Informatics Institute of Technology

In Collaboration with

University of Westminster, UK

KitchenAI - Development of a Personalized and Culturally Adaptive Meal Recommendation System for Healthy Eating and Fitness Goals

A dissertation by

Ms. Hansi Kottawaththa

W1898919 / 20211253

Supervised by

Mrs. Vinodani Thilakaratne

April 2025

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

ABSTRACT

The current generation of personalised food planning systems does not incorporate individual cultural eating customs nor community accessible ingredients nor fitness needs-specific dietary requirements. The present recommendation models depend on global datasets to suggest meals but they produce unpractical and expensive food choices which neglect Sri Lankan cuisine. The functionality of modern systems fails to adapt recipes according to fitness goals including weight loss and muscle gain and dietary restrictions which restricts their effectiveness for fitness enthusiasts and general users.

To address these limitations, we have developed a Personalized and Culturally Adaptive Meal Recommendation System using a Retrieval-Augmented Generation (RAG) and Large Language Model (LLM). The approach is augmented with an in-house recipe embedding model that is trained on global as well as Sri Lanka-centric recipe databases, capable of supporting meal recommendations from ingredients. The system pre-processes user-input ingredients using Natural Language Processing (NLP), converts recipes into vector representations using BERT-based embeddings, and ranks them using cosine similarity. Further recipe modification layers are used to ensure that recommendations are aligned with user-specified fitness goals. The model is deployed using Flask for API management and a React.js-based user interface, offering an interactive and scalable user experience.

Our system reaches 87% accuracy when recommending contextually and nutritionally suitable recipes which proves superior to baseline models according to experimental results. The system demonstrates both precision and recall performance at 78% and 82% which demonstrates its capacity to create appropriate meal recommendations. The model displays an 8.66 Root Mean Square Error (RMSE) that demonstrates consistent performance in creating nutritional links to fitness goals. The research proves that AI-based personalised recommendations will succeed in providing culturally diverse meals to any user type regardless of their fitness needs.