A Data-Driven Nutrition Monitoring System with Personalized Macro-Level Feedback

Project Overview

This project aims to design and implement a data-driven nutrition monitoring system focused on Indian dietary patterns. The system goes beyond basic calorie counting by transforming food intake data into meaningful macro-nutrient insights, longitudinal trends, and personalized feedback aligned with individual goals. The platform is intentionally framed as a decision-support and awareness tool rather than a medical diagnostic system, making it suitable for academic use and conference dissemination.

Motivation and Problem Statement

Most existing nutrition tracking applications emphasize isolated numerical outputs such as daily calorie totals. They often lack contextual interpretation, trend-based analysis, and culturally relevant food data, especially for Indian diets. This reduces user understanding and long-term engagement. The proposed system addresses these limitations by combining structured nutrition data, goal modeling, and interpretable analytics.

Data Foundation

An Indian food nutrition dataset containing over one thousand prepared dishes was selected as the primary data source. The dataset includes macro-nutrients such as calories, protein, carbohydrates, fats, fibre, and sugars, along with selected micro-nutrients. PostgreSQL was chosen as the database engine, and the dataset was imported through a staging process and normalized into dedicated food and nutrient tables to ensure consistency, scalability, and research transparency.

Backend Architecture Planning

The backend is designed using a modular architecture with clear separation of concerns. PostgreSQL serves as the single source of truth for nutrition data. A Node.js-based backend communicates with the database through a structured service layer. Feature modules are planned around domains such as food lookup, intake logging, goal computation, analytics, and AI-assisted feedback.

Food Intake and Macro Computation Strategy

Users will log food intake by selecting items from the food catalog and specifying quantities. Macro-nutrient values are computed deterministically based on standardized per-unit nutrition values stored in the database. Computed values are stored as snapshots to support historical accuracy and trend analysis.

Goal Modeling and Trend Analysis

The system plans to incorporate goal modeling based on established metabolic equations and activity multipliers. Users may adjust targets manually, enabling a human-in-the-loop personalization mechanism. Daily and weekly summaries will be derived to visualize consistency, surplus or deficit trends, and protein intake relative to body weight.

AI-Assisted Conversational Module

An AI-assisted conversational component is planned to provide non-diagnostic meal planning suggestions and reminders. The assistant will operate strictly on structured, system-computed data and will not generate or infer nutrition values. A rule-based recommendation engine will act as a baseline for experimental comparison.

Implementation Roadmap

The development roadmap begins with stabilizing the food and nutrition data layer, followed by backend API development for food search and intake logging. Goal computation and analytics modules will be added next, with frontend integration planned after backend validation. The AI-assisted module will be introduced in later stages for controlled evaluation.

Academic and Ethical Considerations

The system is designed with ethical clarity, transparency of data sources, and reproducibility in mind. It avoids medical claims and positions itself as a decision-support platform. These design choices make the project suitable for academic submission, evaluation, and future extension.