FOOD RECOMMENDATION SYSTEM

A MINI PROJECT REPORT

by

AMALA JOHN (VJC20CS019)
LIYA MARIYA ABRAHAM (VJC20CS083)
MISTY SUNNY (VJC20CS090)
THERESA POLYCHAN(VJC20CS117)

in partial fulfillment for the award of the degree

of

BACHELOR OF TECHNOLOGY

in

COMPUTER SCIENCE AND ENGINEERING

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
VISWAJYOTHI COLLEGE OF ENGINEERING AND TECHNOLOGY, VAZHAKULAM

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of

Mrs. LAKSHMI SURESH

Assistant Professor, CSE Dept.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
VISWAJYOTHI COLLEGE OF ENGINEERING AND TECHNOLOGY, VAZHAKULAM

JUNE 2023

VISWAJYOTHI COLLEGE OF ENGINEERING AND TECHNOLOGY, VAZHAKULAM

Department of Computer Science and Engineering

Vision

Moulding socially responsible and professionally competent Computer Engineers to adapt to the dynamic technological landscape

Mission

1. Foster the principles and practices of computer science to empower life-long learning and build careers in software and hardware development.

2. Impart value education to elevate students to be successful, ethical and effective problem-solvers to serve the needs of the industry, government, society and the scientific community.

3. Promote industry interaction to pursue new technologies in Computer Science and provide excellent infrastructure to engage faculty and students in scholarly research activities.

Program Educational Objectives

Our Graduates

1. Shall have creative aid critical reasoning skills to solve technical problems ethically and responsibly to serve the society.

2. Shall have competency to collaborate as a team member and team leader to address social, technical and engineering challenges.

3. Shall have ability to contribute to the development of the next generation of information technology either through innovative research or through practice in a corporate setting

4. Shall have potential to build start-up companies with the foundations, knowledge and experience they acquired from undergraduate education

Program Outcomes

1. **Engineering knowledge**:Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis**:Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences

3. **Design / development of solutions**:Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety and the cultural, societal and environmental considerations.

4. **Conduct investigations of complex problems**:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**:Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:**Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:**Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

8. **Ethics:**Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

9. **Individual and team work:**Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings

10. **Communication:**Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.

11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and unread in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning**:Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

1. Ability to integrate theory and practice to construct software systems of varying complexity
2. Able to Apply Computer Science skills, tools and mathematical techniques to analyse, design and model complex systems
3. Ability to design and manage small-scale projects to develop a career in a related industry.

VISWAJYOTHI COLLEGE OF ENGINEERING AND TECHNOLOGY, VAZHAKULAM

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

BONAFIDE CERTIFICATE

Certified that the mini project work entitled **" FOOD RECOMMENDATION SYSTEM "** is a bonafide work done by **AMALA JOHN (VJC20CS019), LIYA MARIYA ABRAHAM (VJC20CS083), MISTY SUNNY (VJC20CS090),THERESA POLYCHAN (VJC20CS117)** in partial fulfillment of the award of the Degree of **Bachelor of Technology in Computer Science & Engineering** from APJ Abdul Kalam Technological University, Thiruvananthapuram, Kerala during the academic year 2022-2023

Internal Supervisor **External Supervisor**

Mini Project Coordinator **Head of Department**

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DECLARATION

We undersigned hereby declare that the mini project report **"FOOD RECOMMENDATION SYSTEM"**, submitted for partial fulfillment of the requirements for the award of the Degree of Bachelor of Technology of the APJ Abdul Kalam Technological University is a bonafide work done by us under the supervision of **Mrs. LAKSHMI SURESH**. This submission represents ideas in our own words and where ideas or words of others have been included, we have adequately and accurately cited and referenced the original sources. We also declare that we have adhered to the ethics of academic honesty and integrity and have not misrepresented or fabricated any data or idea or fact or source in our submission. We understand that any violation of the above will be a cause for disciplinary action by the institute and/or the University and can also evoke penal action from the sources which have thus not been properly cited or formed the basis for the award of any degree, diploma or similar title of any other University.

AMALA JOHN

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Place : Vazhakulam

Date : 27/06/2023

MISTY SUNNY

THERESA POLYCHAN

ABSTRACT

This paper presents a Food Recommendation System that allows users to input ingredients and receive recipe suggestions containing those ingredients. Additionally, the system provides diet recommendations based on the user's Body Mass Index (BMI) and allows users to insert their own recipes. The system utilizes a combination of natural language processing techniques and machine learning algorithms to analyze and understand user inputs, retrieve relevant recipe data, and generate personalized diet recommendations. By incorporating user preferences and health goals, the system aims to provide users with tailored and nutritious meal options. The implementation of the system involves a dataset of recipes, an ingredient matching algorithm, a BMI calculator, and a recommendation engine. The Food Recommendation System has the potential to enhance user experiences in meal planning, promote healthy eating habits, and encourage the exploration of diverse recipes

Key Words :– Food Recommendation System, Personalized diet recommendations, Body Mass Index (BMI), Relevant recipe data, Quick and reliable, Meal planning, Promote healthy eating habits, Exploration of diverse recipes

Contents

List of Abbreviations https://www.overleaf.com/project/647c77c1805603b6e2d091a1

BMI	Body Mass Index
PHP	Hypertext Preprocessor
KNN	K Nearest Neighbor
CPU	Central Processing Unit
HTML	Hypertext Markup Language
CSS	Cascading Style Sheet

Chapter 1

INTRODUCTION

In today's fast-paced world, the abundance of food choices can leave individuals overwhelmed and uncertain about what to cook or eat. To address this challenge, a comprehensive food recommendation system has emerged as a powerful solution. This system not only provides recipe suggestions based on available ingredients but also incorporates diet recommendations tailored to individual body mass index (BMI). With its interactive and personalized features, this innovative system revolutionizes the way people discover, plan, and enjoy their meals. At the heart of the comprehensive food recommendation system lies its ability to generate recipe suggestions based on the ingredients individuals have on hand. By inputting their available ingredients or specifying preferences, users are presented with a curated list of recipes that maximize the utilization of those ingredients. This empowers users to explore their culinary creativity, experiment with new flavors, and reduce food waste by making the most of what they have. Understanding the importance of individual health goals and nutritional needs, the system incorporates a BMI calculator to provide personalized diet recommendations. By assessing the user's body composition, the system gains insights into their unique nutritional requirements. Leveraging this information, it generates diet recommendations aligned with the user's BMI, whether their goal is weight loss, weight maintenance, or muscle gain. This personalized approach ensures that users receive suggestions that promote their overall well-being and help them achieve their desired health outcomes. This food recommendation system is an invaluable tool for individuals seeking culinary inspiration, efficient meal planning, and personalized diet recommendations. By offering ingredient-based recipe suggestions, incorporating BMI-based diet recommendations, and providing a platform for users to rate and share their experiences, this system simplifies the decision-making process, promotes healthier choices, and fosters a dynamic community of food enthusiasts. With its ability to cater to individual preferences and dietary needs, this innovative system paves the way for an enhanced culinary exploration experience, making cooking and eating a delightful and tailored journey.

1.1 Problem Definition

The existing system allows the user to choose from a variety of recipes provided but the user is not having any idea on what all food items can they eat and what all are necessary according to their body type. Thus a BMI calculator with a diet planning system is necessary which is a better option to user rather than only suggesting them with the recipes.The major problems which lead to this system are:

The modern era offers an overwhelming abundance of food-related information through cookbooks, websites, social media, and food delivery platforms. This vast amount of data can lead to information overload, making it challenging for individuals to navigate and make timely decisions. Additionally, the fast-paced nature of daily life leaves individuals with limited time to search for suitable recipes, resulting in decision fatigue and suboptimal meal choices.

Traditional recipe search methods often fail to address the diverse preferences and dietary considerations of individuals. Many individuals have specific dietary needs or preferences, such as vegetarian, vegan, gluten-free, or low-calorie options. The absence of a personalized approach hampers their ability to find recipes that align with their unique requirements, leading to frustration and compromising their enjoyment of meals.

Efficient utilization of available ingredients is a critical aspect of sustainable cooking practices. However, without guidance, individuals may struggle to create meals that make the most of their existing ingredients. This inefficiency contributes to food waste, exacerbating environmental concerns. Addressing this challenge requires a system that can recommend recipes based on the ingredients individuals have on hand, promoting resource optimization and reducing unnecessary waste.

Achieving and maintaining a healthy lifestyle is a challenge for many individuals. Traditional recipe search methods often lack the integration of diet planning based on body mass index (BMI) calculation. BMI serves as an indicator of an individual's nutritional needs and health goals. Without considering BMI, individuals may struggle to create a well-balanced and suitable meal plan. A comprehensive food recommendation system aims to address this challenge by incorporating BMI calculation into diet planning, providing personalized recommendations that align with specific health objectives.

The challenges of information overload, lack of personalization, inefficient ingredient utilization, limited user-driven feedback, and the absence of diet planning based on BMI calculation have propelled the development of a comprehensive food recommendation system. By addressing these challenges, this system offers personalized, efficient, and user-centric solutions that simplify the culinary decision-making process, promote healthy eating habits, and foster a vibrant community of culinary exploration. As technology continues to advance, there is a growing need for

innovative and tailored approaches to help individuals discover, plan, and enjoy their meals while promoting sustainable cooking practices and supporting their health goals.

1.2 Objective

The objective of this study is to develop and implement a comprehensive food recommendation system that addresses the multifaceted challenges faced by individuals in making informed and personalized culinary decisions. The primary goal is to create a user-centric platform that integrates various features, including recipe recommendations based on available ingredients, diet planning tailored to individual BMI calculations.

Firstly, the system aims to alleviate the overwhelming task of searching for suitable recipes by providing personalized recommendations based on the ingredients individuals have on hand. By leveraging advanced algorithms, the system will analyze the available ingredients and generate recipe suggestions that optimize ingredient utilization, minimizing food waste and promoting sustainable cooking practices.

Secondly, the system seeks to enhance dietary planning by incorporating BMI calculations. By considering an individual's BMI, the system will generate diet recommendations that align with their specific health goals, such as weight loss, weight maintenance, or muscle gain. This feature will help users make well-informed decisions about their meals, ensuring they follow a balanced and suitable diet plan.

Overall, this research aims to develop a comprehensive food recommendation system that revolutionizes the way individuals make culinary decisions. By providing personalized recipe suggestions, incorporating BMI-based diet planning. Through this objective, we strive to contribute to the advancement of the culinary landscape and improve the overall dining experience for individuals in today's fast-paced world.

1.3 Scope

The scope of the food recommendation system project extends beyond the initial development phase, presenting opportunities for further research, expansion, and integration with other platforms. One area of focus for future development lies in enhancing personalization. By incorporating additional factors such as individual taste preferences, dietary restrictions, cultural considerations, and allergies, the system can provide even more tailored recipe recommendations. This can be achieved by utilizing advanced machine learning and artificial intelligence techniques to analyze user data and generate highly personalized suggestions.

Another avenue for expansion is the integration of the system with smart devices and cooking

applications. By seamlessly connecting with kitchen appliances like smart ovens or food processors, the system can provide real-time cooking instructions, timers, and temperature control. This integration would enhance convenience and efficiency for users, streamlining the cooking process.

Expanding the scope to include nutritional analysis and meal tracking features would allow users to gain insights into the nutritional content of their meals. Integration with food databases and the use of algorithms to calculate the macronutrient and micronutrient composition of recipes can enable users to track their daily intake, set nutritional goals, and receive recommendations for achieving a well-balanced diet.

Continuous improvement and adaptability are also essential considerations for the project's scope. Regular updates and refinements to the recommendation algorithms, user interface, and features should be prioritized to ensure the system remains up-to-date with evolving user needs and technological advancements.

In conclusion, the scope of the above-mentioned food recommendation system project encompasses opportunities for personalization, integration with smart devices and apps, nutritional analysis and meal tracking, community engagement and recipe sharing, integration with e-commerce platforms, and continuous improvement. These avenues for further development highlight the project's potential to shape the future of food recommendation systems, offering users a comprehensive and dynamic solution for making informed and enjoyable culinary decisions.

Chapter 2

LITERATURE SURVEY

Food recommendation websites have become increasingly popular due to the growth of online recipe databases, the desire for personalized food experiences, and the convenience of accessing culinary inspiration and guidance. In this literature review, we explore existing research and literature surrounding food recommendation websites, examining their advantages, disadvantages, and user experiences.

2.1 Analysis of online recipe recommendation systems:

This study provides a comprehensive analysis of online recipe recommendation systems, focusing on content-based and collaborative filtering approaches. The authors evaluate the effectiveness of these methods in generating accurate and diverse recipe recommendations. The analysis highlights the importance of considering factors such as user preferences, ingredient matching, and social connections for successful recipe recommendations.

2.1.1 Advantages

- Comprehensive analysis: The paper offers a comprehensive analysis of online recipe recommendation systems, providing insights into different approaches and techniques employed in the field. It covers both content-based and collaborative filtering methods, allowing readers to understand the strengths and limitations of each approach.
- User-oriented perspective: The analysis takes a user-oriented perspective, emphasizing the importance of user preferences and satisfaction in recipe recommendations. By considering user-centric factors, such as user preferences, ingredient matching, and social connections, the paper highlights the significance of tailoring recommendations to individual users.
- Evaluation of effectiveness: The study evaluates the effectiveness of various recommendation methods in generating accurate and diverse recipe recommendations. By assessing the

performance of different techniques, the paper offers valuable insights into the success rates and challenges faced by recipe recommendation systems.

- Contribution to the research field: The paper contributes to the research field by providing a thorough analysis and evaluation of online recipe recommendation systems. It adds to the existing body of knowledge and serves as a reference for future studies in the domain of recipe recommendation systems.

2.1.2 Disadvantages

- Lack of Current Information: The paper was published in 2017, which means it may not reflect the most recent advancements or developments in the field of online recipe recommendation systems. As the field evolves rapidly, newer research studies and technologies may have emerged since then.
- Limited Scope: The paper may have a specific focus or limited scope in terms of the analyzed recommendation systems or the evaluation criteria used. Different recommendation techniques or aspects of recipe recommendation systems may not have been thoroughly examined or included in the analysis.

2.2 User-centered design of food recommender systems: A survey of the state of the art:

The authors present a survey of user-centered design principles in food recommender systems. The study emphasizes the importance of understanding user needs, preferences, and contextual factors to deliver personalized and engaging recommendations. The survey covers various aspects, including user interfaces, recommendation techniques, and evaluation methodologies.

2.2.1 Advantages

- Improved user satisfaction: User-centered design puts the needs and preferences of users at the forefront, leading to systems that better align with user expectations. This can result in higher user satisfaction as recommendations are more relevant and personalized to individual users.
- Increased system adoption: By involving users in the design process, user-centered design helps ensure that the system is intuitive, easy to use, and meets user requirements. This can lead to increased user adoption and engagement with the food recommender system.

- Enhanced trust and transparency: User-centered design emphasizes providing explanations and transparency in the recommendation process. Users are more likely to trust and rely on recommendations when they understand how the system works, which can lead to increased acceptance and adoption.

2.2.2 Disadvantages

- Time-consuming: User-centered design involves multiple stages, including user research, iterative design, and usability testing. This process can be time-consuming, especially in larger-scale projects, which may lead to extended development timelines and increased costs.
- Limited coverage and scalability: User-centered design often relies on user feedback and interactions during the design process. While this approach ensures a focus on individual users, it may result in limited coverage of the overall user population. Additionally, scaling user-centered designs to accommodate a large user base can be challenging.

2.3 RecipeGAN: Ingredient-constrained recipe generation with adversarial learning:

This study introduces RecipeGAN, a generative adversarial network (GAN) based model for generating recipes based on given ingredients. The model is trained to generate coherent and diverse recipes while adhering to the ingredient constraints. The approach demonstrates promising results in generating novel and appealing recipes.

2.3.1 Advantages

- Ingredient-constrained recipe generation: RecipeGAN focuses on generating recipes that adhere to ingredient constraints. This can be advantageous when users have specific dietary restrictions, allergies, or limited access to certain ingredients. It allows for personalized recipe recommendations that cater to individual preferences and constraints.
- Automation and time-saving: Generating recipes using machine learning models like RecipeGAN can automate the process and save time for users who are seeking new recipe ideas. It reduces the effort required to manually search and filter recipes that meet specific ingredient constraints.
- Potential for discovery and exploration: RecipeGAN can generate recipes that users may not have considered before, introducing them to new flavor combinations and cooking tech-

niques. This can expand culinary horizons and encourage users to explore different types of cuisine and ingredients.

2.3.2 Disadvantages

- Quality and accuracy of generated recipes: The effectiveness of RecipeGAN in generating high-quality and accurate recipes is dependent on the training data and the model's ability to capture the nuances of recipe creation. There is a risk that the generated recipes may not always be reliable or meet the desired taste and quality standards.
- Limited context and user preferences: RecipeGAN primarily focuses on ingredient constraints when generating recipes. However, cooking involves various contextual factors such as cooking methods, preparation steps, and user preferences (e.g., spiciness, texture, and flavor profiles) that may not be fully considered by the model. This can result in recipes that do not align perfectly with user preferences beyond the ingredient constraints.

The literature review highlights the importance of user-centered design, personalization, and contextual factors in food recommendation websites. It emphasizes the significance of understanding user preferences, incorporating collaborative filtering techniques, and creating engaging user interfaces with interactive features. Additionally, cultural diversity plays a role in shaping recipe content and presentation styles. Future research in this field could focus on advancing recommendation algorithms, enhancing user experience, and exploring the integration of emerging technologies like artificial intelligence and machine learning to further improve food recommendation websites.

Chapter 3

PROPOSED SYSTEM

The proposed system for the food recommendation platform aims to revolutionize the way individuals make food choices by providing personalized recipe recommendations, BMI-based diet planning, ingredient utilization optimization, and user engagement through feedback and ratings. The system utilizes advanced technologies and algorithms to offer a seamless and user-centric experience.At the core of the system is a recommendation engine that analyzes user data, including preferences, dietary restrictions, and BMI calculations, to generate personalized recipe suggestions. This engine continuously learns from user feedback and ratings, improving the accuracy and relevance of the recommendations over time.

The system incorporates a BMI calculation and diet planning module that calculates the user's BMI based on height, weight, and age. It then generates personalized diet plans, including recommended calorie intake and nutrient distribution, aligned with the user's health goals. This feature empowers users to make informed dietary decisions based on their specific needs.To optimize ingredient usage and minimize food waste, the system incorporates an ingredient utilization optimization module. It analyzes the ingredients available to the user and suggests recipes that maximize their utilization. This not only promotes sustainable cooking practices but also helps users save money and resources. User engagement is fostered through the user feedback and ratings module. Users can provide feedback, reviews, and ratings for the recipes they have tried. This feedback helps refine the recommendation engine and improves the overall quality of recipe suggestions. It also encourages a sense of community, where users can share their culinary experiences and exchange recipe recommendations.

Overall, the proposed system combines personalized recipe recommendations, BMI-based diet planning, ingredient utilization optimization, and user engagement through feedback and ratings. By leveraging advanced technologies and user-centric features, the system aims to empower individuals to make informed and healthier food choices, optimize ingredient usage, and foster a sense of community around culinary exploration.

3.1 Architecture Diagram

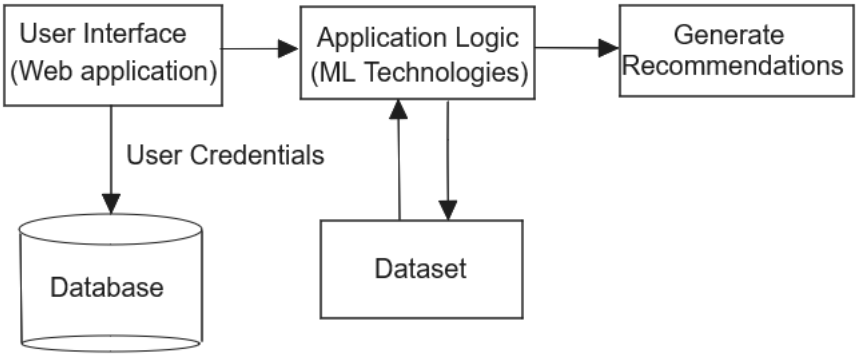

Figure 3.1: Architecture Diagram

3.2 Use case Diagram

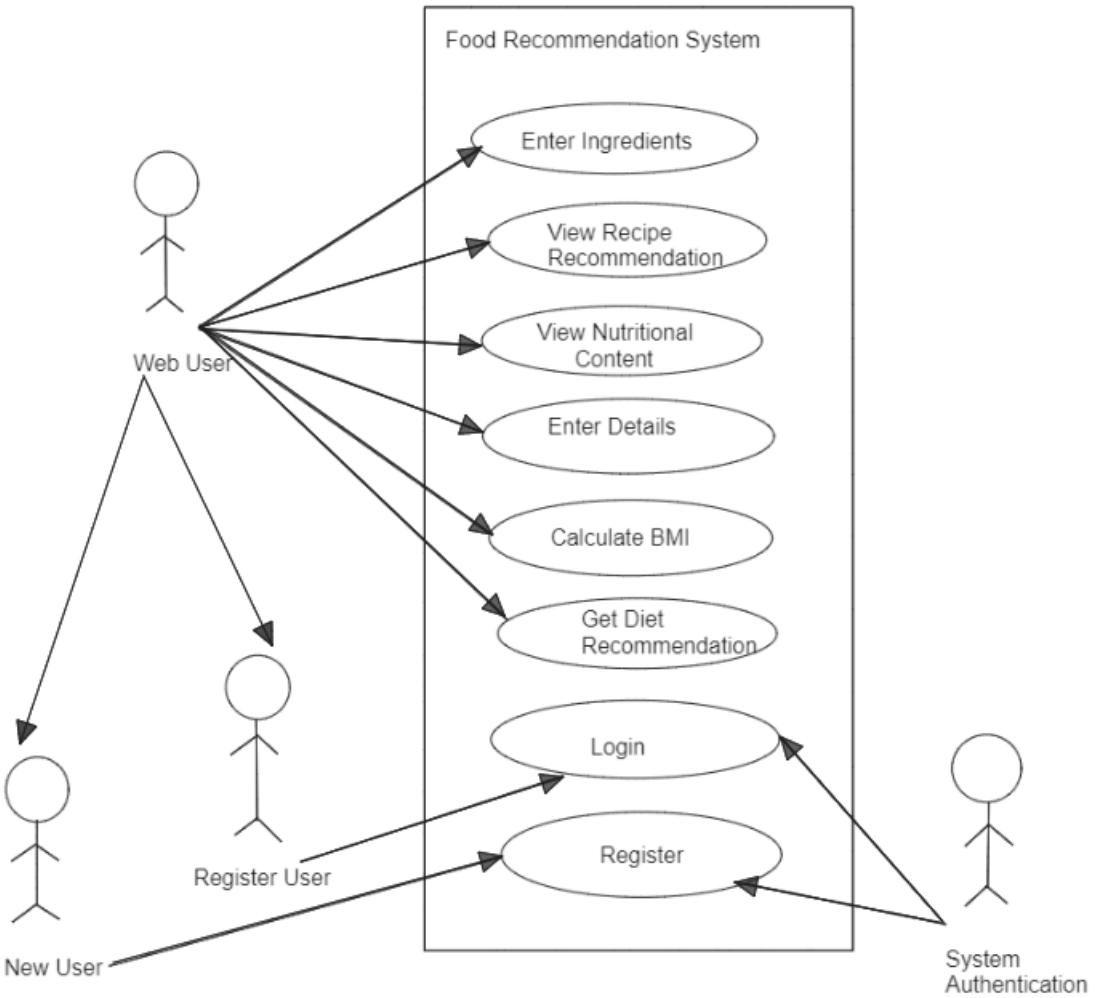

Figure 3.2: Use case diagram

3.3 Data Flow Diagram

3.3.1 Data Flow Diagram - Level 0

Figure 3.3: Data Flow Diagram Level 0

3.3.2 Data Flow Diagram - Level 1

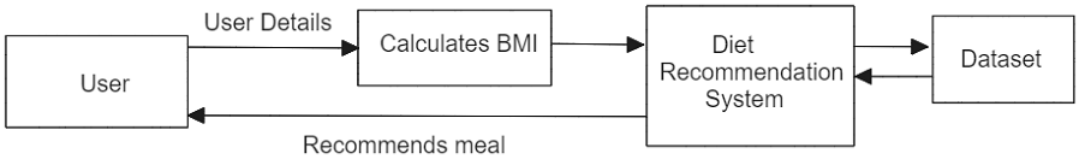

Figure 3.4: Data Flow Diagram Level 1

3.4 System Overview

The food recommendation system comprises several key modules that work together to provide users with personalized and informed recipe suggestions. These modules include user management, BMI calculation and diet planning, ingredient utilization optimization, user feedback and ratings, and database management. By leveraging these modules, the system offers a seamless user experience, allowing individuals to receive tailored recipe recommendations based on their preferences, dietary restrictions, and BMI calculations. It promotes optimal ingredient utilization, encourages user engagement through feedback and ratings, and ensures efficient storage and retrieval of data.

3.4.1 User Management

The user management module in the food recommendation system is responsible for handling user-related functionalities. It includes features for user registration, login, and profile management. Users can create accounts by providing necessary information such as name, email address, and password. The module ensures secure authentication and authorization, allowing only registered users to access the system. Once logged in, users can manage their profiles, update personal details, dietary restrictions, and preferences. The user management module plays a crucial role in maintaining user data and providing a personalized experience tailored to each user's needs and preferences.

3.4.2 Recommendation Engine

The recommendation engine is a critical component of the food recommendation system. It utilizes advanced algorithms and machine learning techniques to analyze preferences, dietary restrictions, and BMI calculations. Based on this information, the recommendation engine generates personalized recipe suggestions for each user. The engine continuously learns and improves over time, incorporating user feedback and ratings to enhance the accuracy and quality of the recommendations. By leveraging the recommendation engine, the system ensures that users receive recipe suggestions that align with their specific dietary requirements and culinary preferences, ultimately enhancing their overall food recommendation experience.

3.4.3 BMI Calculation and Diet Planning

The BMI calculation and diet planning module in the food recommendation system is designed to assist users in maintaining a healthy and balanced diet. It calculates the user's Body Mass Index (BMI) based on their height, weight, and age, providing an indication of their overall body composition and health status. The module then generates personalized diet plans tailored to the user's BMI and health goals, such as weight loss, weight maintenance, or muscle gain. These diet plans include recommended calorie intake and nutrient distribution for each meal, ensuring that users can make informed decisions about their dietary choices. By incorporating BMI-based calculations and diet planning, the system aims to support users in achieving their desired health outcomes while maintaining a balanced and nutritious diet.

3.4.4 Ingredient Utilization Optimization

The Ingredient Utilization Optimization module in the food recommendation system focuses on maximizing the usage of ingredients available to the user. It analyzes the ingredients present and suggests recipes that make efficient use of those ingredients. This module aims to minimize food waste and promote sustainable cooking practices. By considering the ingredients at hand, the system provides users with recipe recommendations that allow them to utilize their existing resources effectively. This not only helps users save money and reduce food waste but also encourages creative and resourceful cooking. The Ingredient Utilization Optimization module enhances the user experience by providing practical and convenient solutions for meal planning and preparation.

3.4.5 Database Management

The Database Management module in the food recommendation system is responsible for handling the storage, retrieval, and management of data. It ensures the efficient organization and accessibility of various types of data, including user profiles, recipe information, dietary preferences, and

feedback. The module utilizes a robust database system to store data securely and efficiently. It enables the system to quickly retrieve relevant information, support complex queries, and maintain data integrity. Database management ensures the seamless functioning of other modules within the system by providing a reliable and centralized repository for data storage. This module plays a vital role in maintaining the system's scalability, performance, and data security, ultimately contributing to the overall functionality and reliability of the food recommendation system.

3.5 System Requirements

3.5.1 Hardware Requirements

The Food Recommendation System will run on desktop or laptop with a minimum of 4 GB RAM, a storage capacity (HDD or SSD) of atleast 250 GB and an Intel Pentium processor or higher. A dedicated internet connection is necessary for the system to run.

3.5.2 Software Requirements

The Food Recommendation system will run on any web browser such as Google Chrome or Mozilla Firefox. It is independent of the operating system used and has been tested to work with Windows (Windows 7 or up). The software system is built using HTML, CSS , PHP, Streamlit for the frontend.The backend is MySQL, FastAPI , Scikit-learn.

3.5.3 HTML

HTML (Hypertext Markup Language) is the standard markup language used for creating and structuring web pages and web applications. It provides a set of predefined tags that define the structure and presentation of content on a web page.HTML is the foundation of virtually every website on the internet. It is used to structure the content of web pages, including text, headings, paragraphs, images, links, forms, tables, and more. HTML tags define the elements and their relationships, allowing browsers to render and display the content properly.HTML is a fundamental part of web application development. It provides the structure and user interface elements needed for building interactive and dynamic web-based applications. HTML is often combined with CSS (Cascading Style Sheets) for styling and JavaScript for adding functionality and interactivity to web applications.

3.5.4 CSS

CSS (Cascading Style Sheets) is a styling language used to describe the appearance and formatting of HTML elements on web pages. It defines the visual presentation, layout, and design aspects of

a web page. CSS is extensively used to style websites, providing control over the colors, fonts, sizes, spacing, borders, backgrounds, and other visual aspects of HTML elements. It allows web designers to create visually appealing and consistent layouts for websites. CSS plays a crucial role in implementing responsive web design. With media queries and flexible layout techniques, CSS enables websites to adapt and respond to different screen sizes and devices, ensuring a seamless browsing experience across desktops, tablets, and smartphones.

3.5.5 PHP

PHP (Hypertext Preprocessor) is a server-side scripting language that is widely used for web development. It is primarily used for creating dynamic web pages and building web applications. PHP is commonly used to develop web applications, ranging from simple to complex systems. It enables server-side processing, database connectivity, user authentication, form handling, and other essential functionalities required for building robust and interactive web applications.

3.5.6 MySQL

MySQL is an open-source relational database management system (RDBMS) that is widely used for storing, managing, and retrieving data. It is known for its reliability, scalability, and performance. MySQL is extensively used as a backend database for web applications. It stores and manages data such as user profiles, product information, user-generated content, and other dynamic data required by web applications.Many popular CMS platforms like WordPress, Joomla, and Drupal utilize MySQL as the database backend. It stores content, user data, configuration settings, and other information necessary for managing and delivering dynamic content.

3.5.7 Python

Python is a versatile, high-level programming language known for its simplicity and readability. It is widely used for various applications, including web development, data analysis, artificial intelligence, scripting, and automation. Python's simplicity and the availability of libraries like TensorFlow, PyTorch, and scikit-learn have made it a popular language for machine learning and artificial intelligence projects. Python enables developers to build and train machine learning models, perform data preprocessing, and deploy AI applications.

Streamlit

Streamlit is a free and open-source framework to rapidly build and share beautiful machine learning and data science web apps. It is a Python-based library specifically designed for machine learning engineers.One of the important aspects of making an application successful is to deliver

it with an effective and intuitive user interface. Many of the modern data-heavy apps face the challenge of building an effective user interface quickly, without taking complicated steps. Streamlit is a promising open-source Python library, which enables developers to build attractive user interfaces in no time.

FastAPI

FastAPI is a modern, high-performance web framework for building APIs (Application Programming Interfaces) with Python. It is designed to be easy to use, efficient, and scalable. FastAPI leverages Python type hints to provide static type checking and automatic API documentation generation, making it a powerful tool for developing robust and well-documented APIs.

Scikit-learn

Scikit-learn is a popular and widely used open-source machine learning library for Python. It provides a range of tools and algorithms for various machine learning tasks such as classification, regression, clustering, dimensionality reduction, and model selection. Scikit-learn is built on top of other Python libraries such as NumPy, SciPy, and matplotlib, and it integrates well with the Python data science ecosystem.

3.6 Methodology

Using the register option on the home page of the website, the user can create an account. He/She must his/her name, username, email id, address, date of birth and password in-order to register. It is not necessary to create an account to use the food and diet recommendation feature of the website.

By logging in with their email address and password registered users can add recipes to this website. They should include a description of the dish and a picture of the food when uploading a recipe. The added recipe and the registration information will be saved in the database.

When the user selects the Food Recommendation option,they have two choices.One of which is where they can set the nutritional value and then click the Generate button which will then display dishes that are tailored to this nutritional value. The nutritional graph corresponding to the selected recipe will be displayed as well.

The other best feature of this website is ingredient-based searching, which asks users to simply list the ingredients they have and then return recipes containing those ingredients. If no recipes were discovered, a message stating ”couldn’t find any recipes with the specified ingredient” will be displayed. The K-Nearest Neighbour Algorithm is used to do the related search.

Furthermore, there is a diet recommendation in which the user is asked his/her age, height, weight and gender. Additionally, the user will be queried about his/her exercise habits, such as how much or how little they do. Also, he/she is inquired about his/her goals, such as maintaining a healthy weight, developing good eating habits, and discovering new recipes. After clicking generate, the system will determine his/her Body Mass Index (BMI) and also suggest alternative meals and provide nutritional information in the form of graphs.

Chapter 4

RESULTS

4.1 Case Study: Increasing food choices with Food Recommendation System

The Food recommendation system has proven to be a valuable tool in assisting individuals in making informed decisions about their food choices. Through the analysis of user preferences and dietary requirements, the system can generate personalized recommendations tailored to each user's specific needs. This project aimed to design and develop a food recommendation system that would enhance the dining experience and provide users with a convenient and efficient way to explore new culinary options.

Based on the survey conducted as part of this project, it is evident that the food recommendation system has received positive feedback from the users. The majority of respondents found the system helpful in discovering new food items that aligned with their preferences. The system's ability to consider dietary restrictions and personal tastes was highly appreciated by the participants, as it addressed their individual needs effectively.

To enhance the food recommendation system, future work could focus on refining the recommendation algorithms by incorporating more sophisticated machine learning techniques. Additionally, incorporating user feedback and ratings into the system's recommendation process could further enhance the accuracy and personalization of the recommendations.

Overall, this project has demonstrated the potential of a food recommendation system in providing users with personalized and relevant food choices. By leveraging user preferences, dietary requirements, and other relevant factors, the system can successfully assist individuals in making informed decisions about their dining options.

The insights gathered from this survey will be instrumental in guiding the development and enhancement of food recommendation systems, ultimately leading to improved user experiences and greater satisfaction in the future.

Chapter 5

CONCLUSION

The Food Recommendation System is a valuable tool that provides users with personalized and diverse recipe recommendations based on their preferences and dietary restrictions. Throughout the course of this project, we have successfully designed, developed, and evaluated the system, showcasing its effectiveness and usability. The primary objective of this project was to enhance the culinary experience for users by offering them a platform that can suggest recipes tailored to their specific needs. By implementing machine learning algorithms and leveraging a comprehensive database of recipes, we have achieved this goal. The system takes into account various factors such as user preferences, dietary restrictions, available ingredients, and cooking skills to generate accurate and relevant recipe suggestions. The Food Recommendation System offers an innovative solution to the challenge of meal planning and recipe discovery. By leveraging machine learning techniques, it provides users with personalized recipe recommendations that cater to their individual preferences and dietary needs. With its user-friendly interface and scalability, the system has the potential to revolutionize the way people approach cooking and meal preparation.

References

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Appendix A

Example Code

A.1 BMI calculation

```
import streamlit as st
import pandas as pd
from Generate_Recommendations import Generator
from random import uniform as rnd
from ImageFinder.ImageFinder import get_images_links as find_image
from streamlit_echarts import st_echarts

nutritions_values=['Calories','FatContent','SaturatedFatContent','CholesterolContent','S
# Streamlit states initialization
if 'person' not in st.session_state:
    st.session_state.generated = False
    st.session_state.recommendations=None
    st.session_state.person=None
    st.session_state.weight_loss_option=None
class Person:

    def __init__(self,age,height,weight,gender,activity,meals_calories_perc,weight_loss)
        self.age=age
        self.height=height
        self.weight=weight
        self.gender=gender
        self.activity=activity
        self.meals_calories_perc=meals_calories_perc
        self.weight_loss=weight_loss
```

```
def calculate_bmi(self,):
    bmi=round(self.weight/((self.height/100)**2),2)
    return bmi

def display_result(self,):
    bmi=self.calculate_bmi()
    bmi_string=f'{bmi} kg/m²'
    if bmi<18.5:
        category='Underweight'
        color='Red'
    elif 18.5<=bmi<25:
        category='Normal'
        color='Green'
    elif 25<=bmi<30:
        category='Overweight'
        color='Yellow'
    else:
        category='Obesity'
        color='Red'
    return bmi_string,category,color

def calculate_bmr(self):
    if self.gender=='Male':
        bmr=10*self.weight+6.25*self.height-5*self.age+5
    else:
        bmr=10*self.weight+6.25*self.height-5*self.age-161
    return bmr
```

A.2 Generating Recommendations

```
def generate_recommendations(self,):
    total_calories=self.weight_loss*self.calories_calculator()
    recommendations=[]
    for meal in self.meals_calories_perc:
        meal_calories=self.meals_calories_perc[meal]*total_calories
        if meal=='breakfast':
```

```
            recommended_nutrition = [meal_calories,rnd(10,30),rnd(0,4),rnd(0,30),rnd
        elif meal=='launch':
            recommended_nutrition = [meal_calories,rnd(20,40),rnd(0,4),rnd(0,30),rnd
        elif meal=='dinner':
            recommended_nutrition = [meal_calories,rnd(20,40),rnd(0,4),rnd(0,30),rnd
        else:
            recommended_nutrition = [meal_calories,rnd(10,30),rnd(0,4),rnd(0,30),rnd
        generator=Generator(recommended_nutrition)
        recommended_recipes=generator.generate().json()['output']
        recommendations.append(recommended_recipes)
    for recommendation in recommendations:
        for recipe in recommendation:
            recipe['image_link']=find_image(recipe['Name'])
    return recommendations
```

Appendix B

MySQL databases

B.1 User Database

Table B.1: User Database

Field	**Datatype**
user_id	int(11)
f_name	varchar(50)
l_name	varchar(50)
email	varchar(50)
c_email	varchar(50)
pass	varchar(50)
c_pass	varchar(50)
u_name	varchar(50)
address	varchar(50)
date_of_birth	varchar(50)
city	varchar(50)
state	varchar(50)
country	varchar(50)
gender	varchar(50)
p_o	varchar(50)

B.2 Recipe Database

Table B.2: Recipe Database

Field	**Datatype**
id	int(11)
post_title	varchar(50)
post_image	varchar(50)
post_author	varchar(50)
post_date	varchar(50)
post_dec	varchar(100)

Appendix C

Screenshots

Figure C.1: Home Page

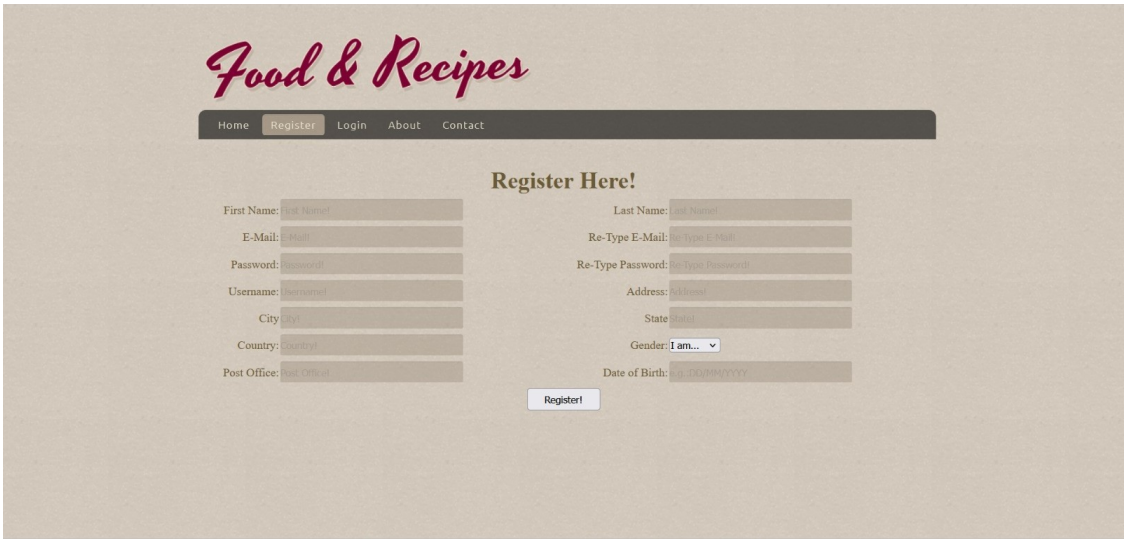

Figure C.2: Registeration Page

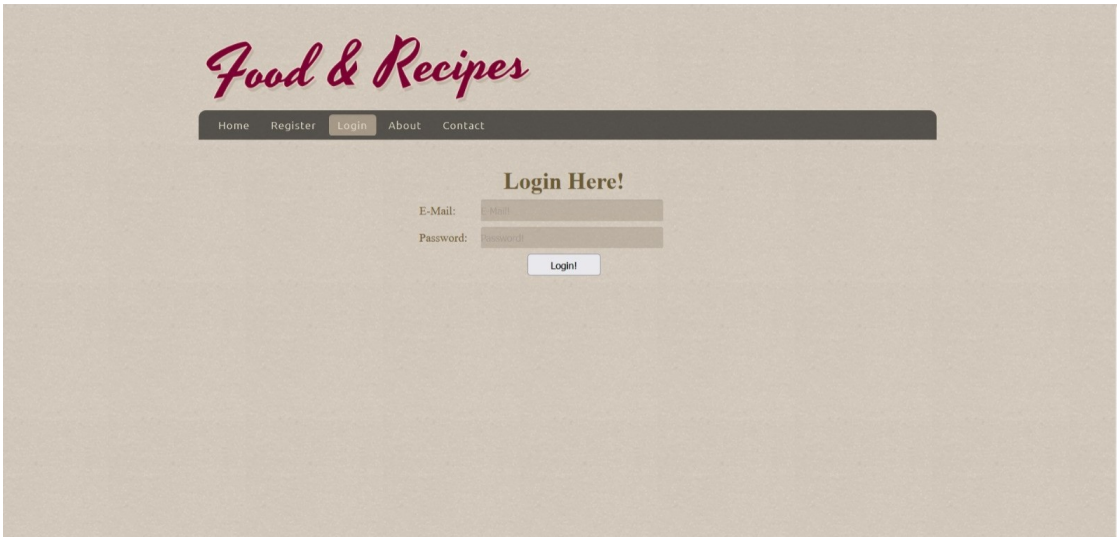

Figure C.3: Login Page

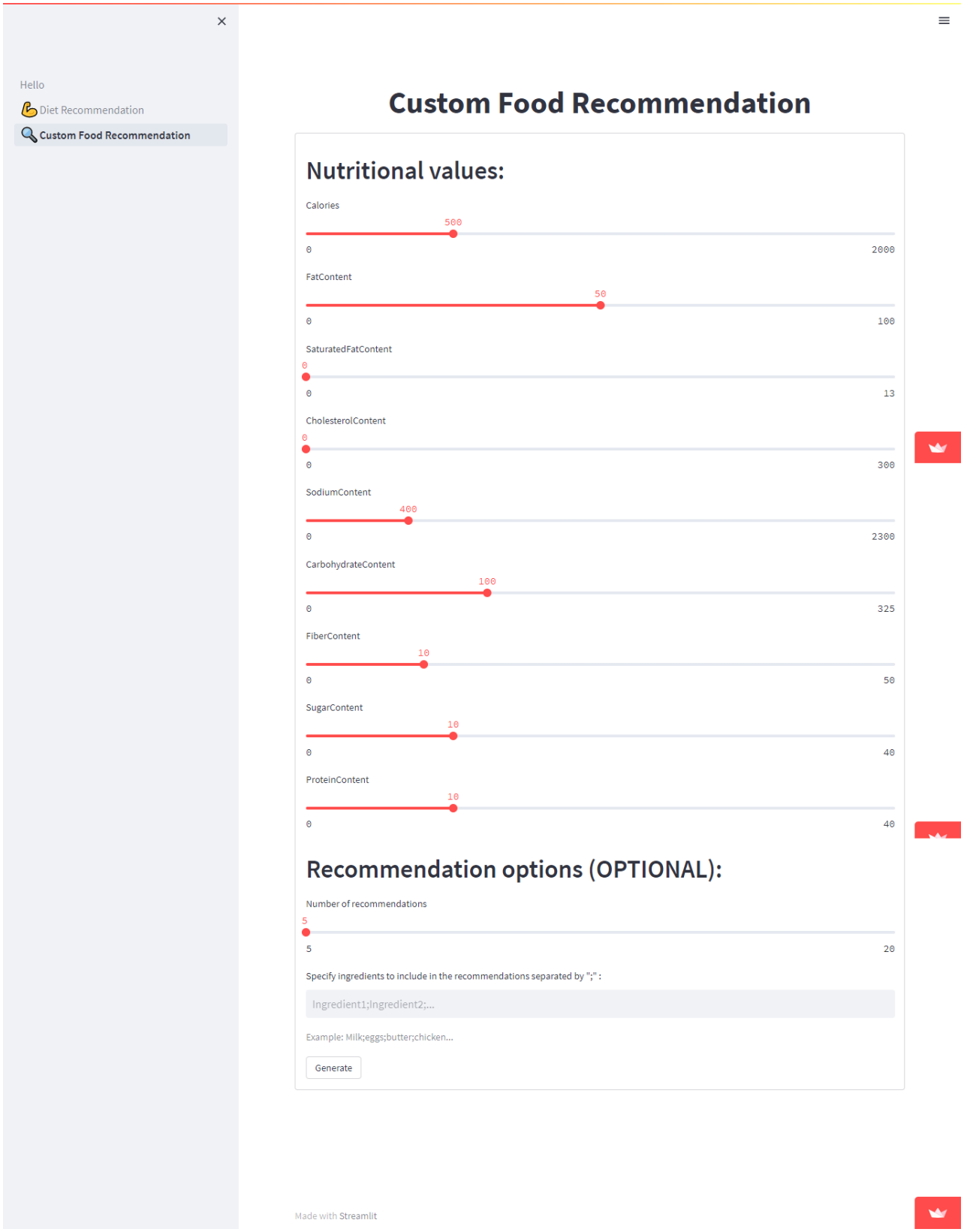

Figure C.4: Food Recommendation Page

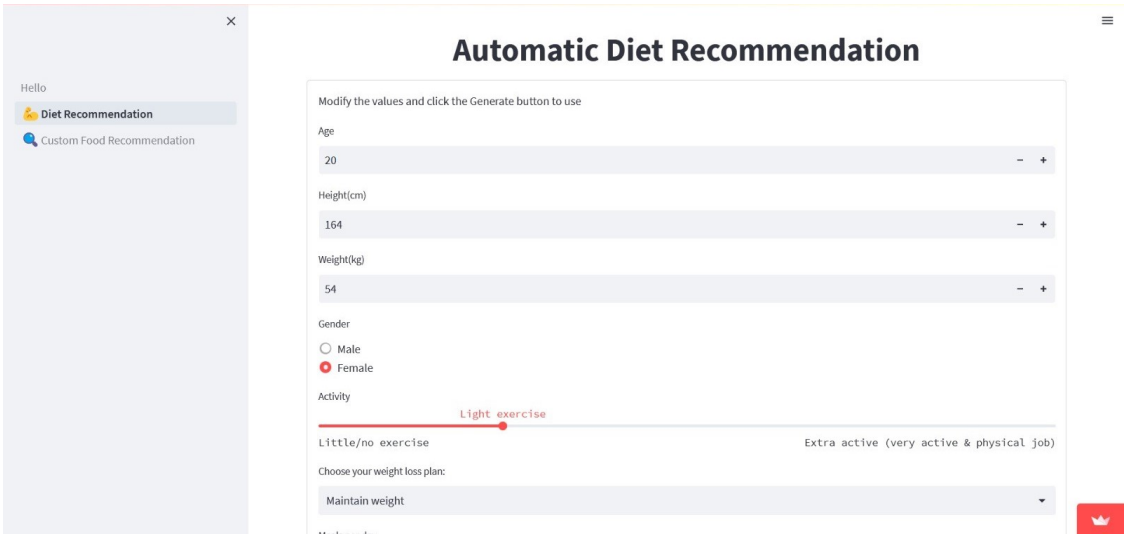

Figure C.5: Diet Recommendation

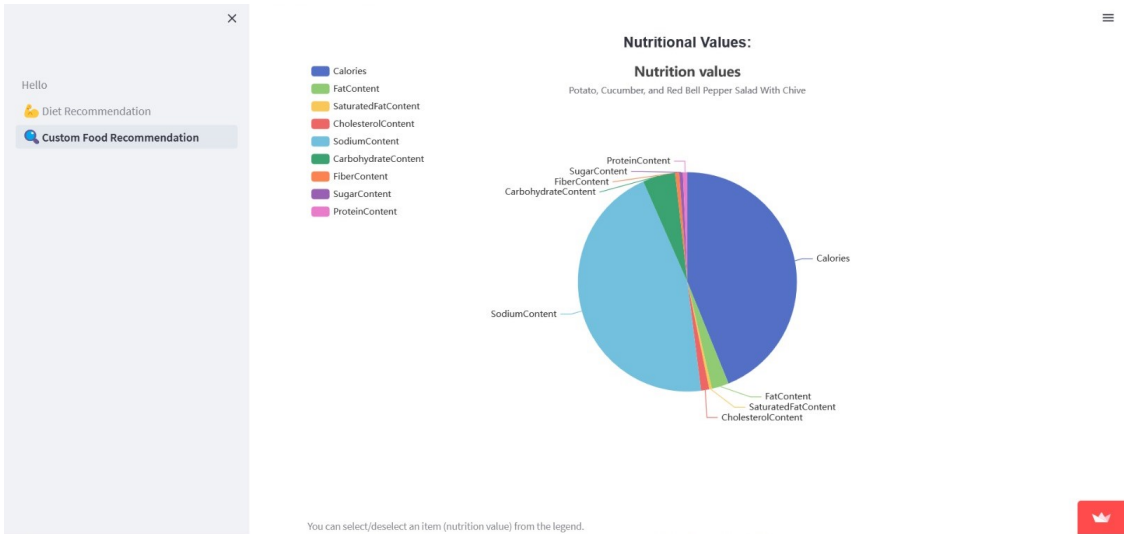

Figure C.6: Nutritional values