**Diet Health Scoring Bot – Problem Definition and Project Goals**

The Diet Health Scoring Bot addresses the problem that many people lack easy feedback on how healthy a particular meal is. Users simply input a list of foods and portions, and the bot computes a basic nutrient breakdown and a “health score” for that meal. This directly applies the USDA Dietary Guidelines (e.g. MyPlate recommendations) to everyday meals. By framing complex nutrition rules in simple scores and suggestions, the bot makes official guidelines more understandable to the general public. For example, USDA MyPlate encourages filling ~50% of the plate with fruits/vegetables and limits calories from added sugar and saturated fat; the bot uses these principles to judge each meal.

Solving this problem is useful because it raises awareness of balanced eating and nutrient content in daily life. Instead of guessing, a user sees calories, protein, fat, carbs, and fiber for their meal, plus a 0–100 health score based on USDA targets. This educates users about portions and nutrient density. The expected outcome is a working demonstration (not a certified medical tool) that shows how generative AI can promote healthy eating. We aim to produce clear, actionable feedback (e.g. “This meal is low on fiber; consider adding vegetables”) and a numeric score similar to USDA’s Healthy Eating Index (HEI) approach. The final model will illustrate these ideas for an AI course, helping students see how AI can translate dietary science into everyday advice.

**Design and Implementation Plan**

* **Generative AI Component:** The core language engine will be a large language model (e.g. OpenAI’s ChatGPT/GPT-4 API). We will prompt it to act as a nutrition assistant. Given the meal details and calculated nutrients, the model will produce a concise summary, score, and suggestions in plain English. For example, the system prompt might instruct: *“You are a dietitian summarizing a meal’s nutrition. Given calories, protein, fat, carbs, and fiber, return a brief breakdown, a health score from 0–100, and a suggestion to improve balance.”* This ensures the AI focuses on USDA-style guidance when answering. Recent studies show AI chatbots can generate nutritionally adequate plans but may struggle with macro balance, so our prompts will explicitly check macros against USDA ranges to guide the model.
* **Prompt Engineering:** We will design structured prompts to elicit the desired output. For example, the prompt might list the nutrient totals and then ask: *“Score this meal on a 0–100 scale based on USDA balance, and give one improvement tip.”* We may use intermediate reasoning cues (e.g. “Calculate percent of calories from each macronutrient first”) to improve accuracy. The prompt will explicitly specify the output format (e.g. bullet points or JSON) so the response is consistent and easy to parse. Iterative testing of prompts will refine clarity; for example, telling the model to “penalize” high saturated fat or low fiber encourages adherence to guidelines. We might also use prompt templates that mention official terms like the USDA’s Acceptable Macronutrient Distribution Ranges to anchor the model’s reasoning.
* **Input/Output Format:** The user **input** will be a plain-text meal description, e.g. “1 cup oatmeal, 200ml milk, 1 banana, 1 tsp honey.” The system will parse this list (possibly via a simple NLP step) into individual foods and quantities. The **output** will be a short, user-friendly summary, such as:
  + *Calories: 350 kcal, Protein: 10g, Fat: 5g, Carbs: 60g, Fiber: 8g.*
  + *Health Score: 75/100.*
  + *Suggestion: Add a source of protein (e.g. nuts or yogurt) to balance macronutrients.*

This could be formatted as a Markdown list or JSON. By defining a clear template in the prompt, we ensure consistency and avoid extraneous text. The tone will be encouraging and non-technical, since the target is the general public.

* **Nutrients and Scoring Logic (USDA Standards):** We focus on the key nutrients: calories, protein, fat, carbohydrates, and fiber. USDA guidelines suggest that for a typical adult, macronutrients should fall within these Acceptable Macronutrient Distribution Ranges (AMDR): 45–65% of calories from carbs, 10–35% from protein, 20–35% from fat. For fiber, the recommendation is 14 grams per 1000 calories (about 28g/day for a 2000 kcal diet). Our scoring logic will compare the meal’s nutrient ratios to these targets. For example, if a meal’s calories are 50% carbs (within 45–65%), 15% protein (within 10–35%), and 35% fat (at upper limit), that is good; deviations from these ranges will lower the score. We may assign sub-scores for each category (macro balance and fiber adequacy) and average them to get 0–100. Meals meeting all targets score near 100, while those very high in fat/sugar or low in fiber score lower. This loosely mirrors the USDA’s Healthy Eating Index, which uses a 0–100 scale to assess diet quality.

In practice, we might assume each meal should cover roughly one-third of daily needs. For example, a 600 kcal meal should aim for ~20g protein, 20g fat, 90g carbs and ~7g fiber (scaling the daily totals). The health score will deduct points for excess saturated fat or sugar (based on USDA discretionary calories limit) and for too little fiber or protein. This rule-based scoring will be coded explicitly and then described in the AI’s prompt so ChatGPT can incorporate it.

* **Tools and APIs:** The system will combine the generative AI (ChatGPT/GPT-4) with a nutrition database. We will use the USDA’s FoodData Central API (or a similar public nutrition API) to obtain accurate nutrient information for each food item. For example, our server code will call the FDC API for “oatmeal” or “banana” and get calories, macronutrients, and fiber per serving. We then multiply by the portion and sum across the meal. These totals are then fed into the ChatGPT prompt. The OpenAI API (or an open LLM) generates the textual output. In summary: input text → parse foods → query FoodData Central for nutrients → compute totals and score → send to ChatGPT → get breakdown + explanation.
* **Testing and Improvement:** We will test the system with a variety of sample meals (e.g. high-carb breakfast, balanced lunch, high-fat dinner) to ensure the outputs are sensible. A feedback loop can include user or expert reviews: dietitians or testers can flag inaccuracies or misleading suggestions. Prompt refinements might be needed if ChatGPT under/overestimates nutrients. We will also compare the bot’s output to simple ground-truth calculations (for nutrient totals) to check accuracy. Over time, we can adjust the scoring weights (e.g. penalize fat more if needed) based on testing. Finally, informal user testing (asking friends to input their meals) can reveal if explanations and scores are understandable and helpful. This iterative process of testing and refining will improve the model’s reliability and user-friendliness over time.

**Sources:** USDA guidelines on balanced diets and nutrient targets; MyPlate recommendations on meal composition; FoodData Central nutrition database info; Healthy Eating Index methodology; recent AI nutrition study highlighting macro-balancing challenges.