

ADVANCING NUTRITION SCIENCE THROUGH GEMINIAI

1. Introduction

Advancing Nutrition Science Through GeminiAI is an AI-powered web-based application designed to help individuals understand the nutritional value of their food and make informed dietary decisions. The system provides real-time nutritional analysis, personalized meal planning, and virtual nutrition coaching using advanced generative artificial intelligence technology.

The application allows users to enter food names or upload food images to receive detailed insights about calories, macronutrients (proteins, carbohydrates, fats), and micronutrients (vitamins and minerals). It also generates customized meal plans based on dietary restrictions, health conditions, and activity levels.

By integrating modern AI capabilities with a user-friendly web interface, the system simplifies nutrition awareness and promotes healthier lifestyle choices.

Project Title:

Advancing Nutrition Science Through GeminiAI

Team Members:

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1.1. Project Overview

Advancing Nutrition Science through GeminiAI is an AI-powered web-based application designed to provide users with comprehensive nutritional information about food items. The system leverages Google Generative AI (Gemini) to deliver instant and detailed insights into macronutrients such as proteins, fats, and carbohydrates, as well as micronutrients including vitamins and minerals, along with calorie estimation.

The application is developed using **Streamlit** for the user interface and integrates the **Gemini 2.5 Flash** model for real-time intelligent nutrition analysis. It assists users in understanding food composition, planning healthier diets, and receiving personalized nutrition guidance.

This project demonstrates the practical use of generative AI in healthcare and nutrition by offering a fast, interactive, and user-friendly platform for dietary awareness and meal planning.

1.2. Objectives

The main objectives of this project are:

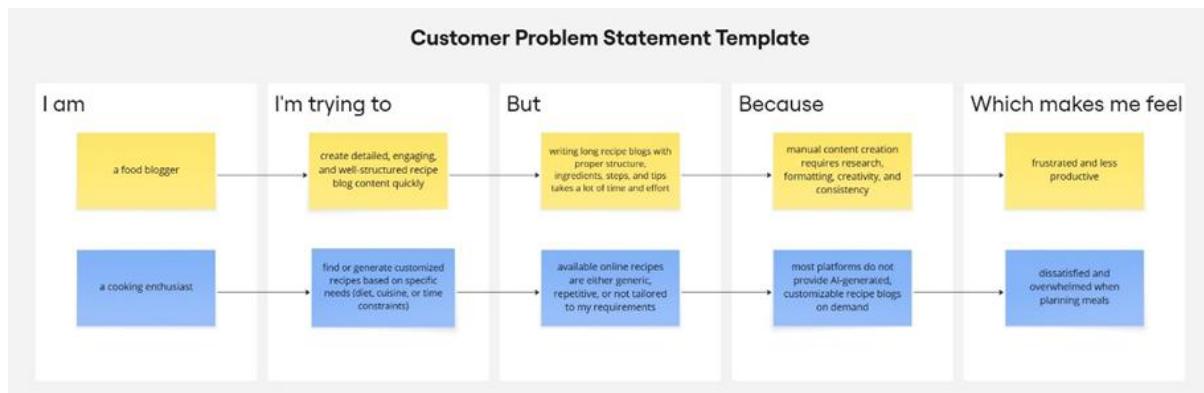
- To develop an AI-powered web application for nutritional analysis
- To provide detailed macronutrient and micronutrient information about foods
- To generate personalized weekly meal plans based on user preferences
- To provide virtual nutrition coaching using AI
- To help users make informed dietary decisions
- To create a simple and user-friendly interface using Streamlit

2. Project Initialization and Planning Phase

2.1. Defining Problem Statement

Many individuals struggle to understand the nutritional value of their daily food intake and often fail to maintain balanced diets. Manual diet planning and consulting nutrition experts can be expensive and time-consuming. Moreover, most existing tools provide generic and non-personalized nutrition advice.

This project solves the problem by providing an AI-powered system that delivers real-time personalized nutrition insights, meal planning, and virtual coaching using Gemini AI.



Problem Statement (PS)	I am	I'm trying to	But	Because	Which makes me feel
PS-1	A food blogger	Create detailed, and high-quality recipe blog content in less time	Writing long and recipe blogs manually is time-consuming	It requires research, creativity, formatting, and consistency	Frustrated and less productive
PS-2	A cooking enthusiast	Generate customized recipes	Existing recipes available online are generic and not customizable	Most platforms do not offer AI-driven recipe blog generation	Dissatisfied and overwhelmed while planning meals

2.2. Project Proposal (Proposed Solution)

Project Overview	
Objective	The main objective of this project is to develop an AI-powered web application that generates customized and high-quality recipe blogs based on user inputs.
Scope	The scope of the project includes building a Streamlit-based web interface where users can enter a recipe topic and desired word count. The system generates a complete recipe blog using an AI model and displays it to the user.
Problem Statement	
Description	Many food bloggers and users find it difficult to create detailed and well-structured recipe blogs within a short time. Manual content creation requires creativity, research, and proper formatting, making it time-consuming.
Impact	Solving this problem helps users save time and effort while creating customized recipe blogs
Proposed Solution	
Approach	The proposed solution uses a Streamlit web application integrated with the Gemini Flash Lite model. Users provide a recipe topic and word count through the UI. The AI model processes the input and generates a complete recipe blog.
Key Features	<ul style="list-style-type: none">• User-friendly Streamlit interface• AI-powered nutritional analysis• Image-based food nutrition detection• Virtual AI nutrition coach

Resource Requirements

Resource Type	Description	Specification/Allocation
Hardware		
Computing Resources	CPU for application execution	Standard system CPU
Memory	RAM required to run application	8 GB
Storage	Disk space for application files	50 GB SSD
Software		
Frameworks	Python web framework	Streamlit
Libraries	AI and utility libraries	google-generativeai
Development Environment	IDE and version control	VS Code, Git
Data		
Data	User input text	Food Items names entered by user

2.3. Initial Project Planning

Product Backlog, Sprint Schedule, and Estimation

The following table represents the product backlog and sprint-wise planning for the **Nutrition Science** project.

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members	Sprint Start Date	Sprint End Date
Sprint 1	User Interface Setup	USN-1	As a user, I can access a Streamlit-based interface to enter a recipe	2	High	All Team Members	28 January 2026	31 January 2026

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members	Sprint Start Date	Sprint End Date
			topic and word count.					
Sprint 1	Input Validation	USN-2	As a user, I want the application to validate my inputs before generating the recipe.	1	High	All Team Members	28 January 2026	31 January 2026
Sprint 2	AI Model Integration	USN-3	As a user, I want the system to generate a recipe blog using the Gemini Flash Lite model.	3	High	All Team Members	02 February 2026	09 February 2026
Sprint 2	Joke Generation	USN-4	As a user, I want to see a programming joke while the recipe is being generated.	1	Medium	All Team Members	02 February 2026	09 February 2026
Sprint 3	Output Display	USN-5	As a user, I want to view the generated recipe blog clearly on the screen.	2	High	All Team Members	12 February 2026	18 February 2026
Sprint 3	Deployment	USN-6	As a user, I want the application to be deployed and accessible through the internet.	2	Medium	All Team Members	12 February 2026	18 February 2026

3. Data Input Handling & Prompt Engineering Phase

Since the NutriAssist AI system does not rely on traditional datasets, this phase focuses on real-time user input handling, validation, prompt engineering, and AI interaction instead of dataset collection and preprocessing.

3.1. Real-Time Data Input Strategy

Unlike conventional machine learning systems that require structured datasets (CSV, images, databases), this application dynamically processes:

- User-entered food names
- Uploaded food images
- Dietary restrictions
- Health conditions
- Nutrition-related questions

The system does not store or maintain historical data. All processing happens in real time through API communication with the AI model.

3.2. Data Source Description

Source Name	Description	Type	Storage
User Input (Text)	Text entered in Streamlit UI Dynamic	Text	Not Stored
Uploaded Image	Food image uploaded by user	Image	Temporary Memory
AI Response	Generated nutrition analysis / meal plan	Text	Display Only

3.3. Input Validation & Cleaning

Since there is no dataset, preprocessing focuses on input quality control:

- Empty input validation
- Acceptable word limits
- Removal of extra spaces
- Structured prompt formatting
- Error handling for API failures

This ensures meaningful and reliable AI-generated responses.

3.4 Prompt Engineering

The system uses structured prompts to guide the AI model.

Example prompt structure:

- Role assignment (“You are a nutrition expert”)
- Clear output formatting instructions
- Requested nutritional breakdown
- Disclaimer for estimated values

Prompt engineering acts as the optimization mechanism instead of dataset preprocessing

3.5 AI Processing Flow

User Input → Validation → Prompt Formatting → Gemini 2.5 Flash API → Generated Output → Display on Streamlit UI

4. Model Development Phase

4.1. Model Selection Report

In this project, the focus is on selecting a pre-trained generative language model suitable for real-time recipe blog generation. Unlike traditional deep learning projects that require training CNNs or RNNs, this application leverages an existing large language model (LLM) to generate high-quality text content. The model is selected based on performance, response time, ease of integration, and suitability for text-based content generation.

Model	Description
Gemini Flash Lite (models/gemini-flash-latest)	A lightweight pre-trained generative language model designed for fast and efficient text generation. It supports real-time content creation with good coherence, relevance, and low latency, making it ideal for recipe blog generation.

4.2. Initial Model Training Code, Model Validation and Evaluation Report

In this project, no custom model training is performed. Instead, a pre-trained generative AI model is integrated and used for recipe blog generation. The focus of this phase is on model selection, configuration, prompt design, and output evaluation, rather than training from scratch.

Initial Model Training Code:

Model Selection and Initialization

The **Gemini Flash Lite (models/gemini-flash-latest)** model is selected due to its lightweight architecture, faster response time, and suitability for real-time text generation tasks.

The model is initialized using the Google Generative AI API. Configuration parameters such as temperature, top-p, top-k, and maximum output tokens are defined to control creativity, response quality, and output length.

Model Validation and Evaluation Report:

Model	Summary	Training and Validation Performance Metrics
Gemini Flash Lite	Pre-trained generative language model optimized for fast text generation	Relevance of generated content, adherence to word count, coherence, clarity, and response time

5. Model Optimization and Tuning Phase

5.1. Tuning Documentation

The primary goal of the Model Optimization and Tuning phase is to enhance the accuracy, clarity, and usefulness of the responses generated by the Gemini AI model. Since the project uses a pre-trained generative AI model rather than training a custom neural network, optimization is achieved through **prompt engineering, parameter tuning, and response formatting**.

Hyperparameter Tuning Documentation

Model	Tuned Hyperparameters
Gemini 2.5 Flash	Temperature: 0.6 (Balanced creativity)
	Top-p: 0.9 (Improves coherence)
	Top-k: 40 (Reduces irrelevant token sampling)
	Max Output Tokens: 2048 (Ensures complete nutritional analysis)
	Response Format: Markdown for structured UI display

5.2. Final Model Selection Justification

Final Model	Reasoning
Gemini Flash Lite (models/gemini-flash-latest)	Selected due to its fast response time, efficient resource usage, high-quality text generation, and seamless integration with Streamlit for real-time recipe suggestions.

6. RESULTS

6.1. Output Screenshots

The complete execution of Advancing Nutrition Science through GeminiAI application is represented step by step in the following screenshots.

Step 1: To run the Streamlit Application we have to use the command `streamlit run app.py` in the terminal in path where the `app.py` file is located.

```
(venv) PS C:\Users\VEERA HARI\Desktop\Advancing Nutrition Science Through GeminiAI> streamlit run app.py
>>

You can now view your Streamlit app in your browser.

Local URL: http://localhost:8501
Network URL: http://192.168.1.9:8501
```

Step 2: After running the command in terminal, the code will get executed and the webpage will open directly. Another way to open webpage is that a localhost link will get generated in the terminal, we can access the webpage using that link.

```
You can now view your Streamlit app in your browser.

Local URL: http://localhost:8501
Network URL: http://192.168.1.9:8501

C:\Users\VEERA HARI\Desktop\Advancing Nutrition Science Through GeminiAI\app.py:3: FutureWarning:
All support for the `google.generativeai` package has ended. It will no longer be receiving
updates or bug fixes. Please switch to the `google.genai` package as soon as possible.
See README for more details:
https://github.com/google-gemini/deprecated-generative-ai-python/blob/main/README.md
import google.generativeai as genai
```

Step 3: The Streamlit webpage opens as shown in the figure given below. This is an automated webpage. No secondary HTML codes required to build this webpage. Python code itself consists the webpage building code.

Scenario 1: Dynamic Nutritional Insights Understanding the nutritional content of food is essential for making healthy choices. NutriAssist AI provides users with dynamic nutritional insights about their meals and snacks. By inputting food items or scanning barcodes, users

can instantly receive detailed information about macronutrients (protein, fat, carbohydrates), micronutrients (vitamins, minerals), and calorie content. This empowers users to make conscious decisions about their food intake and track their progress toward their nutritional goals.

The screenshot shows the NutriAssist AI interface. On the left, a sidebar menu includes 'Nutrition AI Scenario' (selected), 'Dynamic Nutritional Insights' (highlighted in blue), 'Tailored Meal Planning', and 'Virtual Nutrition Coaching'. The main content area features a logo for 'NutriAssist AI' with the subtitle 'Smart Nutrition Powered by Gemini 2.5 Flash'. Below this is a section titled 'Dynamic Nutritional Insights' with a camera icon. It contains two input fields: 'Food item name (optional)' and 'Upload an image'. The 'Upload an image' field has a placeholder 'Drag and drop file here' and a note 'Limit 200MB per file • JPG, JPEG, PNG'. A 'Browse files' button is also present. A red 'Analyze Nutrition' button is located below these fields. A disclaimer at the bottom states: '⚠️ Disclaimer: All values are AI-generated estimates. Consult a certified dietitian for medical advice.' The footer indicates 'Powered by NutriAssist AI • Gemini 2.5 Flash • 2026'.

This screenshot shows the same NutriAssist AI interface as above, but with a file uploaded to the 'Upload an image' field. The file is named 'Indian_Spicy_Noodles' and is a jpg image of a plate of Indian spicy noodles. The rest of the interface remains the same, including the sidebar menu and the 'Dynamic Nutritional Insights' section.

[Analyze Nutrition](#)

✓ Analysis complete!

Nutrition Analysis

As a nutrition expert, I can analyze this "Indian Spicy Noodles" dish based on the visual information and common culinary practices for such food items in India.

Important Note: The nutritional values provided are approximate, as the exact ingredients, cooking methods, and portion sizes can vary significantly. This analysis is based on typical preparations involving noodles (likely wheat-based), various vegetables, oil, and a blend of Indian spices.

Nutrition Analysis: Indian Spicy Noodles ↵

Approximate Values (per 100g cooked portion)

- **Calories:** 180 - 220 kcal
- **Macronutrients:**
 - **Carbohydrates:** 25 - 35 grams (primarily from noodles and vegetables)
 - **Protein:** 4 - 6 grams (from noodles, peas, and other vegetables)
 - **Fat:** 6 - 10 grams (from cooking oil, some natural fats in ingredients)

Typical Serving Size & Calories: A common serving of this dish might be around 200-250g, which would equate to approximately 360-550 calories per serving.

Key Micronutrients (Estimated)

The micronutrient profile will depend heavily on the variety and quantity of vegetables used. Based on the image showing carrots, peas, and onions, along with typical Indian spices:

- **Vitamins:**
 - **Vitamin A (Beta-carotene):** From carrots (significant).
 - **Vitamin C:** From onions, peas, and potentially other vegetables like bell peppers (if added), and chilies.
 - **Vitamin K:** From peas and coriander garnish.
 - **B Vitamins (Thiamine, Niacin, Riboflavin, Folate):** From noodles (especially if fortified), peas, and other vegetables.
- **Minerals:**
 - **Potassium:** From vegetables like carrots, peas, and onions.
 - **Manganese:** From noodles and peas.
 - **Iron:** Present in small amounts from peas and wheat noodles.
 - **Sodium:** Likely high due to added salt and potential use of processed sauces/spice mixes.

Health Benefits & Concerns

Health Benefits:

1. **Energy Boost:** Primarily rich in carbohydrates, providing readily available energy for daily activities.
2. **Vegetable Contribution:** The inclusion of vegetables like carrots and peas adds dietary fiber, vitamins (A, C, K), and minerals (potassium, manganese), contributing to overall nutrient intake.

Serving Suggestions

To enhance the nutritional profile and make it a more balanced meal:

1. **Boost Protein:**

- Serve alongside or mix in cooked paneer, tofu, chicken, eggs, or lentils (dal).
- A side of yogurt or raita (yogurt with cucumber/spices) can also add protein and probiotics.

2. **Increase Fiber and Micronutrients:**

- Add more non-starchy vegetables during cooking, such as cabbage, bell peppers, spinach, mushrooms, or green beans.
- Serve with a fresh, crisp salad on the side.

3. **Choose Whole Grains:**

- Opt for whole wheat noodles, brown rice vermicelli, or millet-based noodles if available, to increase fiber and complex carbohydrates.

4. **Control Sodium and Fat:**

- Reduce the amount of added salt. Rely more on herbs, fresh spices, and lemon juice for flavor.
- Use cooking oil sparingly and choose healthier options like olive oil or avocado oil.

5. **Portion Control:**

- Be mindful of serving sizes, especially if it's prepared with higher oil content or refined noodles. Consider it as a part of a larger, balanced meal rather than the sole component.

 Disclaimer: All values are AI-generated estimates. Consult a certified dietitian for medical advice.

Step 4:

Scenario 2: Tailored Meal Planning Many individuals struggle with creating healthy and satisfying meal plans that align with their specific needs and preferences. **NutriAssist AI** addresses this challenge by generating personalized meal plans based on user input. Users can provide information about their dietary restrictions, allergies, health conditions, activity levels, and taste preferences. The AI then crafts a week-long meal plan with recipes and grocery lists, ensuring nutritional balance, variety, and enjoyment.

The screenshot shows the NutriAssist AI platform. On the left, a sidebar menu includes 'Nutrition AI Scenario' (selected), 'Dynamic Nutritional Insights', 'Tailored Meal Planning' (selected), and 'Virtual Nutrition Coaching'. The main content area features the 'NutriAssist AI' logo with the tagline 'Smart Nutrition Powered by Gemini 2.5 Flash'. Below the logo is the heading 'Tailored Meal Planning'. A sub-instruction 'Provide your dietary details for a personalized 1-day plan.' is displayed. The form fields include: 'Dietary restrictions/allergies' (e.g., vegetarian, nut-free), 'Health conditions' (e.g., diabetes, weight loss), 'Activity level' (dropdown: Sedentary), 'Taste preferences' (e.g., spicy, Indian), and a 'Generate Meal Plan' button.

Tailored Meal Planning

Provide your dietary details for a personalized 1-day plan.

Dietary restrictions/allergies	Health conditions
vegetarian	weight loss
Activity level	Taste preferences
Moderate	Indian

Generate Meal Plan

Your Personalized Meal Plan

Here's a 1-day balanced Indian vegetarian meal plan tailored for weight loss with moderate activity, keeping your taste preferences in mind!

Overall Strategy for Weight Loss:

- **Calorie Deficit:** The plan aims for approximately 1400-1600 calories, creating a moderate deficit for weight loss while providing adequate nutrition.
- **High Protein & Fiber:** To enhance satiety, preserve muscle mass, and aid digestion.
- **Complex Carbohydrates:** For sustained energy and better blood sugar control.
- **Healthy Fats:** For essential nutrients and satiety.
- **Minimal Processed Foods:** Focus on whole, fresh ingredients.
- **Minimal Oil:** Recipes focus on sautéing, boiling, or baking with very little oil/ghee.

1-Day Indian Vegetarian Weight Loss Meal Plan

1. Breakfast (Approx. 280-300 calories)

- **Meal:** Savory Besan Cheela (Chickpea Flour Pancake) with Mint Chutney & Curd
- **Portion Sizes:**
 - 2 medium-sized Besan Cheelas (made from ~1/2 cup besan/chickpea flour)
 - 2 tbsp Mint Chutney
 - 1/2 cup (120g) Plain Low-Fat Curd (Dahi)
- **Ingredients & Preparation:**
 - **Cheela:** Mix 1/2 cup besan with water to form a smooth batter. Add finely chopped onions (1/4), tomatoes (1/4), green chilies (1), ginger (1 tsp grated), coriander leaves (2 tbsp), and spices (pinch of turmeric, red chili powder, cumin powder, salt to taste). Cook on a non-stick pan with 1 tsp oil/ghee per cheela.
 - **Mint Chutney:** Blend fresh mint leaves, coriander leaves, green chilies, a piece of ginger, a squeeze of lemon juice, and a pinch of black salt.
- **Balanced Macros:**
 - **Carbohydrates:** Complex carbs from besan, fiber from veggies.
 - **Protein:** Excellent source from besan (chickpea flour) and curd.
 - **Fats:** Minimal healthy fats from cooking oil/ghee and curd.
- **Nutritional Benefits:** High in plant-based protein, fiber, and iron. Keeps you full and energized throughout the morning. Probiotics from curd aid digestion.

Total Estimated Calories for the Day: ~1360 - 1470 calories

Important Considerations for Weight Loss:

- **Hydration:** Drink at least 8-10 glasses of water throughout the day.
- **Cooking Oil:** Use minimal oil (preferably cold-pressed mustard oil, groundnut oil, or a tiny bit of ghee) for cooking. Non-stick pans are your best friend.
- **Spices:** Utilize the rich array of Indian spices (turmeric, cumin, coriander, ginger, garlic, fenugreek, etc.) as many have medicinal and metabolic benefits.
- **Listen to Your Body:** Adjust portion sizes slightly based on your hunger and fullness cues.
- **Consistency:** Adherence to a balanced meal plan and regular moderate activity is key for sustainable weight loss.
- **Customize:** Feel free to swap vegetables or dals based on availability and preference, maintaining similar nutritional profiles.
- **Avoid:** Fried foods, excessive sugar, processed snacks, white rice, and refined flour.

Enjoy your delicious and healthy Indian meals on your weight loss journey!

 **Disclaimer:** All values are AI-generated estimates. Consult a certified dietitian for medical advice.

Powered by NutriAssist AI • Gemini 2.5 Flash • 2026

Step 5:

Scenario 3: Virtual Nutrition Coaching Receiving personalized guidance from a nutrition expert can be costly and time-consuming. NutriAssist AI democratizes access to nutritional expertise by offering virtual nutrition coaching. The AI acts as a virtual coach, providing users with personalized advice, answering questions, and offering support throughout their wellness journey. This interactive coaching experience helps users stay motivated, make sustainable lifestyle changes, and achieve long-term health improvements.

The screenshot shows a web-based nutrition coaching platform. On the left, a sidebar lists "Nutrition AI Scenario" options: "Dynamic Nutritional Insights", "Tailored Meal Planning", and "Virtual Nutrition Coaching". The "Virtual Nutrition Coaching" option is selected and highlighted with a blue border. The main content area features a large "Virtual Nutrition Coaching" title with a speech bubble icon. Below it, a message says "Ask any nutrition question — get expert advice!". A text input field contains the question "Suggest me the Best protein sources for vegetarians?". A red "Ask Coach" button is positioned below the input field. A progress bar indicates "Coach is responding...". At the bottom of the main area, a disclaimer states: "⚠️ Disclaimer: All values are AI-generated estimates. Consult a certified dietitian for medical advice." The footer of the page includes the text "Powered by NutriAssist AI • Gemini 2.5 Flash • 2026".

 Ask Coach

Coach Says:

Hello there! As your friendly nutrition coach, I'm thrilled you're focusing on this vital aspect of your diet. Getting adequate protein as a vegetarian is not only achievable but can be incredibly delicious and diverse!

Let's dive into the "best" protein sources for you.

1. Direct Answer: The Best Protein Sources for Vegetarians

For vegetarians, the 'best' protein sources are really about variety, nutrient density, and ensuring you get all the essential amino acids your body needs. Here are my top picks:

- **Legumes & Pulses:** These are your powerhouses! Think **lentils** (red, green, brown), **chickpeas** (garbanzo beans), **black beans**, **kidney beans**, **cannellini beans**, split peas, and **edamame** (soybeans). They're not just protein-rich but also packed with fiber, iron, and other essential nutrients.
- **Soy Products:** **Tofu** (firm, silken, extra-firm), **tempeh** (fermented soybean block with a nutty flavor), and **edamame** are fantastic. They are *complete proteins*, meaning they contain all nine essential amino acids your body can't produce itself. Fortified soy milk is also a good option.
- **Nuts & Seeds:** **Almonds**, **walnuts**, **peanuts**, **pistachios**, **cashews**, **chia seeds**, **flax seeds**, **hemp seeds**, **pumpkin seeds**, and **sunflower seeds** are excellent for protein, healthy fats, and fiber. Hemp and chia seeds are notable for being complete proteins!
- **Whole Grains:** **Quinoa** stands out as a complete protein on its own. Other whole grains like **oats**, **brown rice**, **buckwheat**, and whole wheat bread contribute significantly to your daily protein, especially when combined with legumes.
- **Dairy & Eggs (if you include them):** If you're a lacto-ovo vegetarian, **eggs** are a gold standard complete protein. Dairy products like **Greek yogurt** (very high

2. Actionable Tips: Making it Practical

Now, let's make this easy to implement into your daily life:

- **Embrace Variety:** Don't just stick to one or two sources. Mix and match! The beauty of vegetarian protein is in its diversity. Combining different plant proteins throughout the day (e.g., rice and beans, hummus and whole wheat pita, nut butter on whole-grain toast) helps ensure you get a full spectrum of amino acids. Your body is smart and creates a "pool" of amino acids, so you don't need to combine them perfectly in every single meal, but variety over the day is key.
- **Protein at Every Meal:** Aim to include a protein source with each meal and snack. This helps with satiety, blood sugar stability, and muscle maintenance. For example:
 - **Breakfast:** Oatmeal with hemp seeds and berries, or Greek yogurt with nuts.
 - **Lunch:** Lentil soup with whole-grain bread, or a big salad with chickpeas and tofu.
 - **Dinner:** Black bean burgers, tempeh stir-fry, or a hearty lentil dahl.
- **Snack Smart:** Keep protein-rich snacks handy. Think a handful of nuts, a scoop of hummus with veggie sticks, a hard-boiled egg, or a small container of Greek yogurt.
- **Don't Be Afraid of Portions:** Plant proteins often come with fiber and water, making them very filling. Ensure you're eating enough of them to meet your daily protein needs, especially if you're active.
- **Cook with Purpose:** Make legumes a staple in your kitchen. Add them to soups, salads, stews, or make your own veggie burgers. Experiment with tofu and tempeh in various marinades and cooking styles – they are incredibly versatile!

3. Common Mistakes to Avoid

Even with good intentions, some common pitfalls can happen. Let's make sure you steer clear of them:

- **Underestimating Protein Needs:** Especially if you're active, your protein requirements might be higher than you think. Don't assume you're getting enough just by eating "some" vegetarian food. Pay attention to how you feel, your energy levels, and muscle recovery.
- **Relying Heavily on Processed Vegetarian Alternatives:** While convenient, many "fake meats" can be high in sodium, unhealthy fats, and heavily processed. While fine in moderation, prioritize whole, unprocessed protein sources like legumes, whole grains, nuts, and seeds.
- **Insufficient Variety:** Sticking to just pasta and bread, and not actively incorporating diverse protein sources, can lead to nutrient gaps. Challenge yourself to try a new protein source each week!
- **Ignoring Nutrient Density:** Not all protein sources are created equal. Opt for whole grains over refined grains, and unsweetened plant milks or yogurts over sugary versions to maximize your nutrient intake.
- **Forgetting Other Key Nutrients:** While not directly protein mistakes, vegetarians (especially vegans) need to be mindful of nutrients like iron (pair iron-rich plant foods with Vitamin C for better absorption) and Vitamin B12 (often requires supplementation or fortified foods).

4. Follow-Up Question ↗

I hope this gives you a fantastic starting point! To help me tailor this even more to you, tell me:

What are some of your current go-to vegetarian meals or ingredients, and what are your biggest challenges when it comes to incorporating protein into your diet right now?



7. ADVANTAGES AND DISADVANTAGES

Advantages

- Provides real-time nutrition insights
- Generates personalized meal plans
- Offers AI-powered virtual nutrition coaching
- User-friendly and interactive interface
- No dataset required for training
- Fast and efficient response generation
- Supports both text and image input
- Helps users make healthier lifestyle decisions

Disadvantages

- Requires continuous internet connection
- Depends on third-party AI API services
- Accuracy depends on clarity of user input
- Cannot replace professional medical consultation
- Limited offline functionality

8. CONCLUSION

The **Advancing Nutrition Science through GeminiAI(NutriAssist AI)** project successfully demonstrates the application of generative AI in the field of nutrition and healthcare. The system provides intelligent nutritional insights, personalized meal planning, and virtual coaching through an easy-to-use web interface.

By leveraging Gemini AI, the application helps users understand food composition, make informed dietary decisions, and adopt healthier lifestyle habits. The project highlights how AI can make personalized nutrition guidance accessible, affordable, and efficient for everyone.

9. FUTURE SCOPE

The project can be further enhanced with the following improvements:

- Barcode-based food scanning.
- Mobile application development (Android/iOS)
- Multi-language support for wider accessibility
- Diet tracking and progress monitoring dashboard
- Integration with wearable fitness and health devices
- AI-based calorie tracking system
- Voice-based interaction with nutrition coach
- Personalized diet recommendations based on medical history

These future enhancements will further improve usability, accuracy, and real-world applicability.

10. APPENDIX

10.1. Source Code

The project is implemented using Python and Streamlit and integrates Google Gemini AI for nutrition analysis, meal planning, and coaching.

CODE

```
import os

import streamlit as st

import google.generativeai as genai

from dotenv import load_dotenv

from PIL import Image


# ----- CONFIG -----


st.set_page_config(
    page_title="NutriAssist AI",
    layout="wide"
)


# Main Heading


st.markdown("<h1 style='text-align: center;'>🥗 NutriAssist AI</h1>", unsafe_allow_html=True)

st.markdown("<p style='text-align: center; color: gray;'>Smart Nutrition Powered by Gemini 2.5 Flash</p>", unsafe_allow_html=True)

st.markdown("---")


# Load API key
```

```
load_dotenv()

genai.configure(api_key=os.getenv("GOOGLE_API_KEY"))

# Gemini Model (Vision + Text Supported)

model = genai.GenerativeModel("models/gemini-2.5-flash")

# ----- CUSTOM SIDEBAR STYLE -----

st.markdown("""""")
```

```
section[data-testid="stSidebar"] .stButton > button {width: 100%;text-align: left;padding: 10px 14px;margin-bottom: 8px;border-radius: 8px;border: 1px solid #e0e0e0;background-color: #f8f9fa;font-weight: 500;transition: all 0.2s ease-in-out;}section[data-testid="stSidebar"] .stButton > button:hover {background-color: #1a8cff;color: white;}
```

```
}
```

```
section[data-testid="stSidebar"] .stButton > button[kind="primary"] {  
    border-left: 5px solid #0033cc;  
    background-color: #eeeeee;  
    color: black;  
    font-weight: 600;  
}  
</style>  
"""", unsafe_allow_html=True)
```

```
# ----- SIDEBAR NAVIGATION -----
```

```
if "page" not in st.session_state:  
    st.session_state.page = "Dynamic Nutritional Insights"
```

```
st.sidebar.markdown("### 🌟 Nutrition AI Scenario")
```

```
pages = [  
    "Dynamic Nutritional Insights",  
    "Tailored Meal Planning",  
    "Virtual Nutrition Coaching"  
]
```

```
for page in pages:
```

```
def set_page(p=page):
    st.session_state.page = p

st.sidebar.button(
    page,
    key=f"btn_{page}",
    use_container_width=True,
    type="primary" if st.session_state.page == page else "secondary",
    on_click=set_page
)
```

```
option = st.session_state.page
```

```
# ===== PAGE 1 =====
```

```
if option == "Dynamic Nutritional Insights":
    st.title("📸 Dynamic Nutritional Insights")
    st.write("Upload an image of food or enter its name for detailed nutritional analysis.")
```

```
col1, col2 = st.columns([2, 3])
```

```
with col1:
```

```
    food_name = st.text_input("Food item name (optional)")
```

```
with col2:
```

```
    uploaded_image = st.file_uploader("Upload an image", type=["jpg", "jpeg", "png"])
```

```
image = None

if uploaded_image:

    image = Image.open(uploaded_image)

    st.image(image, caption="Uploaded Image", width=500)

if st.button("⚡ Analyze Nutrition", type="primary"):

    if not image and not food_name:

        st.warning("Please provide food name or image!")

    else:

        with st.spinner("Analyzing nutrition using Gemini AI..."):

            prompt = f"""

You are a nutrition expert.
```

Analyze the food based on:

Food name: {food_name if food_name else "Image provided"}

Provide:

- Calories (per 100g or serving)
- Macronutrients (carbs, protein, fat in grams)
- Key micronutrients (vitamins & minerals)
- Health benefits & concerns
- Serving suggestions

Mention clearly values are approximate.

```
"""
try:
    if image:
        response = model.generate_content([prompt, image])
    else:
        response = model.generate_content(prompt)

    st.success("✅ Analysis complete!")

    st.subheader("🍎 Nutrition Analysis")
    st.markdown(response.text)

except Exception as e:
    st.error(f"Error: {str(e)}")

# ===== PAGE 2 =====

elif option == "Tailored Meal Planning":
    st.title("📅 Tailored Meal Planning")
    st.write("Provide your dietary details for a personalized 1-day plan.")

    col1, col2 = st.columns(2)
    with col1:
        diet = st.text_input("Dietary restrictions/allergies", placeholder="e.g., vegetarian, nut-free")
```

```
activity = st.selectbox("Activity level", ["Sedentary", "Moderate", "Active", "Athlete"])
```

with col2:

```
condition = st.text_input("Health conditions", placeholder="e.g., diabetes, weight loss")
```

```
taste = st.text_input("Taste preferences", placeholder="e.g., spicy, Indian")
```

```
if st.button("Generate Meal Plan", type="primary"):
```

```
    with st.spinner("Creating your meal plan..."):
```

```
        prompt = f"""
```

Create a 1-day balanced meal plan (3 meals + 2 snacks) for:

Diet: {diet or 'None'}

Health condition: {condition or 'General health'}

Activity level: {activity}

Taste preferences: {taste or 'Balanced'}

Include:

- Portion sizes
- Calories per meal
- Balanced macros
- Easy Indian-friendly ingredients
- Nutritional benefits per meal

```
""""
```

try:

```
response = model.generate_content(prompt)

st.subheader("📋 Your Personalized Meal Plan")

st.markdown(response.text)

except Exception as e:

    st.error(f"Error: {str(e)}")
```

```
# ===== PAGE 3 =====
```

```
elif option == "Virtual Nutrition Coaching":

    st.title("⌚ Virtual Nutrition Coaching")

    st.write("Ask any nutrition question — get expert advice!")
```

```
question = st.text_area(
    "Your question:",
    height=100,
    placeholder="e.g., Best protein sources for vegetarians?"
)
```

```
if st.button("⌚ Ask Coach", type="primary"):
```

```
    if question:

        with st.spinner("Coach is responding..."):

            prompt = f"""
```

```
You are a friendly expert nutrition coach.
```

```
Answer clearly and practically:
```

Question: {question}

Structure:

1. Direct answer
2. Actionable tips
3. Common mistakes
4. Follow-up question

"""

try:

```
    response = model.generate_content(prompt)
```

```
    st.markdown("### 🧑 Coach Says:")
```

```
    st.markdown(response.text)
```

except Exception as e:

```
    st.error(f"Error: {str(e)}")
```

----- FOOTER -----

```
st.markdown("---")
```

```
st.info(
```

"⚠ Disclaimer: All values are AI-generated estimates."

"Consult a certified dietitian for medical advice."

)

```
st.caption("Powered by NutriAssist AI • Gemini 2.5 Flash • 2026")
```

10.2. Github & Project Demo Link

Github :- <https://github.com/Sudheerpithani/Advancing-Nutrition-Science-Through-GeminiAI>

DemoVideo:-

<https://drive.google.com/file/d/14baEl9g5ZG68F2VgJjikTITCehtGSnyh/view?usp=sharing>