FOOD RECIPE RECOMMENDATION BASED ON INGREDIENTS

A DESIGN PROJECT REPORT

submitted by

DEVADHARSHINI S

DHIVYA S

GAYATHRI R

in partial fulfilment for the award of the degree

of

BACHELOR OF ENGINEERING

in

COMPUTER SCIENCE AND ENGINEERING

K RAMAKRISHNAN COLLEGE OF TECHNOLOGY

(An Autonomous Institution, affiliated to Anna University Chennai, Approved by AICTE, New Delhi)

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BONAFIDE CERTIFICATE

Certified that this project report titled **"FOOD RECIPE RECOMMENDATION BASED ON INGREDIENTS"** is the bonafide work of **DEVADHARSHINI S (811722104028), DHIVYA S (811722104034), GAYATHRI R (811722104043)** who carried out the project under my supervision. Certified further, that to the best of my knowledge the work reported here in does not form part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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DECLARATION

We jointly declare that the project report on **"FOOD RECIPIE RECOMMENDATION BASED ON INGREDIENTS"** is the result of original work done by us and best of our knowledge, similar work has not been submitted to **"ANNA UNIVERSITY CHENNAI"** for the requirement of Degree of **BACHELOR OF ENGINEERING.** This project report is submitted on the partial fulfilment of the requirement of the awardof Degree of **BACHELOR OF ENGINEERING.**

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ABSTRACT

A web-based food recipe recommendation system that aims to assist users in finding recipes based on the ingredients they have at hand. With the growing interest in personalized nutrition and meal planning, this system provides an intuitive platform for users to input the ingredients they currently possess, and in return, the system suggests a range of recipes that can be made with those ingredients. The core of the recommendation engine utilizes a hybrid approach that combines content-based filtering and machine learning algorithms, enabling the system to provide relevant, diverse, and tailored recipe suggestions. In addition to basic ingredient-based recommendations, the system offers filtering options to accommodate dietary preferences such as vegan, gluten-free, low-calorie, and allergen-free choices, ensuring that users receive personalized suggestions. The project also includes an emphasis on user experience, implementing an easy-to-navigate interface and features like saved recipes and user preferences. To ensure the quality and reliability of the system, functional testing is conducted to validate the accuracy of recommendations, the performance of the system under load, and the robustness of the user interface across different devices. This project aims to solve the common problem of meal planning by offering a practical, accessible, and personalized solution that encourages resource efficiency and reduces food waste by helping users make the most out of what they already have in their kitchens.

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LIST OF ABBREVIATIONS

ABBREVIATIONS	FULL FORM
BMI	Body Mass Index
UI	User Interface
RDBMS	Relational Database Management System
CI	Continuous Integration
CD	Continuous Deployment
IDE	Integrated Development Environment
CSS	Cascading Style Sheet
CRISPR	Clustered Regularly Interspaced Short Palindromic Repeats

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

The rise of digital platforms for food enthusiasts has revolutionized how recipes are discovered and shared. Traditional recipe books have transitioned into dynamic web and mobile applications that cater to diverse user preferences and dietary needs. This project, a **Recipe Recommendation System Based on Ingredients**, is designed to bridge the gap between available kitchen resources and accessible, tailored recipes. It leverages modern web technologies to provide a user-centric solution for discovering recipes using ingredients users already have on hand. The Recipe Recommendation System Based on Ingredients is designed to address a common challenge faced by home cooks: deciding what to prepare with available ingredients. With the increasing popularity of home cooking due to its cost-effectiveness and health benefits, this project offers a practical solution by matching user-provided ingredients to relevant recipes. The system is a web-based application that allows users to input ingredients, filter recipes, and explore variants for customization based on taste or dietary preferences. Built using modern web technologies, the application ensures a seamless user experience with intuitive search functionality and real-time feedback. By promoting efficient use of ingredients, it not only simplifies meal planning but also contributes to reducing food waste. In the future, the system can be enhanced with features like personalized recommendations, advanced search algorithms, and integration with dietary tracking to cater to a broader audience. This project exemplifies the intersection of technology and everyday problem-solving, making it a valuable tool for modern kitchens.

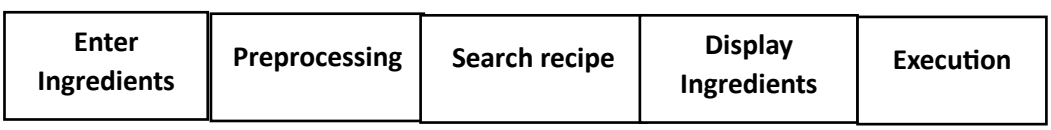

Fig 1.1 Flow chart

1.2 OVERVIEW

The Recipe Recommendation System Based on Ingredients is an innovative web-based application designed to help users easily find recipes based on the ingredients they already have in their kitchen. This project aims to solve a common problem faced by many home cooks—deciding what to cook with the ingredients they have on hand—thereby saving time, money, and reducing food waste. The system allows users to input a list of ingredients, which it then uses to filter and display recipes that match the provided items. Each recipe also comes with several variants to cater to different preferences and dietary needs, offering a wide range of meal options.

The application utilizes modern web technologies, including JavaScript for functionality, HTML/CSS for the user interface, and localStorage to store filtered recipes temporarily, allowing for a seamless user experience as they navigate through the application. The project also includes features like dynamic navigation, real-time search results, and error handling to guide users through the recipe discovery process. Additionally, the platform supports easy integration of more complex features in the future, such as personalized recommendations, AI-powered search algorithms, and a meal planning feature.

In the long term, this system could evolve into a more comprehensive solution by incorporating additional functionalities like ingredient substitution suggestions, dietary filters (e.g., vegetarian, gluten-free), and even integration with grocery delivery services for a more complete cooking experience. Ultimately, the goal of the project is to make cooking more accessible, creative, and sustainable for users, while addressing food waste concerns in a practical way.

1.3 PROBLEM STATEMENT

The problem this project seeks to address is the challenge many individuals face when trying to plan meals using the ingredients they already have available at home. Often, people struggle to come up with meal ideas based on limited ingredients, leading to food waste, unnecessary grocery purchases, and time wasted deciding what to cook. Additionally, finding recipes that cater to specific dietary preferences or restrictions can be cumbersome. While there are numerous recipe platforms, they often require users to search for specific recipes, which may not be convenient when they have a random assortment of ingredients. This project aims to solve this issue by providing an easy-to-use web application that allows users to input the ingredients they have on hand, and receive a list of relevant recipes that match those ingredients. The goal is to make meal planning more efficient, reduce food waste, and inspire creativity in the kitchen by offering users tailored recipe suggestions with their current pantry items.

1.4 OBJECTIVE

The objective of the **Recipe Recommendation System Based on Ingredients** project is to develop a web application that allows users to input available ingredients and receive personalized recipe suggestions. The goal is to help users make the most of their existing ingredients, reducing food waste and unnecessary grocery shopping. The system will provide a simple and intuitive interface, offering recipe variations based on different tastes and dietary preferences.

1.5 IMPLICATION

On a societal level, the system supports the growing movement toward sustainability by minimizing food waste, a major issue globally. It also empowers individuals to cook more creatively with what they already possess, reducing reliance on takeout and packaged foods, it could play a key role in transforming how people approach cooking, making it more accessible, environmentally friendly, and tailored to individual needs.

CHAPTER 2

LITERATURE SURVEY

TITLE : Ingredient-Based Recommendation for Vegetarian Dishes.

AUTHORS : S. Rajasekar and Divya Sharma

YEAR : 2021

This study presents an ingredient-focused recommendation model tailored to vegetarian diets. By analyzing user input on preferred and disliked ingredients, the system suggests recipes that align with their dietary habits. The model is particularly useful for Indian vegetarian users, considering the diversity of ingredients like lentils, spices, and grains. Results show that integrating ingredient similarity into the recommendation process increased relevance and user satisfaction. Future developments in this field could include incorporating real-time dietary tracking, voice-based user interfaces, and augmented reality tools for interactive recipe guidance. Such advancements would further improve the accessibility and convenience of vegetarian meal planning, making it an indispensable tool for modern households.

TITLE : Ingredient-Based Search Engines

AUTHORS : Lee et al, Liu et al

YEAR : 2022

Ingredient-based search engines represent a more niche category within recipe recommendation systems. These search engines aim to find recipes based on specific ingredients provided by the user. The work of Focused on developing a semantic search engine for recipes that integrates structured data on ingredients and their culinary relationships, using machine learning to provide more accurate recipe suggestions based on ingredient input. Their approach enhances search efficiency by considering ingredient substitutions and variations. Other studies, such as, have explored algorithms for filtering recipes based on an ingredient's nutritional content, further personalizing the user's experience.

TITLE : Food Recommendation Systems Based On Content-based and Collaborative Filtering techniques

AUTHOR : Reetu Singh , Pragya Dwivedi

YEAR : 2023

On the internet, numerous options are available for a specific type of product. It is tough to manually go through every product in a particular type when a user is trying to choose the best one. Because of this, manual searching is not very efficient. The recommendation system is crucial in recommending the best product in that situation. A food recommendation system is developed in this research paper using K-nearest neighbor's methods. The food data set is taken from Kaggle. We used Python programming language to implement the system. Our proposed recommendation system recommends food based on food name, food id, cuisine type, diet type like veg or non-veg in the case of content based filtering recommendation.

TITLE : Recommendation of Indian Cuisine Recipes Based on Ingredients.

AUTHOR : Prof. Shobha Bamane

YEAR : 2021

There are plenty of different types of Indian delicacies available with the same ingredients. In India, traditional recipes are varied due to the locally available spices, vegetables, fruits & herbs. In this paper, we purposed a way that recommends Indian recipes based on readily available ingredients and popular dishes. In this task, we perform a web search to create a collection of recipe types and apply a content-based approach to machine learning to recommend recipes. This system provides Indian food recommendations based on ingredients. The system is particularly beneficial for promoting the use of locally available and seasonal ingredients, reducing reliance on pre-packaged or processed foods. Additionally, it encourages users to experiment with lesser-known regional recipes, fostering cultural appreciation and culinary innovation.

TITLE : Personalized Recipe Recommendation Using Collaborative Filtering.

AUTHOR : Aarti Nagarkar

YEAR : 2019

Recipe Recommendation System for Indian cuisines is a system that learns from the past preferences of a user's preferred dishes to recommend him/her new, untested cuisines. The basis of recommendation is the ingredients in the recipes already liked by the user. The conventional food of India has been broadly refreshing for its remarkable utilization of herbs and flavors. Indian food is known for its substantial arrangement of dishes. The Cooking style shifts from locale to the district and is generally separated into South Indian and North Indian food. India is very acclaimed for its differing multi-food accessible in countless and inn resorts, which is reminiscent of solidarity in assorted variety.

TITLE : Health-Aware Recipe Recommendation.

AUTHOR : Arvind Kumar, Anjali Gupta, and Ramesh S.

YEAR : 2021

In this paper, a personalized food recommendation system is proposed to cater to users with specific dietary needs. Using machine learning techniques such as decision trees and support vector machines, the system analyzes user health data, including Body Mass Index (BMI) and dietary restrictions. Recipes are scored based on nutritional content, and the results are presented through a user-friendly interface. Experimental evaluations show that the model achieves an accuracy of 85% in recommending recipes tailored to user health profiles. The proposed model incorporates user health data, such as Body Mass Index (BMI), age, activity level, and any dietary restrictions (e.g., low-sodium, gluten-free, or diabetic-friendly). By leveraging algorithms like decision trees and support vector machines (SVMs), the system identifies suitable recipes from a curated database. Each recipe is scored based on its nutritional content, including macronutrients (carbohydrates, proteins, and fats), micronutrients, and calorie values.

CHAPTER 3

SYSTEM ANALYSIS

3.1 EXISTING SYSTEM

Here are some existing systems for ingredient-based recipe recommendation:

ALL RECIPES

All Recipes provides a recipe search engine that allows users to search for recipes based on ingredients, dietary needs, and cuisine type. Users can enter a list of ingredients, and the platform will generate a set of recipes that match the available items. All Recipes also features crowd sourced reviews and ratings, which help refine the recommendations over time. They emphasize community-driven content and personalization to improve the recipe discovery process

SUPER COOK

Super Cook is another ingredient-based recipe recommendation system that generates recipes from what users already have in their kitchen. By entering the ingredients available in the pantry, users can find recipes that match their input. Super Cook's search engine offers advanced filtering options, allowing users to search based on cuisine, dietary preferences, or meal type. It also offers the option of substituting ingredients to fit personal preferences, helping users minimize food waste

COOK PAD

Cook pad is a social platform where users can share their own recipes and search for others based on available ingredients. While Cook pad allows users to input ingredients and get recipe suggestions, it distinguishes itself by focusing on community-driven content. Cook pad supports ingredient-based search and incorporates user-generated content for more diverse and localized recipes. The platform also allows users to upload photos of the dishes they prepare, adding a social aspect to the recipe recommendation system

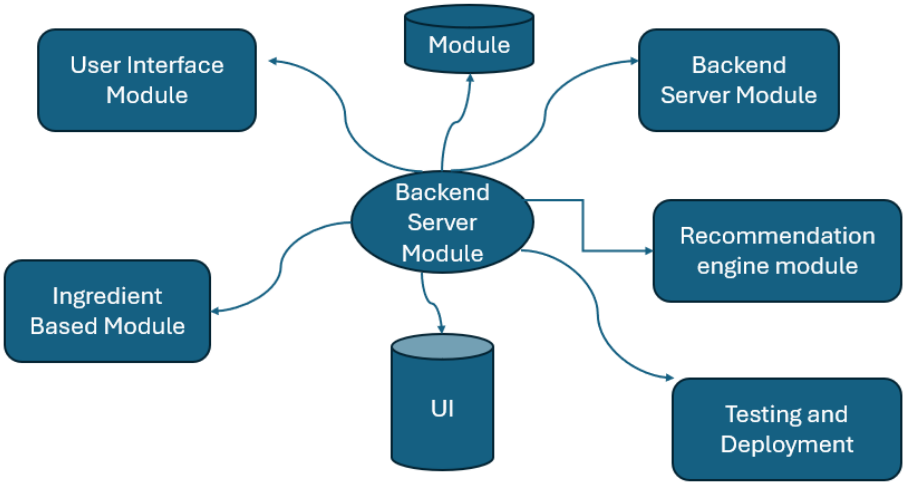

Fig 3.1 Existing Diagram

3.2 PROPOSED SYSTEM

The proposed system is an ingredient-based recipe recommendation platform designed to help users discover recipes using the ingredients they already have. This web application allows users to input available ingredients and receive a list of recipe suggestions based on those ingredients. The system enhances the user experience by offering ingredient substitution recommendations, ensuring that users can still prepare a dish even if they lack a specific item. It also supports personalization by learning user preferences, dietary restrictions, and past behaviors, thus providing tailored suggestions over time. The platform features filtering options for meal type, cuisine, difficulty level, and prep time, allowing for more refined searches.

Additionally, users can access detailed nutritional information for each recipe, making it easier to align with their health goals. The system is cloud-based, using advanced technologies like image recognition for ingredient identification, making it versatile and accessible on both desktop and mobile platforms.

To enhance recommendation quality, the system integrates a content-based filtering approach, utilizing ingredient similarity metrics to suggest alternative recipes if an exact match isn’t found. For example, if a user lacks a specific ingredient, the system

can propose substitutions or recipes that adapt to available ingredients. Machine learning models like decision trees or collaborative filtering can be incorporated to learn user preferences over time, further personalizing suggestions. system also provides additional features such as nutritional analysis and step-by-step cooking instructions, making it a comprehensive tool for meal planning. Future iterations could include voice input, real-time ingredient pricing, or integration with wearable health devices to further improve usability and relevance.

The proposed system is an ingredient-based recipe recommendation platform designed to help users discover recipes using the ingredients they already have on hand. This platform minimizes food waste and simplifies meal preparation by allowing users to input a list of available ingredients and receive curated recipe suggestions. To further enhance usability, the system offers ingredient substitution recommendations, enabling users to prepare dishes even if they lack specific items. Personalization is a key feature, as the platform leverages machine learning to learn user preferences, dietary restrictions, and past behaviors, providing tailored suggestions over time. Advanced filtering options allow users to refine their searches by meal type, cuisine, difficulty level, and preparation time, making the system highly versatile.

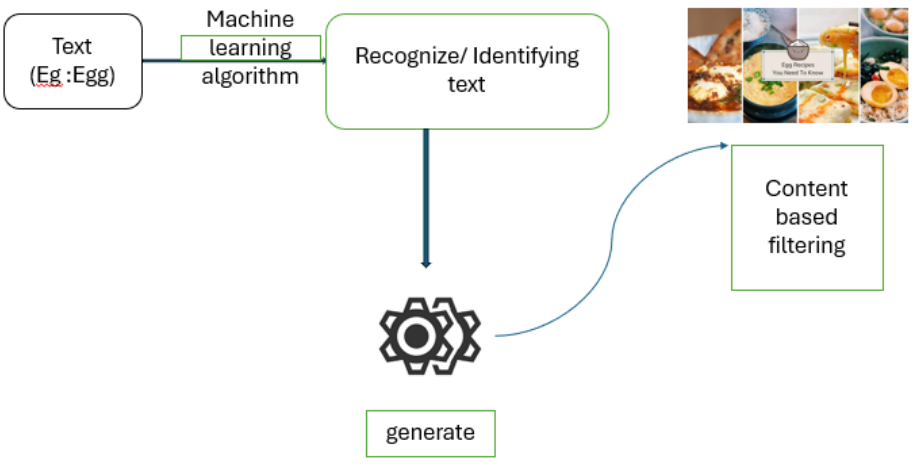

Fig 3.2 System Architecture

3.3 FLOWCHART

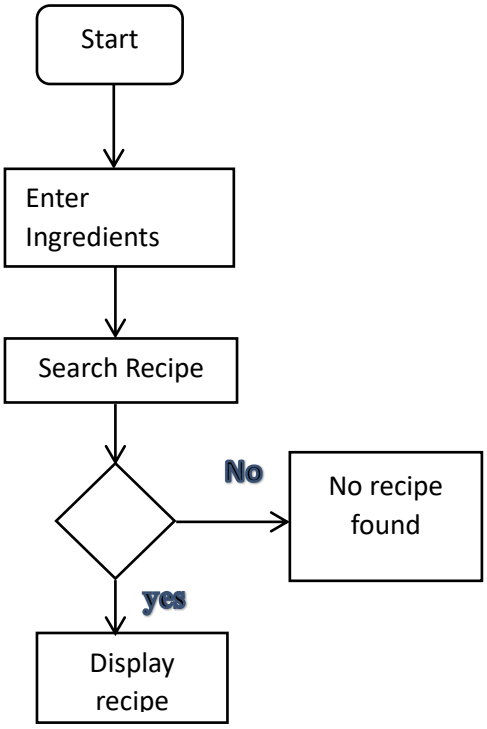

Fig 3.3 Flow of Control

3.4 PROCESS CYCLE

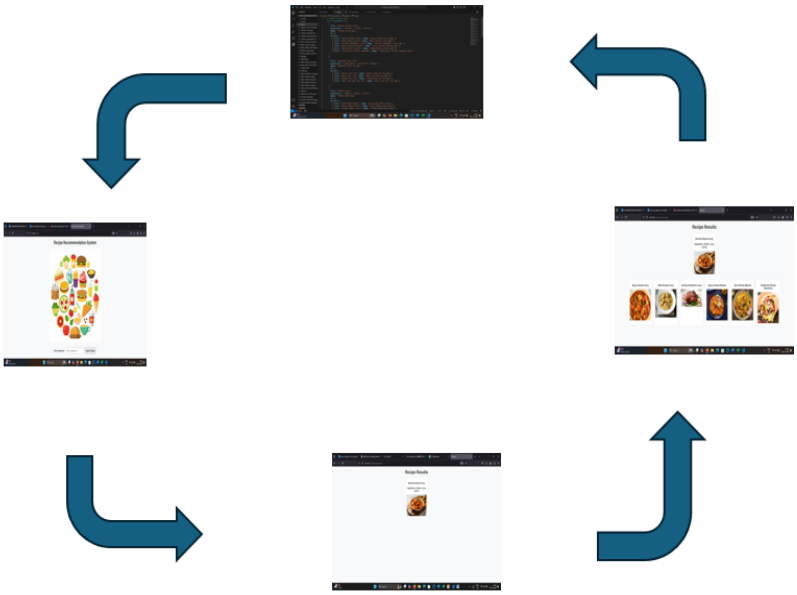

Fig 3.4 Life Cycle of the Process

3.5 ACTIVITY DIAGRAM

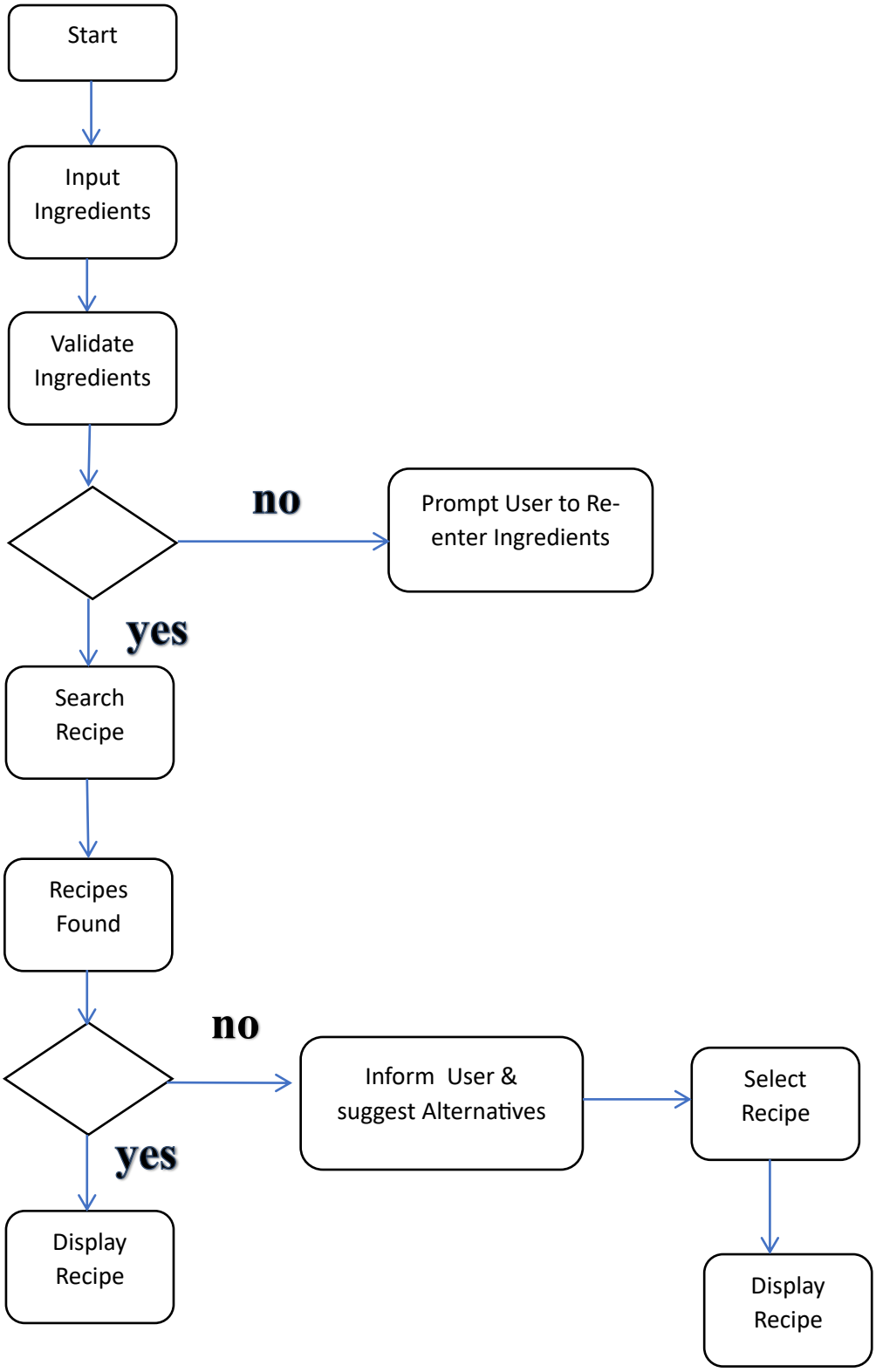

Fig 3.5 Activity Diagram

CHAPTER 4

MODULES

4.1 MODULE DESCRIPTION

- User Interface(UI) Module
- Ingredient and Recipe Database Module
- Recommendation Engine Module
- Backend Server Module
- Testing and Deployment Module

4.1.1 USER INTERFACE (UI) MODULE

The User Interface (UI) Module is a crucial component of the Recipe Recommendation System, designed to provide users with an intuitive and visually appealing platform to interact with the application. It serves as the primary touchpoint, enabling users to input ingredients, explore recipe suggestions, and access other features seamlessly. The home screen offers a central hub with options to search for recipes, manage pantry inventory, or view trending dishes. A dedicated ingredient input interface allows users to add ingredients via manual entry, dropdowns, or even image uploads, ensuring flexibility and ease of use.

The recipe display page organizes suggestions into visually appealing cards, showcasing key details like recipe name, preparation time, difficulty, and ingredient match percentage, with filtering options for customization. For more detailed information, users can access the recipe details page, which provides step-by-step instructions, nutritional data, and interactive options to save, share, or add recipes to meal plans. A personalized user profile page further enhances the experience by allowing users to manage saved recipes, dietary preferences, and viewing history.

Designed with a responsive approach, the module ensures compatibility across devices, delivering a consistent experience on desktops, tablets, and smartphones.

Accessibility features like adjustable text size, dark mode, and screen reader support make the interface inclusive for all users. By focusing on simplicity, aesthetic appeal, and interactivity, the UI Module ensures a seamless and enjoyable user experience, making cooking with available ingredients both convenient and engaging.

4.2 INGREDIENTS AND RECIPE DATABASE MODULE

The Ingredients and Recipe Database Module is the foundational element of the Recipe Recommendation System, responsible for storing, organizing, and managing all the data related to ingredients and recipes. This module serves as a centralized repository where every ingredient and recipe is systematically cataloged to enable efficient querying and retrieval. The ingredient database includes details such as ingredient names, categories (e.g., vegetables, proteins, grains), nutritional information, and substitution options, ensuring that the system can provide accurate and flexible recommendations. For instance, if a user lacks a specific ingredient, the database can suggest alternatives based on pre-defined substitution rules, enhancing usability.

The recipe database, on the other hand, contains comprehensive information about each recipe, including the name, list of required ingredients, preparation steps, cooking time, difficulty level, and associated metadata such as cuisine type, meal category, and dietary restrictions. Additionally, it holds nutritional details like calorie count and macronutrient breakdown, which are crucial for users with specific health goals. Each recipe is also tagged with keywords to facilitate advanced filtering, such as "quick recipes," "low-fat meals," or "vegan-friendly dishes," enabling users to find exactly what they need.

A key feature of this module is the relationship between ingredients and recipes, allowing for efficient matching. Recipes are linked to their respective ingredients in a way that supports both exact and partial matches. For example, the system can identify recipes that utilize a majority of the user’s available ingredients and suggest minimal additions to complete the dish. This relational structure ensures that the system operates dynamically and offers users a wide range of recipe suggestions tailored to their inputs.

The database is designed for scalability and flexibility, making it capable of handling a growing collection of ingredients and recipes over time. Relational database management systems (RDBMS) such as MySQL or PostgreSQL are typically used for structured and relational data. Alternatively, NoSQL databases like MongoDB can be employed for unstructured or semi-structured data, providing greater flexibility. To optimize performance, indexing and caching mechanisms are implemented, ensuring quick data retrieval and minimal latency during user interactions.

This module also integrates with external APIs or datasets, such as Spoonacular or Edamam, to enrich its content by adding new recipes and ingredient details. This ensures that the system stays up-to-date with current culinary trends and user demands. Regular updates and maintenance of the database are crucial to remove outdated recipes and incorporate new data, keeping the system relevant and valuable.

In addition to storage and retrieval, the Ingredients and Recipe Database Module plays a crucial role in ensuring data consistency and accuracy. Automated data validation processes are implemented to prevent errors during data entry, such as duplicate records or incorrect categorizations. The module also supports multilingual ingredient and recipe names, making the system accessible to users across different regions and languages.

Ultimately, the Ingredients and Recipe Database Module is designed to empower the Recipe Recommendation System by providing a reliable and well-structured data backbone. Its ability to store and organize vast amounts of culinary information ensures that users receive relevant, accurate, and diverse recipe suggestions, enhancing their overall experience with the system

4.3 RECOMMENDATION ENGINE MODULE

The Recommendation Engine Module is the central component of the Recipe Recommendation System, designed to provide users with personalized recipe suggestions based on their input and preferences. This module processes the ingredients entered by users, matches them with recipes in the database, and ranks the

results to deliver the most relevant options. It uses advanced algorithms to support both exact matches, where recipes use only the provided ingredients, and partial matches, where a minimal number of additional ingredients are required. To enhance flexibility, the module suggests ingredient substitutions when necessary, ensuring users can still explore recipes with slight modifications.

Personalization is a key feature of this module, as it leverages user profiles to tailor recommendations according to dietary preferences, cooking habits, and past interactions. It ranks recipes dynamically based on factors such as ingredient match percentage, preparation time, difficulty level, and popularity. Users can further refine suggestions through filters like cuisine type, meal category, and dietary restrictions. Advanced machine learning techniques, such as collaborative filtering and content-based filtering, can be incorporated to analyze user behavior and improve recommendations over time. Additionally, context-aware features, like seasonal ingredients and location-based preferences, can be included to make suggestions more relevant.

The Recommendation Engine Module is built with efficient matching algorithms, robust data processing, and a feedback loop to continually enhance its accuracy. By combining intelligent techniques and user-centric design, this module ensures that recipe suggestions are relevant, efficient, and adaptable to user needs, making it an integral part of the system.

4.4 BACKEND SERVER MODULE

The Backend Server Module serves as the backbone of the Recipe Recommendation System, managing the seamless communication between the user interface and the underlying databases and algorithms. It is responsible for handling user requests, processing data, and delivering responses in a structured and efficient manner. This module acts as an intermediary that ensures the frontend receives accurate and timely data from the database and recommendation engine, facilitating smooth operation of the system.

The backend server processes ingredient inputs from users, queries the recipe and ingredient databases, and interacts with the recommendation engine to generate

personalized suggestions. It handles data validation, ensuring that user inputs are clean and correctly formatted before being processed. Additionally, the backend enables the application of filters such as dietary preferences, cuisine type, and preparation time during recipe searches. It also supports functionalities like saving user profiles, managing preferences, and maintaining a history of interactions.

Built using robust frameworks such as Node.js, the backend server ensures scalability, reliability, and security. It employs RESTful or GraphQL APIs to facilitate structured communication with the frontend, making it flexible for future enhancements or integration with third-party services. Security measures such as authentication, authorization, and data encryption are implemented to protect user data and ensure safe interactions.

The Backend Server Module is designed for high performance, managing concurrent requests efficiently to maintain responsiveness even during peak usage. By acting as the central hub for data flow and processing, this module ensures that the Recipe Recommendation System operates seamlessly, delivering a reliable and efficient experience to users.

4.5 TESTING AND DEPLOYMENT MODULE

The Testing and Deployment Module is a critical component of the Recipe Recommendation System, ensuring the application is robust, reliable, and ready for real-world use. This module focuses on systematically evaluating the system's functionality, performance, and security through various testing methodologies, followed by deploying the application to a live environment. It aims to deliver a seamless and error-free experience to end-users while maintaining operational stability.

During the testing phase, the system undergoes rigorous checks, including unit testing to validate individual components, integration testing to ensure smooth interaction between modules, and system testing to verify end-to-end functionality. User interface testing ensures that the application is intuitive and free from design inconsistencies, while performance testing evaluates its behavior under varying loads

to guarantee scalability. Security testing is also conducted to identify and resolve vulnerabilities, ensuring data integrity and user privacy. Automated and manual testing approaches are combined to enhance test coverage and efficiency.

In the deployment phase, the system is configured and deployed to production servers, often using cloud platforms like AWS, Azure, or Google Cloud for scalability and reliability. Continuous Integration and Continuous Deployment (CI/CD) pipelines are implemented to automate testing, building, and deployment processes, enabling faster updates and fixes. Post-deployment, monitoring tools are used to track application performance and detect potential issues, allowing for prompt resolution. The Testing and Deployment Module ensures that the Recipe Recommendation System meets the highest standards of quality and functionality.

By systematically identifying and addressing potential issues and leveraging modern deployment practices, this module guarantees a smooth transition from development to a production-ready application. The ingredient database includes details such as ingredient names, categories (e.g., vegetables, proteins, grains), nutritional information, and substitution options, ensuring that the system can provide accurate and flexible recommendations. For instance, if a user lacks a specific ingredient, the database can suggest alternatives based on pre-defined substitution rules, enhancing usability.

Personalization is a key feature of this module, as it leverages user profiles to tailor recommendations according to dietary preferences, cooking habits, and past interactions. It ranks recipes dynamically based on factors such as ingredient match percentage, preparation time, difficulty level, and popularity. Users can further refine suggestions through filters like cuisine type, meal category, and dietary restrictions. Advanced machine learning techniques, such as collaborative filtering and content-based filtering, can be incorporated to analyze user behavior and improve recommendations over time.

CHAPTER 5
SYSTEM SPECIFICATION

5.1 SOFTWARE REQUIREMENTS

- Java script
- HTML
- CSS
- Visual Studio

5.2 HARDWARE REQUIREMENTS

- Processor - Intel i5
- RAM - 8GB
- Storage - 256 GB SSD
- Server Requirements – Internet Connection

5.1.1 VISUAL STUDIO CODE

Visual Studio is an integrated development environment (IDE) developed by Microsoft, widely used by developers for creating applications, websites, and services. It is particularly popular for building applications in languages such as C#, C++, Python, JavaScript, and more. Visual Studio provides a comprehensive suite of tools to streamline the development process, from coding and debugging to testing and deployment.

For a food recipe recommendation system, Visual Studio can be used for both frontend and backend development. On the frontend, developers can use Visual Studio to work with HTML, CSS, and JavaScript, creating the user interface (UI) and interactive elements for the recipe application. The IDE offers features like IntelliSense, which provides code suggestions, auto-completion, and error checking,

making the process faster and less error-prone. It also supports various web development frameworks and libraries, such as React.js, Angular, or Vue.js, allowing developers to build dynamic, interactive websites.

On the backend, Visual Studio is a powerful tool for server-side development. It supports languages such as C# for building web services or APIs using frameworks like ASP.NET Core. Developers can use Visual Studio to create the logic for querying recipe databases, processing ingredient inputs, and generating recipe recommendations based on user preferences. Additionally, Visual Studio integrates seamlessly with SQL Server or other database systems, enabling developers to manage the storage and retrieval of recipe data efficiently.

Visual Studio also includes features for debugging and testing, which are essential for ensuring that the food recipe recommendation system functions as expected. The built-in debugging tools allow developers to identify and resolve errors in the code, while the testing frameworks support unit testing to ensure that individual components work as intended. Visual Studio's Git integration simplifies version control, making it easy for teams to collaborate and manage code changes.

The IDE's extensibility is another significant advantage. Visual Studio supports various plugins and extensions that add extra functionality, such as tools for UI design, performance profiling, and cloud deployment. Developers can also customize the environment to suit their workflow, with features like themes, customizable key bindings, and project templates.

Overall, Visual Studio is a powerful and versatile tool for developing a food recipe recommendation system, providing everything from coding and debugging to deployment, and streamlining the development process across both frontend and backend tasks.

CHAPTER 6

SYSTEM TESTING

6.1 FUNCTIONAL TESTING

Functional testing focuses on verifying that the application works as intended by ensuring all features and workflows are operational.

1. **Ingredient Input Validation**:
    - Test whether the application accepts various input formats, such as text, voice commands, or image uploads for ingredient recognition.
    - Validate that unsupported inputs, like special characters or unrecognized ingredient names, trigger appropriate error messages.
2. **Recommendation Accuracy**:
    - Test the system's ability to generate relevant recipe suggestions based on different combinations of ingredients.
    - Check for edge cases, such as when minimal or unconventional ingredients are provided.
3. **Filter and Sorting Functionality**:
    - Validate filters for dietary preferences and ensure they work seamlessly when combined.
    - Test sorting options, such as by preparation time, popularity, or user ratings.
4. **Error Handling**:
    - Verify that the system gracefully handles scenarios like empty inputs, server downtime, or missing recipes, displaying appropriate fallback messages.
    - Ensure alternative navigation paths and partial inputs are handled smoothly.

6.2 VALIDATION TESTING

Validation testing ensures the application meets user expectations and performs well under real-world conditions.

1. **Recommendation Validation**:
    - Test the relevance and diversity of recipe suggestions for various inputs.
    - Assess the system's ability to recommend recipes that align with user dietary preferences and restrictions.
2. **Performance Validation**:
    - Perform stress testing by simulating high user traffic to ensure the system's stability and responsiveness.
    - Measure response times for searches and recipe retrieval to validate speed and reliability.
3. **Data Integrity**:
    - Test the consistency of stored user data, such as preferences and saved recipes, ensuring no data loss or corruption occurs.
4. **Real-Time Behavior Testing**:
    - Test dynamic features like ingredient substitutions and expiration notifications to verify real-world applicability.

CHAPTER 7

CONCLUSION AND FUTURE ENHANCEMENT

7.1 CONCLUSION

The food recipe recommendation system, developed using modern web technologies such as HTML, CSS, JavaScript, and backend frameworks, provides a practical and engaging solution for users looking to create meals based on the ingredients they have available. By focusing on simplicity and user-friendliness, the system successfully streamlines the process of discovering recipes and encourages users to experiment with the ingredients they already have. The integration of JavaScript for dynamic content generation, CSS for responsive and visually appealing design, and HTML for structure creates a seamless experience for users, enhancing both the functionality and accessibility of the platform.

7.2 FUTURE ENHANCEMENT

Future enhancements in the field of disease-based dietary ingredients could focus on personalized nutrition plans powered by AI and machine learning, analyzing individual health data like genetics, microbiome, and lifestyle to recommend tailored diets. Integration with digital health trackers could enable real-time monitoring of health parameters such as blood sugar and heart rate, providing instant dietary advice. Advancements in research could lead to the discovery of new functional foods, bioactive compounds, and microbiome-targeted ingredients to prevent or manage diseases. Precision agriculture and techniques like CRISPR could help develop nutrient-enriched crops for specific health needs. Additionally, innovations in dietary solutions for chronic diseases such as diabetes, cardiovascular disorders, and cancer, along with allergy-friendly alternatives, could transform the way nutrition supports health management.

APPENDIX A
SOURCE CODE

Index.html

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>Recipe Recommendation</title>
  <link rel="stylesheet" href="style.css">
</head>
<body>
  <h1>Recipe Recommendation System</h1>
  <img src="img.jpg" alt="Recipe">
  <form id="ingredients-form">
    <label for="ingredients">Enter Ingredients :</label>
    <input type="text" id="ingredients" placeholder="Enter ingredients" required>
    <button type="submit">Search Recipes</button>
  </form>
 <script src="app.js"></script>
</body>
</html>
```

recipes.html

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>Recipes</title>
  <link rel="stylesheet" href="style.css">
```

```
</head>
<body>
  <h1>Recipe Results</h1>
  <div id="recipes-list"></div>
  <div id="varieties-list"></div>
      <script src="recipes.js"></script>
</body>
</html>
```

app.js

```
const recipesData = [
  {
    title: "Normal Chicken Curry",
    ingredients: ["chicken", "curry", "onions"],
    image: "chicken curry.jpg",
    id: 1,
    variants: [
      { title: "Spicy Chicken Curry", image: "Spicy Chicken Curry.jpg" },
      { title: "Mild Chicken Curry", image: "mild chicken curry.jpg" },
      { title: "chicken thandhoori curry",image: "chicken thandhoori curry.jpg" },
      { title: "Spicy Chicken Biryani", image: "spicy_chicken_biryani.jpg" },
      { title: "Dum Chicken Biryani", image: "dum_chicken_biryani.jpg" },
          { title: "Traditional Chicken Shawarma", image: "traditional chicken shawarma.jpg" }
    ]
  },
  {
    title: "Vegetable Stir Fry",
    ingredients: ["vegetables", "soy sauce", "ginger"],
    image: "Vegetable Stir Fry.jpg",
    id: 2,
    variants: [
```

```
    { title: "Garlic Stir Fry", image: "garlic veg stir fry.jpg" },
    { title: "Spicy Stir Fry", image: "spicy veg stir fry.jpg" },
    { title: "Cashew Stir Fry", image: "cashew veg stir fry.jpg" },
    { title: "Sweet and Sour Stir Fry", image: "sweet sour stir fry.jpg" }
  ]
},
{
  title: "Tomato Pasta",
  ingredients: ["tomato", "pasta", "basil"],
  image: "tomato pasta.jpg",
  id: 3,
  variants: [
    { title: "Pasta with Cheese", image: "pasta_with_cheese.jpg" },
    { title: "Spicy Tomato Pasta", image: "spicy_tomato_pasta.jpg" },
    { title: "Creamy Tomato Pasta", image: "creamy_tomato_pasta.jpg" },
    { title: "Tomato Pasta with Vegetables", image: "vegetable_tomato_pasta.jpg" }
  ]
},
{
    title: "Grilled Salmon",
    ingredients: ["salmon", "lemon", "garlic"],
    image: "grilled_salmon.jpg",
    id: 4,
    variants: [
      { title: "Spicy Grilled Salmon", image: "spicy_grilled_salmon.jpg" },
      { title: "Garlic Herb Salmon", image: "garlic_herb_salmon.jpg" },
      { title: "Honey Glazed Salmon", image: "honey_glazed_salmon.jpg" }
    ]
  },
  {
    title: "Egg",
```

```
  ingredients: ["egg", "pepper", "salt"],
  image: "egg.jpg",
  id: 5,
  variants: [
    { title: "Egg curry", image: "Egg_curry.jpg" },
    { title: "Egg Fried rice", image: "Egg_fried_rice.jpg" },
    { title: "Egg kuzhambu", image: "Egg_kuzhambu.jpg" },
    { title: "Boiled egg fry", image: "Boiled egg fry.jpg" },
  ]
},
{
  title: "Vegetable Soup",
  ingredients: ["carrot", "celery", "potato"],
  image: "vegetable_soup.jpg",
  id: 6,
  variants: [
    { title: "Creamy Vegetable Soup", image: "creamy_vegetable_soup.jpg" },
    { title: "Spicy Lentil Soup", image: "spicy_lentil_soup.jpg" },
    { title: "Tomato Basil Soup", image: "tomato_basil_soup.jpg" }
  ]
},
{
  title: "Pancakes",
  ingredients: ["flour", "milk", "sugar"],
  image: "pancakes.jpg",
  id: 7,
  variants: [
    { title: "Blueberry Pancakes", image: "blueberry_pancakes.jpg" },
    { title: "Banana Pancakes", image: "banana_pancakes.jpg" },
    { title: "Chocolate Chip Pancakes", image: "chocolate_chip_pancakes.jpg" }
  ]
```

```
  },
  {
    title: "Pizza",
    ingredients: ["flours", "tomato sauce", "cheese", "olive oil"],
    image: "pizza.jpg",
    id: 8,
    variants: [
      { title: "Margherita Pizza", image: "margherita_pizza.jpg" },
      { title: "Pepperoni Pizza", image: "pepperoni_pizza.jpg" },
      { title: "BBQ Chicken Pizza", image: "bbq_chicken_pizza.jpg" },
      { title: "Veggie Delight Pizza", image: "veggie_pizza.jpg" }
    ]
  }
  {
    title: "Prawn ",
    ingredients: ["prawns", "butter", "parsley"],
    image: "prawn.jpg",
    id: 9,
    variants: [
      { title: "Garlic Butter Prawn", image: "garlic butter prawn.jpg" },
      { title: "Lemon Herb Prawn", image: "lemon herb prawn.jpg" },
      { title: "Spicy Prawn", image: "spicy prawn.jpg" }
    ]
  },];
function searchRecipes(ingredients) {
  const ingredientsList = ingredients.toLowerCase().split(',').map(item => item.trim());
  const filteredRecipes = recipesData.filter(recipe =>
  recipe.ingredients.some(ingredient=>
ingredientsList.includes(ingredient.toLowerCase()))
  );
  return filteredRecipes;
```

```
}
document.getElementById('ingredients-form').addEventListener('submit', function (e)
{
  e.preventDefault();

  const ingredients = document.getElementById('ingredients').value;
  const recipes = searchRecipes(ingredients);
  if (recipes.length === 0) {
    alert('No recipes found. Try other ingredients!');
    return;
  }
  localStorage.setItem('filteredRecipes', JSON.stringify(recipes));
  window.location.href = 'recipes.html'; // Ensure file name matches the actual file
});
```

recipes.js

```
const recipes = JSON.parse(localStorage.getItem('filteredRecipes'));
const recipesList = document.getElementById('recipes-list');
if (!recipes || recipes.length === 0) {
  recipesList.innerHTML = '<p>No recipes found. Try other ingredients!</p>';
} else {
  recipes.forEach(recipe => {
    const recipeElement = document.createElement('div');
    recipeElement.classList.add('recipe');
    recipeElement.innerHTML = `
      <h3>${recipe.title}</h3>
      <p>Ingredients: ${recipe.ingredients.join(', ')}</p>
    const recipeImage = document.createElement('img');
    recipeImage.src = recipe.image;
    recipeImage.alt = recipe.title;
    recipeImage.addEventListener('click', () => displayVarieties(recipe.id));
    recipeElement.appendChild(recipeImage);
```

```
    recipesList.appendChild(recipeElement);
  });
}
function displayVarieties(recipeId) {
  const varietiesList = document.getElementById('varieties-list');
  varietiesList.innerHTML = '';
  const selectedRecipe = recipes.find(recipe => recipe.id === recipeId);
  if (!selectedRecipe) {
    varietiesList.innerHTML = '<p>No varieties found.</p>';
    return;
  }
```

style.css

```
body {
    font-family: Arial, sans-serif;
    margin: 0;
    padding: 0;
    background-color: #f8f9fa;
    text-align: center;
  }
  h1 {
    color: #333;
    margin-top: 20px;
  }
  form {
    margin: 20px 0;
  }
  input, button {
    padding: 10px;
    font-size: 16px;
    margin: 5px;
  }
```

```
#recipes-list, #varieties-list {
  display: flex;
  flex-wrap: wrap;
  justify-content: center;
  gap: 20px;
  margin: 20px;
 }
 .recipe, .variety {
  border: 1px solid #ddd;
  padding: 10px;
  background: white;
  width: 200px;
  text-align: center;
 }
 .recipe img, .variety img {
  width: 100%;
  height: auto;
  cursor: pointer;
 }
 .recipe h3, .variety h3 {
  font-size: 16px;
  color: #333;
 }
```

APPENDIX B

SCREENSHOTS

Sample Output:

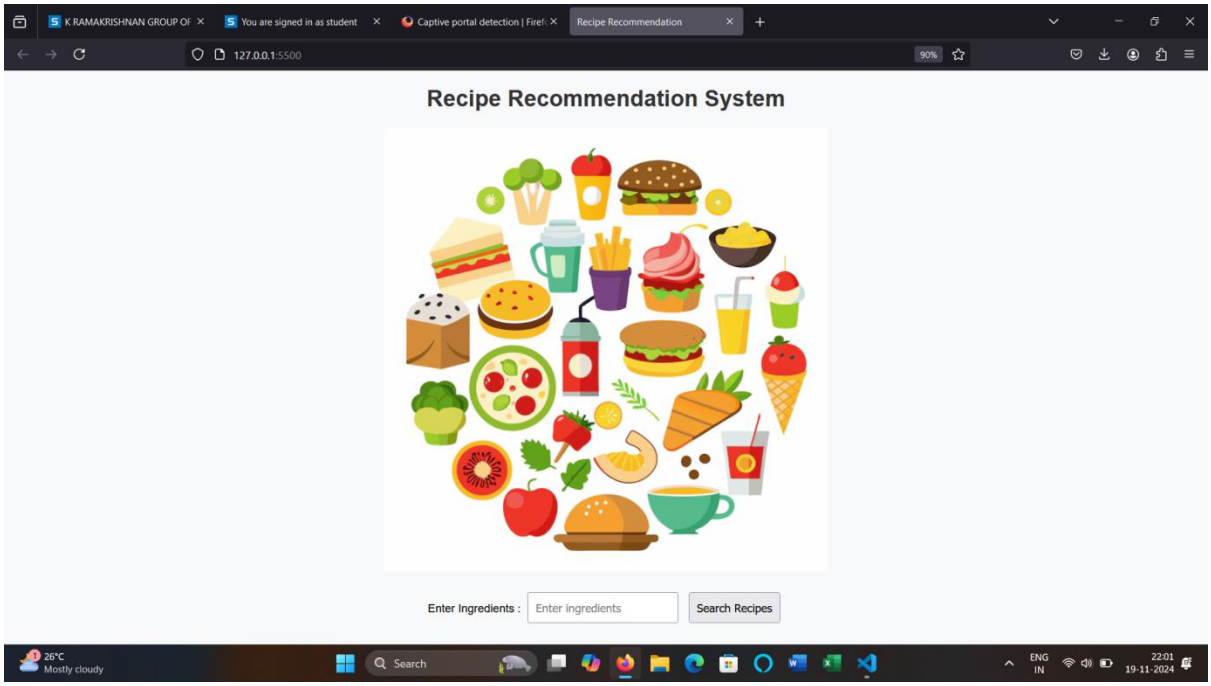

Fig B.1 Home page

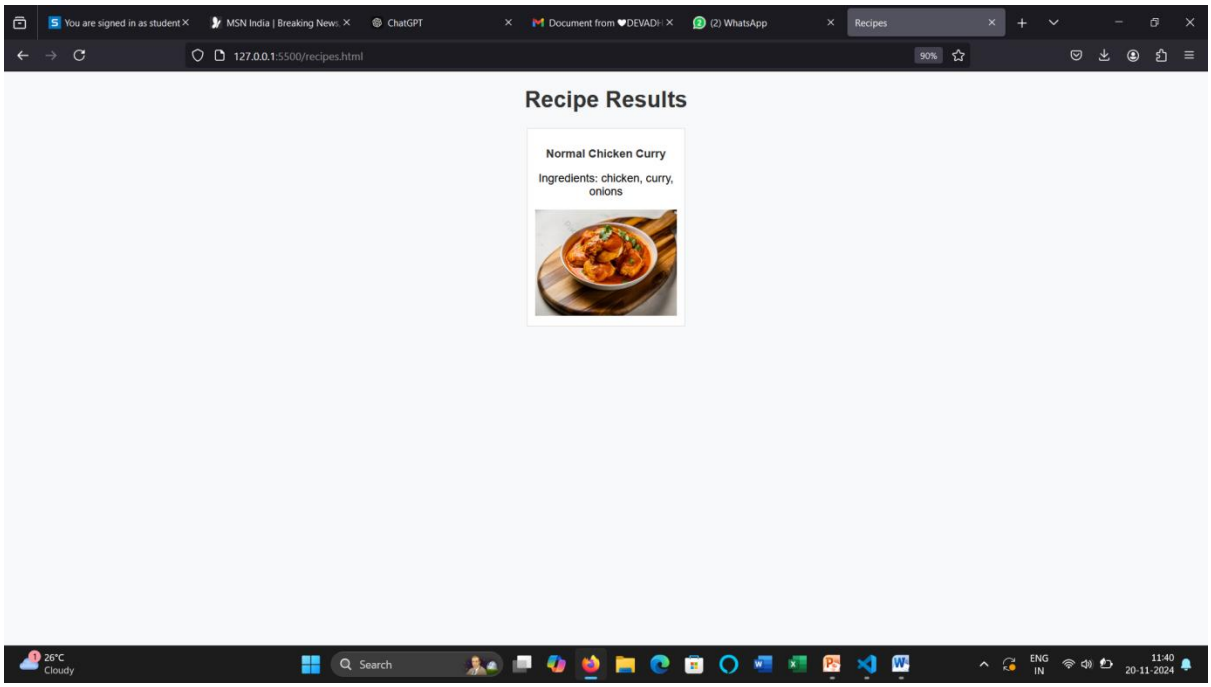

Fig B.2 Display recipe

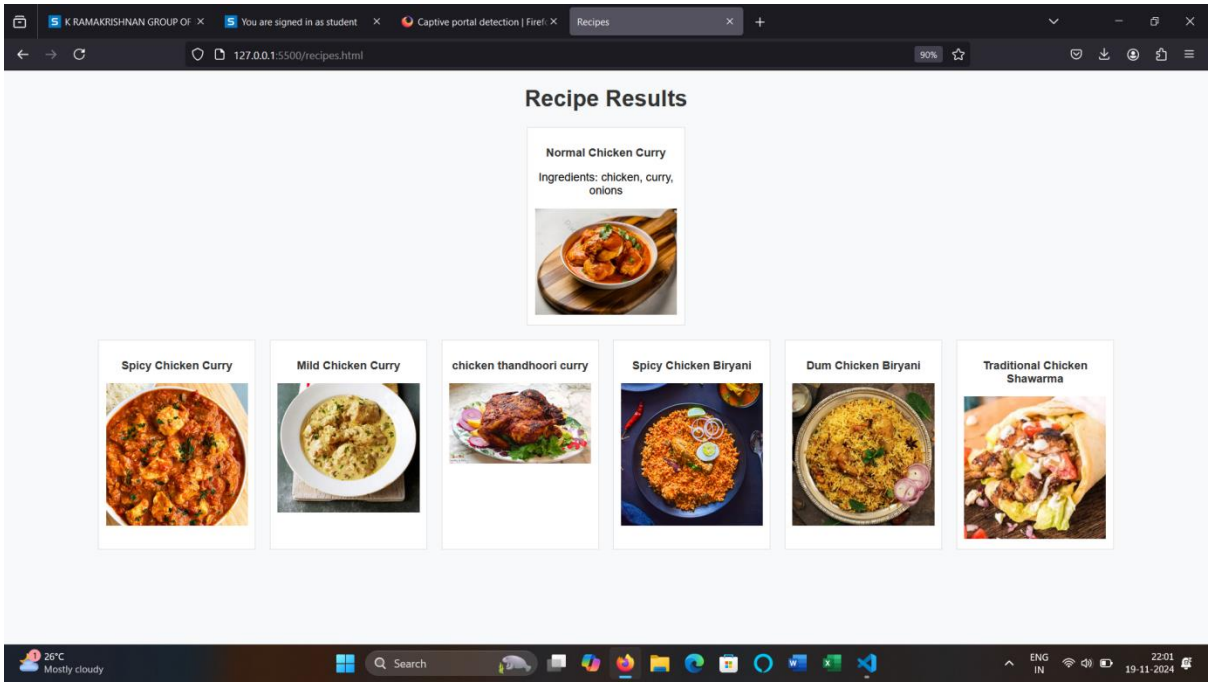

Fig B.3 Displaying variety recipes

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