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In Collaboration with

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MealFit

Meal Planner For NCD - Web Application

A Project Proposal by

Mr. Minura Ranathunga

Supervised by

Mr. Devon Wijesinghe

Submitted in partial fulfilment of the requirements for the BEng Software Engineering degree at the University of Westminster.

July 2025

ABSTRACT

Non-Communicable Diseases (NCDs) such as diabetes, hypertension, and cardiovascular conditions remain among the most pressing global health challenges. These are often exacerbated by poor dietary habits and the complexities of comorbidity management. Existing digital meal planning solutions typically offer generic advice, lacking the capacity to reason across individual health profiles or provide clinically grounded dietary interventions for users with multiple overlapping conditions.

To address this gap, this research introduces MealFit, an AI-powered web application that delivers personalized dietary recommendations tailored to both NCD and non-NCD users. The system integrates a multi-agent architecture with a Retrieval-Augmented Generation (RAG) pipeline and a domain-specific Bio-Medical LLaMA model, enabling the interpretation of structured health data (e.g., BMI, age, blood pressure) and unstructured user input (e.g., ingredient preferences, disease mentions). Agents collaborate to perform risk assessment, disease detection, and meal plan generation, grounded in clinical guidelines from sources such as the WHO and ADA.

The system was developed using FastAPI, LangChain, and ChromaDB, and tested using real-world health profiles. Manual evaluation across diverse test cases demonstrated a 80% clinical accuracy rate, while domain expert reviews confirmed the relevance, personalization, and interpretability of recommendations. Benchmarking against general-purpose models like GPT-4, Gemini, and DeepSeek highlighted the system's superior performance in medical alignment and dietary precision. The platform's modular design supports future enhancements including ingredient substitution, real-time biomarker integration, and multilingual expansion-positioning MealFit as a scalable and clinically meaningful tool in AI-driven personalized nutrition.

Keywords: Non-Communicable Diseases (NCDs), Personalized Meal Planning, AI in Nutrition, Multi-Agent Systems, Large Language Models (LLMs), Retrieval-Augmented Generation (RAG), Clinical Safety, Digital Health Systems, Biomedical Reasoning.

Subject Descriptors:

Information Systems → Health Informatics → AI-powered dietary recommendation systems
Human-centered computing → Human-computer interaction → Explainable decision support
Applied computing → Life and Medical Sciences → Personalized digital health interventions