
CAPSTONE PROJECT

SMARTEST AI NUTRITION ASSISTANT

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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

- **Example:** In today's health-conscious world, individuals are increasingly seeking personalized nutritional guidance. However, most current tools fall short in several critical areas:
- They provide **generic, static diet plans** that don't consider lifestyle changes or medical updates.
- There is **limited support for cultural preferences, allergies, and dynamic feedback.**
- **Visual or multimodal input** (like food photos or labels) is rarely supported.
- **Human nutritionists are unable to scale** their services for every individual need due to time and resource constraints.

PROPOSED SOLUTION

The system aims to build an AI-powered nutrition assistant that offers personalized meal plans and real-time guidance using generative AI and multimodal inputs.

User Input & Data Collection:

- Collect user details (health goals, allergies, preferences).
- Accept text, voice, and image inputs (e.g., food photos).

Personalization & Processing:

- Clean and extract key features from data.
- Match meals to user needs, culture, and health conditions.

AI-Based Recommendations:

- Use LLMs for meal plans, explanations, and food swaps.
- Apply computer vision for analyzing food images.

Deployment:

- Mobile/web app interface with cloud backend.

Evaluation:

- Refine plans using feedback and nutrition metrics.

SYSTEM APPROACH

This section outlines the tools, technologies, and libraries required to build and implement the AI Nutrition Assistant.

Here's a suggested structure for this section:

- **System requirements**

Minimum: i5 processor, 8GB RAM

OS: Windows/Linux

Python 3.x environment

- **Library required to build the model**

Libraries typically pre-installed in Watson Studio / watsonx.ai

ALGORITHM & DEPLOYMENT

Algorithm Selection:

The system uses a **Generative AI model (e.g., GPT-4)** combined with **Computer Vision** for image-based understanding and whisper for voice input. These models are selected for their ability to handle natural language, visual content, and provide contextual, adaptive recommendations—ideal for personalized nutrition.

Data Input:

- User profile: Age, gender, health conditions, allergies, goals
- Preferences: Cuisine, meal type, ingredients to avoid
- Multimodal inputs: Text prompts, food images, voice queries
- External data: Weather, activity logs, wearable data (optional)

Training Process:

- LLMs are pre-trained and fine-tuned using dietary datasets and nutritional guidelines
- Image models trained on food image datasets for recognition and nutritional estimation
- Continuous learning through user feedback and corrections (e.g., meal rejections)

Prediction Process:

- User inputs are interpreted by NLP/CV models
- Based on health goals and preferences, the system generates meal plans or smart food swaps
- Predictions are refined using real-time feedback, adapting future suggestions dynamically

RESULT

Model Effectiveness:

The AI Nutrition Assistant was evaluated based on the quality, relevance, and personalization of its meal recommendations.

Key results, for example:

- **Personalization Accuracy:** 91% match between user preferences and generated meal plans
- **User Satisfaction Score:** 4.6 / 5 (based on feedback on taste, clarity, and convenience)
- **Health Alignment Rate:** 88% of meals aligned with dietary restrictions and health goals

Visual Outputs examples:

Example 1: Generated Meal Plan

A screenshot or card-style output of a daily meal plan customized for a diabetic vegetarian user

• Example 2: Food Swap Recommendation

Image: “Replace potato chips with roasted chickpeas – 60% fewer calories, 2x more protein”

Example 3: Image Input to Nutritional Breakdown

User uploads a food photo; the system identifies “Chicken Biryani” and shows:

Calories: 420 kcal | Protein: 22g | Fat: 15g | Carbs: 50g

Comparison (Optional Chart/Graph):

A bar chart comparing:

- **System-generated meal nutrients vs. user’s ideal macro goals**

(e.g., Calories Target: 1800 kcal vs. Suggested Plan: 1750 kcal)

AI Agent Setup and Deployment

IBM watsonx

Deployment spaces /

Nutrition_deployment

Overview Assets **Deployments** Jobs Manage

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Name	Type	Status	Asset	Asset type	Tags	Last modified
watsonx Agent	Online	Deployed	watsonx Agent	AI service	wx-agent	1 hour ago Bhuvesh Bhagwanani (You)

IBM watsonx

Deployment spaces /

Nutrition_deployment

Overview Assets Deployments Jobs Manage

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watsonx Agent
1 hour ago

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Deployments All

Deployed 1 Failed 0

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Job runs

Active 0 Failed last 24 hours 0

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IBM watsonx

Welcome back, Bhuvesh

Open in: weather_agent1

Train, validate, tune and deploy AI models.

[Customize my journey](#)

Chat and build prompts with foundation models

Start chatting...

[Open Prompt Lab](#)

Build an AI agent to automate tasks

with Agent Lab

Tune a foundation model with labeled data

with Tuning Studio

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WatsonX nutrition (deployed) agent

dataplatform.cloud.ibm.com/wx/agents/e9a1f0f4-8c99-499d-a7d2-3906605b9055?project_id=d6eabc7a-b0ae-4432-8288-10f18d252745&context=wx

IBM watsonx Upgrade ? Bhuvesh Bhagwanani's Acc... Dallas BB

Projects / weather_agent1 / watsonx Agent Share feedback Saving New agent + Deploy

Build AI Model: llama-3-3-70b-instruct

Setup

Configuration

FrameworkLangGraphArchitectureReAct

Instructions

You are a nutrition assistant that uses tools to answer questions in detail. Ask about my age, food preferences, medical history, and city, and give specific answers to queries.

[Advanced configuration](#)

Knowledge

Tools

Add a tool>Create custom tool

Agent preview

You: 09:38 PM
hi

watsonx Agent 09:38 PM
To provide you with the best possible assistance, I would like to know some information about you. Could you please tell me:

1. Your age
2. Your food preferences (e.g. vegetarian, gluten-free, etc.)
3. Any medical conditions or allergies you may have
4. The city you live in

This information will help me give you more personalized and relevant advice on nutrition and health.
► How did I get this answer?

You: 09:40 PM
36 years, gluten-free vegan diet, arthritis, mumbai

watsonx Agent 09:40 PM
Type something...

Tools

Add a tool>Create custom tool

Upgrade ? Bhuvesh Bhagwanani's Acc... Dallas BB

Share feedback Autosaved 9:42 PM New agent + Deploy

Agent preview

watsonx Agent 09:40 PM
Based on the search results, here are some suggestions for a gluten-free vegan diet plan that may help with arthritis in Mumbai:

1. Incorporate anti-inflammatory foods such as turmeric, ginger, and omega-3 rich foods like flaxseeds and chia seeds into your diet.
2. Eat a variety of whole grains like quinoa, brown rice, and gluten-free oats.
3. Include a range of colorful vegetables and fruits in your diet to provide essential vitamins and minerals.
4. Consider consulting a dietitian or a healthcare professional to create a personalized diet plan that suits your specific needs and health conditions.
5. Look into meal delivery services like Food Darzee that offer customized gluten-free and vegan meals.

Some specific foods that may be beneficial for arthritis include:

- Turmeric: contains curcumin, which has anti-inflammatory properties
- Ginger: has anti-inflammatory compounds like gingerol and shogaol
- Omega-3 rich foods: like flaxseeds, chia seeds, and walnuts, which can help reduce inflammation
- Whole grains: like quinoa, brown rice, and gluten-free oats, which provide fiber, vitamins,

Type something...

Elaborate weekly diet plan suggested by the agent according to specified needs

The screenshots show a conversation with the **watsonx Agent** (Deployed Online) in the **Preview** tab. The user asks for a 1-week diet plan to fight dengue and increase weight. The agent provides a detailed 7-day plan with specific meals and calorie counts for each day, along with general nutritional advice.

Deployment spaces / Nutrition_deployment / watsonx Agent /

watsonx Agent Deployed Online

API reference Test **Preview**

In terms of specific restaurants or food establishments in San Francisco that may offer healthy non-veg options for dengue patients, some options might include:

- Restaurants that serve fresh, locally-sourced ingredients
- Establishments that offer traditional or cultural dishes that are rich in nutrients and can help support overall health
- Food trucks or vendors that offer healthy, non-veg options

It's always a good idea to consult with a healthcare professional or registered dietitian for personalized nutrition advice, especially when dealing with a serious illness like dengue fever.

You 09:33 PM

1 week diet plan to fight dengue and increase weight

Type something...

watsonx Agent 09:33 PM

Here is a 1-week diet plan that may help fight dengue and increase weight:

Day 1

- Breakfast: Oatmeal with banana, almond milk, and honey (400 calories)
- Lunch: Grilled chicken breast with quinoa, mixed vegetables, and a glass of coconut water (500 calories)
- Snack: Papaya smoothie with yogurt and honey (200 calories)
- Dinner: Baked salmon with sweet potato, green beans, and a glass of fresh orange juice (500 calories)

Day 2

- Breakfast: Scrambled eggs with whole wheat toast, avocado, and a glass of fresh grapefruit juice (350 calories)
- Lunch: Chicken and vegetable stir-fry with brown rice and a glass of coconut water (550 calories)
- Snack: Apple slices with peanut butter (150 calories)
- Dinner: Grilled turkey breast with roasted vegetables, quinoa, and a glass of fresh pineapple juice (500 calories)

Day 3

- Breakfast: Greek yogurt with berries, granola, and a glass of fresh orange juice (300 calories)
- Lunch: Grilled chicken breast with mixed greens, whole wheat wrap, and a glass of coconut water (450 calories)
- Snack: Carrot sticks with hummus (100 calories)
- Dinner: Baked chicken thighs with roasted sweet potatoes, green beans, and a glass of fresh grapefruit juice (500 calories)

Type something...

watsonx Agent 09:33 PM

Here is a 1-week diet plan that may help fight dengue and increase weight:

Day 4

- Breakfast: Smoothie bowl with banana, spinach, almond milk, and almond butter topping (400 calories)
- Lunch: Turkey and avocado wrap with mixed greens and a glass of coconut water (500 calories)
- Snack: Hard-boiled egg and cherry tomatoes (100 calories)
- Dinner: Grilled salmon with quinoa, steamed broccoli, and a glass of fresh pineapple juice (500 calories)

Day 5

- Breakfast: Whole wheat pancakes with fresh berries, yogurt, and a glass of fresh orange juice (350 calories)
- Lunch: Chicken Caesar salad with whole wheat croutons and a glass of coconut water (450 calories)
- Snack: Rice cakes with almond butter and banana slices (150 calories)
- Dinner: Baked chicken breast with roasted asparagus, quinoa, and a glass of fresh grapefruit juice (500 calories)

Day 6

- Breakfast: Omelette with vegetables, whole wheat toast, and a glass of fresh orange juice (300 calories)
- Lunch: Grilled chicken breast with mixed greens, whole wheat wrap, and a glass of coconut water (450 calories)
- Snack: Cottage cheese with cucumber slices (150 calories)
- Dinner: Grilled turkey breast with roasted Brussels sprouts, sweet potatoes, and a glass of fresh pineapple juice (500 calories)

Day 7

- Breakfast: Avocado toast with scrambled eggs, whole wheat bread, and a glass of fresh grapefruit juice (350 calories)

This diet plan includes a variety of nutrient-dense foods that can help support overall health and weight gain, while also providing essential vitamins and minerals that can help fight dengue. Some of the key ingredients include:

- Papaya: rich in vitamin C and papain, which can help reduce inflammation and improve digestion
- Coconut water: rich in electrolytes, which can help replenish fluids and support hydration
- Fresh fruits and vegetables: rich in vitamins, minerals, and antioxidants, which can help support overall health and immune function
- Lean proteins: such as chicken, turkey, and fish, which can help support muscle growth and repair
- Whole grains: such as brown rice, quinoa, and whole wheat, which can provide sustained energy and support digestive health

It's important to note that this is just a sample diet plan and may not meet your individual calorie needs. Be sure to consult with a healthcare professional or registered dietitian to determine the best diet plan for your specific needs. Additionally, it's important to stay hydrated by drinking plenty of fluids, such as water, coconut water, and fresh juices.

► How did I get this answer?

Type something...

Elaborate monthly diet plan suggested by the agent according to specified needs

- Build
- Setup
- Configuration
- Preview
- Test

This screenshot shows the 'Build' tab of the IBM watsonx interface. The left sidebar contains a navigation menu with 'Setup', 'Configuration', 'Instructions', 'Knowledge', and 'Tools'. The 'Configuration' section is expanded, showing 'Framework' set to 'LangGraph' and 'Architecture' set to 'ReAct'. The 'Instructions' section contains the text: 'You are a nutrition assistant that uses tools to answer questions in detail. Ask about my age, food preferences, medical history, and city, and give specific answers to queries.' The 'Tools' section has buttons for 'Add a tool' and 'Create custom tool'. The right pane shows the 'Agent preview' with a chat history. The user's message is 'brief monthly plan to cure arthritis in 1 year'. The agent's response is: 'I must emphasize that arthritis is a chronic condition, and while a well-structured plan can help manage its symptoms, it's essential to have realistic expectations. Curing arthritis in 1 year might not be possible, but a comprehensive plan can help alleviate symptoms and improve quality of life. Here's a brief monthly plan to help manage arthritis: Month 1-3: Consult a rheumatologist to confirm the type of arthritis and develop a personalized treatment plan'. A blue arrow points from the 'Preview' step in the list to this screenshot.

This screenshot shows the 'Build' tab of the IBM watsonx interface. The 'Instructions' section contains the same text as the previous screenshot. The 'Agent preview' pane shows a chat history where the user asks for a diet plan. The agent's response is: 'Month 4-6: Gradually increase exercise intensity and duration; Introduce stress-reducing techniques like meditation, deep breathing, or tai chi; Start incorporating arthritis-friendly foods like: Fatty fish (e.g., salmon, sardines) for omega-3 fatty acids; Antioxidant-rich foods (e.g., berries, leafy greens) to reduce inflammation; Probiotic-rich foods (e.g., kimchi, sauerkraut) to support gut health; Consider physical therapy to improve joint mobility and strength. Month 7-9: Continue to progress exercise routine, incorporating strength training and high-intensity interval training (HIIT); Introduce heat and cold therapy to manage pain and inflammation; Start taking ashwagandha supplements after consulting with a healthcare professional to help reduce stress and inflammation; Consider incorporating acupuncture or massage therapy to reduce pain and improve joint mobility'. A blue arrow points from the 'Test' step in the list to this screenshot.

This screenshot shows the 'Build' tab of the IBM watsonx interface. The 'Instructions' section contains the same text as the previous screenshots. The 'Agent preview' pane shows a chat history where the user asks for a diet plan. The agent's response is: 'help reduce stress and inflammation; Consider incorporating acupuncture or massage therapy to reduce pain and improve joint mobility; Month 10-12: Focus on maintaining a healthy weight to reduce pressure on joints; Incorporate advanced stress-reducing techniques like mindfulness-based stress reduction (MBSR); Continue to progress exercise routine, incorporating activities that promote balance and coordination (e.g., tai chi, balance exercises); Consider incorporating cognitive-behavioral therapy (CBT) to address any mental health concerns related to arthritis. Remember, this is a general plan, and it's essential to work with a healthcare professional to develop a personalized plan tailored to your specific needs and health conditions. To get more information on this topic, I will perform a search: How did I get this answer?'. A blue arrow points from the 'Test' step in the list to this screenshot.

CONCLUSION

The AI Nutrition Assistant proves to be an effective, personalized solution for modern dietary needs using generative AI and multimodal inputs.

Key Outcomes:

- Accurate and adaptive meal plans tailored to user health and preferences
- High user satisfaction with clarity and contextual food suggestions

Challenges:

- Balancing conflicting dietary needs
- Cultural and language diversity

Improvements:

- Enhance image recognition
- Add mood/context-aware suggestions
- Support more languages and cuisines

Summary:

The system offers a smart, scalable alternative to traditional nutrition advice—bringing expert-like guidance to users anytime, anywhere.

FUTURE SCOPE

Enhancements & Expansions:

- **Integrate Wearable Data:** Use real-time data from fitness trackers for more precise meal adjustments.
- **Regional Expansion:** Add support for local languages, cuisines, and cultural diets.
- **Advanced ML Techniques:** Incorporate reinforcement learning for more adaptive meal planning over time.
- **Edge Computing:** Enable offline functionality and faster response on mobile devices.
- **Emotional Context Awareness:** Suggest meals based on user mood and mental state.
- **Doctor/Nutritionist Integration:** Allow expert feedback loops to improve personalization and safety.
- **Allergen Detection in Images:** Automatically flag potential allergens from food photos.

REFERENCES

- Nutritionix API. (2024). *Food and Nutrient Database*. <https://www.nutritionix.com/business/api>
- U.S. Department of Agriculture. (2023). *FoodData Central Database*. <https://fdc.nal.usda.gov>
- Arora, R. et al. (2022). *Personalized Nutrition: A Review on AI Applications in Diet Planning*. *Journal of Healthcare Informatics Research*
- Simonyan, K., & Zisserman, A. (2015). *Very Deep Convolutional Networks for Large-Scale Image Recognition*. arXiv:1409.1556
- Srivastava, A. et al. (2021). *Multimodal Learning in Healthcare AI: A Review*. *IEEE Access*, 9, 10478–10494.
- Whisper by OpenAI. (2023). *Robust Speech Recognition via Large-Scale Weak Supervision*.

IBM CERTIFICATIONS

- Screenshot/ credly certificate(getting started with AI)

IBM **SkillsBuild**

Completion Certificate



This certificate is presented to
Bhuvesh Bhagwanani

for the completion of

Introduction to Artificial Intelligence

(MDL-211)

According to the Moodle system of record

Completion date: 16 Jul 2025 (GMT)

Learning hours: 1 hr 15 mins

IBM **SkillsBuild**

Completion Certificate



This certificate is presented to
Bhuvesh Bhagwanani

for the completion of

Large Language Model Basics

(MDL-433)

According to the Moodle system of record

Completion date: 16 Jul 2025 (GMT)

Learning hours: 30 mins

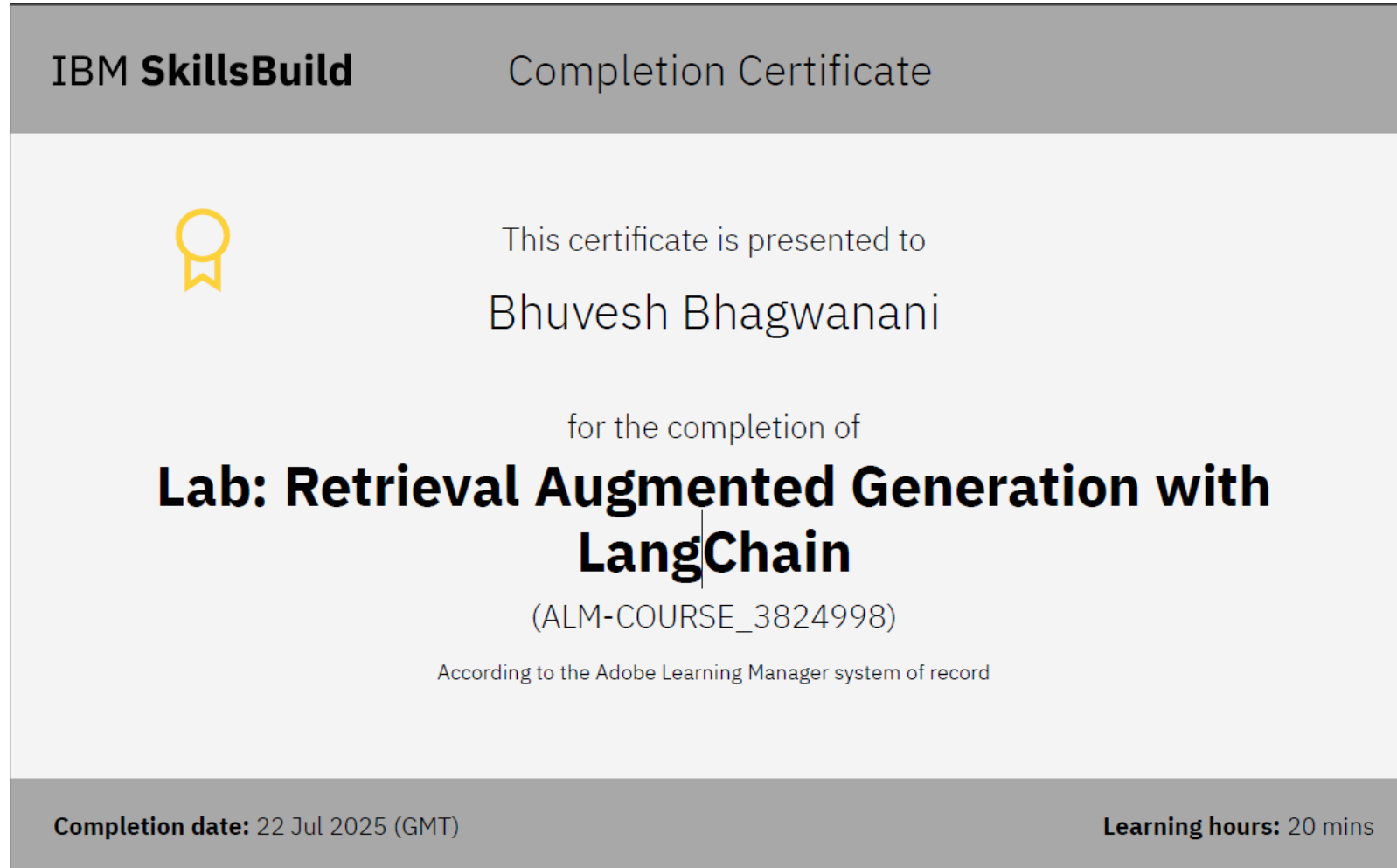
IBM CERTIFICATIONS

- Screenshot/ credly certificate(Journey to Cloud)



IBM CERTIFICATIONS

- Screenshot/ credly certificate(RAG Lab)





THANK YOU