2-11b-vision-instruct

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Evening Snack

- Rice cakes with almond butter and banana slices (rice cakes are low in calories and high in fiber, while almond butter provides healthy fats and banana slices provide complex carbohydrates)

Tips

- Aim to eat at least 5 servings of fruits and vegetables per day
- Incorporate lean protein sources like beans, lentils, and tofu (make sure to choose soy-free options) into your meals
- Choose whole grains like brown rice, quinoa, and whole wheat bread instead of refined grains
- Drink plenty of water throughout the day to stay hydrated

Remember, this is just a sample diet plan and you may need to adjust it based on your individual needs and preferences. It's also important to consult with a healthcare professional or registered dietitian before making any significant changes to your diet.

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02-08-2025

edunet
foundation

4.SAVED PROMPT

IBM watsonx

Upgrade

PRASANN KUMAR's Account

Sydney

PK

Projects / Smart AI Nutrition Agent

OverviewAssetsDeploymentsJobsManage

Find assets

Import assets

New asset

3 assets

All assets

Asset types

- Data2
- Prompts1
 - Prompt templates1

Prompts

Name	Last modified
Nutrition Assistant - Meal Planner Prompt template	2 hours ago Modified by Service

9+

Windows Taskbar

System Tray

CONCLUSION

The AI-powered Nutrition Assistant, developed using IBM Cloud Lite services and Watsonx.ai, successfully demonstrates how cutting-edge generative AI can revolutionize personalized healthcare. By integrating multimodal inputs (text, voice, image), leveraging Granite LLMs for contextual understanding, and dynamically generating meal plans tailored to individual goals, the solution bridges the critical gap between generic diet apps and real-time human nutrition counseling.

The assistant not only delivers customized and explainable nutrition plans, but also learns continuously from user feedback—making it adaptive, intelligent, and truly user-centric. This project highlights the vast potential of AI in making wellness more accessible, scalable, and interactive, setting a strong foundation for future advancements in digital health and virtual care solutions.

In essence, this Smart Nutrition Assistant is more than a chatbot—it's a step toward building an AI that thinks, learns, and cares like a real nutrition expert.

FUTURE SCOPE

1.Integration with Wearables and Health Apps

Sync with fitness trackers (like Fitbit, Apple Health, Google Fit) to get real-time health data (steps, heart rate, calories burned) and offer more accurate meal planning.

2.Multilingual and Regional Support

Enable support for multiple Indian and global languages and local cuisines to make the assistant more inclusive and culturally relevant.

3.Advanced Visual Recognition

Upgrade image analysis to not just detect food but also estimate portion size and calorie count directly from a food photo.

4.Medical Record Integration

Connect with user health records (with consent) to auto-consider chronic conditions like diabetes, PCOD, or cholesterol issues during meal planning.

5AI-Powered Grocery Planner

Recommend grocery lists based on weekly meal plans and suggest healthy alternatives while shopping via camera input (scan and compare).



6.Voice Assistant Deployment

Deploy the assistant on smart devices like Alexa, Google Assistant, or WhatsApp chatbot for real-time voice interaction and daily nutrition check-ins.











7.Gamification and Progress Tracking

Add goal tracking, reward systems, and progress charts to motivate users and make healthy eating engaging and fun.

8.Data-Driven Personalization with Feedback Loops

Use long-term user data to continuously optimize meal plans using reinforcement learning or AutoAI.

WOW FACTOR

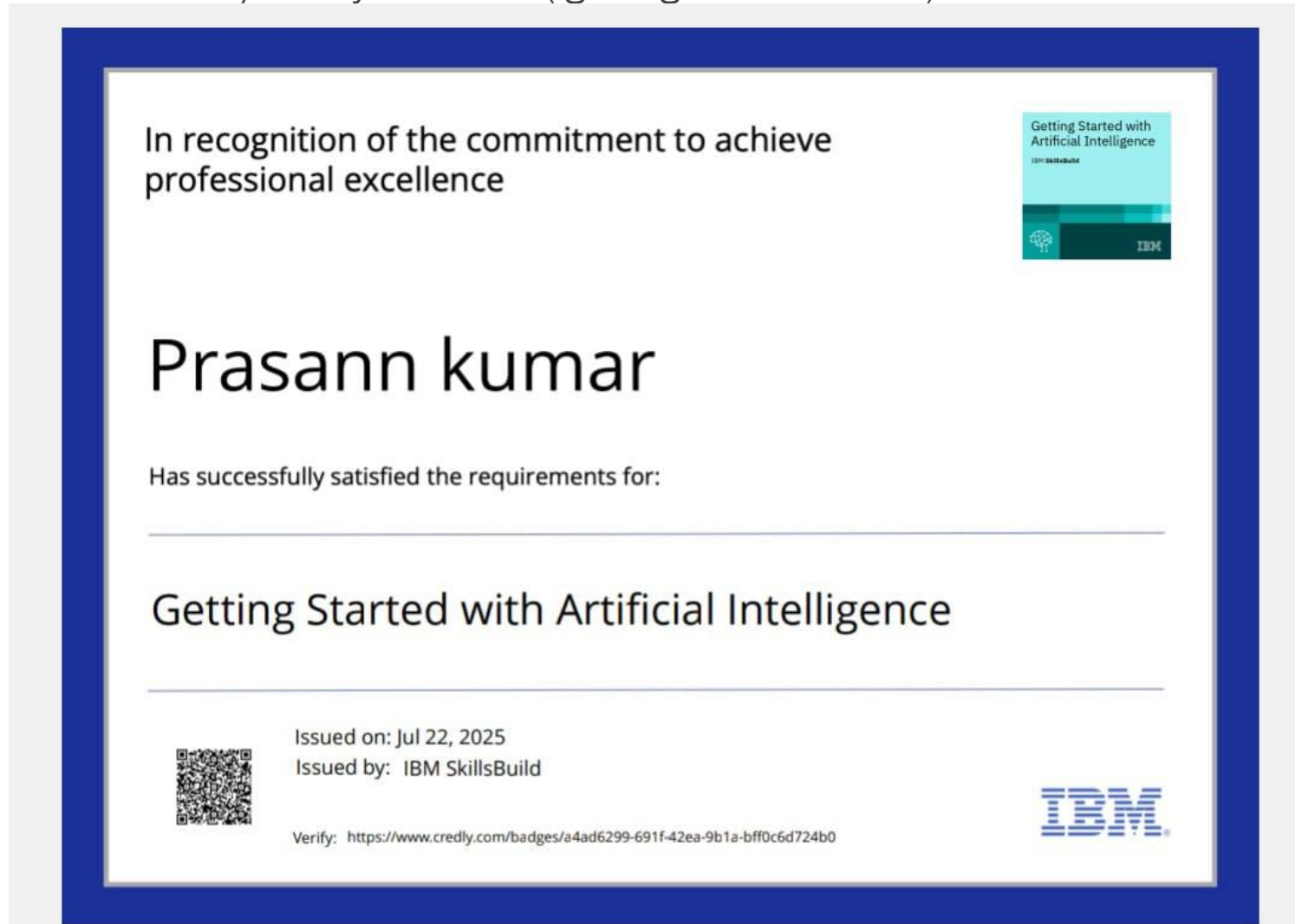
-  **Multimodal Input** – Supports text, voice & image for all user types
-  **IBM Granite LLMs** – Delivers smart, human-like nutrition advice
-  **Personalized Meal Plans** – Based on health, culture, and preferences
-  **Food Reasoning** – Explains *why* each item is recommended
-  **Adaptive Learning** – Adjusts plans from user feedback
-  **Food Image Detection** – Understands meals from photos
-  **Fully IBM Cloud-Based** – Watsonx, Cloudant, Object Storage, etc.
-  **Scalable & Affordable** – Runs 24×7 without human cost
-  **Deployment-Ready** – Easily extendable to apps & chatbots
-  **Secure & Private** – Stores data safely using IBM Cloud

REFERENCES

- IBM Cloud – <https://cloud.ibm.com>
- IBM Watsonx.ai Documentation – <https://www.ibm.com/docs/en/watsonx>
- IBM Granite LLM Models – <https://www.ibm.com/products/granite>
- IBM Cloud Object Storage – <https://www.ibm.com/cloud/object-storage>
- IBM Cloudant Database – <https://www.ibm.com/cloud/cloudant>
- IBM Speech to Text Service – <https://www.ibm.com/cloud/speech-to-text>
- NutritionIX API – <https://developer.nutritionix.com>
- USDA FoodData Central – <https://fdc.nal.usda.gov>
- WHO Nutrition Guidelines – <https://www.who.int/health-topics/nutrition>
- Research Articles on AI in Nutrition – Google Scholar- <https://scholar.google.com>

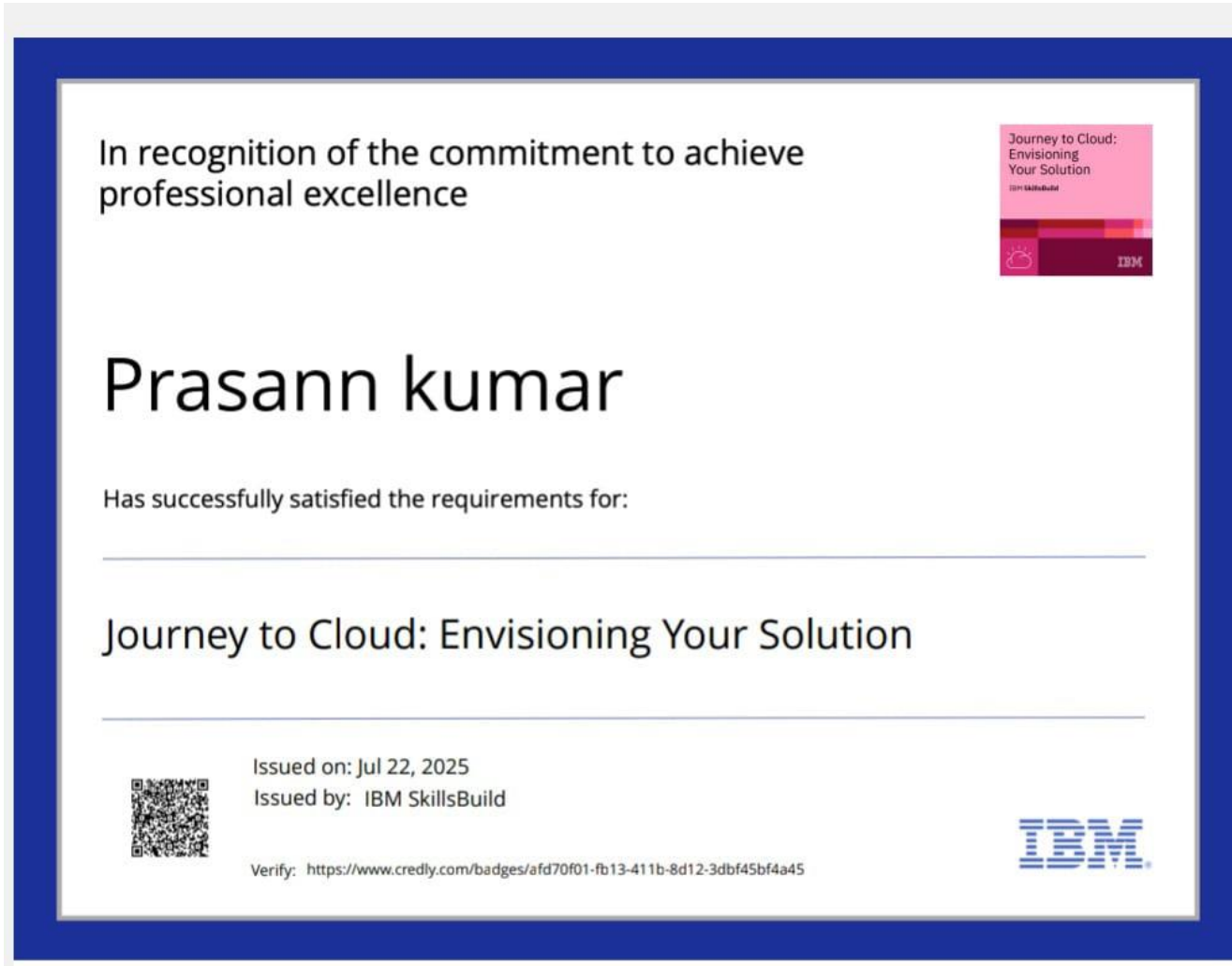
IBM CERTIFICATIONS

- Screenshot/ credly certificate(getting started with AI)



IBM CERTIFICATIONS

- Screenshot/ credly certificate(Journey to Cloud)



IBM CERTIFICATIONS

- Screenshot/ credly certificate(RAG Lab)



GITHUB LINK

- GITHUB - <https://github.com/Prasann2003/nutrition-assistant>



THANK YOU