

SMART CHEF: AI RECIPE GENERATOR AND RECOMMENDER

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Abstract

Smart Chef is an AI-enabled recipe generator and recommender that assists users in discovering and creating recipes based on their preferences. The heart of the system is a Large Language Model (LLM) used to generate recipes, allowing users to manually input ingredients, specify serving sizes, and select a type of meal (breakfast, lunch, dinner, or dessert). The recipe is initially displayed in English, with a translation option in Telugu or Hindi. Recipes contain attributes such as the recipe name, ingredients, instructions, and nutritional information. The Recipe Recommender suggests recipes based on the ingredients provided by the user. It displays the recipe name, image, ingredients, instructions, and a translation feature. This model is trained using LSTM to provide recommendations. Additional features include a Random Recipe Recommender, Seasonal Recipe Suggestions, and a Profile page to manage favourite recipes. Built with React.js and MongoDB, Smart Chef provides a personalized and user-friendly cooking experience.

Keywords: AI-based recipe generation, Recipe recommendation, Seasonal recipe suggestions, User-friendly interface.

1. Introduction

Food is an essential part of day-to-day living, but individuals often find it difficult to decide what to prepare based on the specific ingredients they have. Most recipe websites require the user to input exactly what the user has in order to search recipes based on available ingredients. This process is time taking. A large problem is food wastage, often times perfectly good ingredients go unused simply because of not having the knowledge of how to use a particular ingredient.

To overcome these issues, we have developed Smart Chef, an AI-powered recipe generator and recommender system that allows users to figure out how to use ingredients in their meals. Smart Chef uses LLaMA, a powerful Large Language Model (LLM), to generate high-quality recipes. Users need to input at least three ingredients, specify the number of servings, and select the type of meal (Dessert, Breakfast, or Lunch/Dinner). The recipe recommendations feature in Smart Chef uses combination of LSTM. LSTM takes ingredient data as input, the system identifies patterns between ingredients, enhancing the accuracy of recommendations. Users will only be required to input the ingredients in a text format, and Smart Chef will recommend a number of appropriate recipes.

The seasons recipe recommender categorizes recipes into three seasons: summer, rainy, and winter. Also, there is a refresh button to allow the user to try new seasonal recipes. In addition, there is a random recipe generator that allows the user to get a completely random recipe encouraging users to try new

meals effortlessly. The front-end of the Smart Chef was first created in Figma and then developed using React.js to keep the user experience simple and appealing to the eye. User records are stored in MongoDB, including usernames, passwords, and user favourite recipes, to create an effortless and seamless cooking experience.

2. Literature Survey

Tejaswini and V. S. Reddy [1] introduced an AI-driven recipe generator and cooking assistant that creates personalized recipes for users based on preferences, dietary restrictions, and ingredient availability. The cooking assistant helps users with cooking in real-time and encourages a healthier diet.

Neelam and Veerella [2] put forward a hybrid personalized recipe recommendation system utilizing multiclass classification and association rule mining, improving recipe recommendations based on the ingredient networks and user preferences.

Pareek, Gahlot, Khatri, and Sachdeva [3] developed a machine learning methodology for improving the generation of personalized recipes using AI approaches. Their structure combines ingredient information data, user preferences, and cooking modalities to produce new personalized recipes for users. The objective is to increase user engagement to food variation, healthy eating, and use of foods. This research provides an important resource in personalizing their cooking experience.

Vivek, Manju, and Vijay [4] established a full recipe recommendation framework based on multi-class classification and collaborative filtering. The framework uses complex methods for similarity computations to find similarities across user interests to the recipes based on an extensive recipe database. It presents item-based and user-based recommendation processes to better understand the different recipe recommendations.

Moolya, Pansare, Kshirsagar & Bodekar-Kale [5] developed a recipe generation method utilizing deep learning implementations. The research utilizes recipe generation with sophisticated machine learning methodologies, so that users can provide their own ingredients and then generate personalized recipes. The research is revealing even newer aspects of automated recipe generation with advanced neural network methodologies.

Pandey, Varma, Gupta & Tekwani [6] developed a recipe recommendation framework leveraging advanced algorithmic utilities. The approach uses Non-Negative Matrix Factorization along with sentiment analysis with the aim of generating personalized recipe recommendations. By implementing a combined reference model, the research is revealing even newer directions for ingredient-based recipe recommendations.

Srivastava & Siddiqui [7] developed a novel food recipe recommendation framework utilizing machine learning methodologies. Their method used advanced algorithms to provide personalized recipe suggestion based on user preferences and historical data. The study used a personalized reference model for the request and the implication is to explore better directions in culinary recommendation systems.

S. Chhipa, V. Berwal, T. Hirapure & S. Banerjee [8] developed a recipe recommendation system using machine learning, leveraging TF-IDF and Cosine Similarity to suggest recipes based on available ingredients. The mobile application allows users to input ingredients, filter recipes by course type and diet preferences, and create grocery lists. Unlike traditional apps, it considers ingredient constraints to optimize resource use and minimize waste, enhancing user convenience in meal planning.

Rane, Chobe, Kapadnis, Deshmukh & Magar [9] analyzed machine learning models for recipe recommendation based on available ingredients, evaluating Decision Tree, Random Forest, SVM, and

KNN on an Indian recipe dataset. They highlighted the effectiveness of AI in meal planning and suggested fine-tuning GPT-2 for diverse, context-aware recipe generation, enhancing ingredient use and cooking decisions.

Han Su, Man-Kwan Shan, Ting-Wei Lin, Janet Chang & Cheng-Te Li [10] explore cuisine classification using associative classification and SVM to analyze ingredient-cuisine relationships. By treating recipes as instances and cuisines as labels, they build predictive models using food.com data. The study highlights common ingredients across cuisines, demonstrating how automated cuisine labelling can enhance recipe recommendations and meal planning.

Krishna Prasad D.S, Dhanya, Nishmitha, Shreesha H Rao & Srideva [11] propose a recipe recommendation system that suggests dishes based on available ingredients using machine learning. The system employs Count Vectorizer to convert ingredients into vectors and utilizes cosine similarity to identify relevant recipes. Built with Flask, Firebase, and Python, the system allows users to register, search, and add recipes.

3. Methodology

3.1 System Architecture

The five main characteristics of the Smart Chef system recipe generation, recipe recommendation, random recipe recommendation, seasonal recommendations, and profile management are represented by the flow chart. By registration or logging in, users interact with the platform in an organised manner.

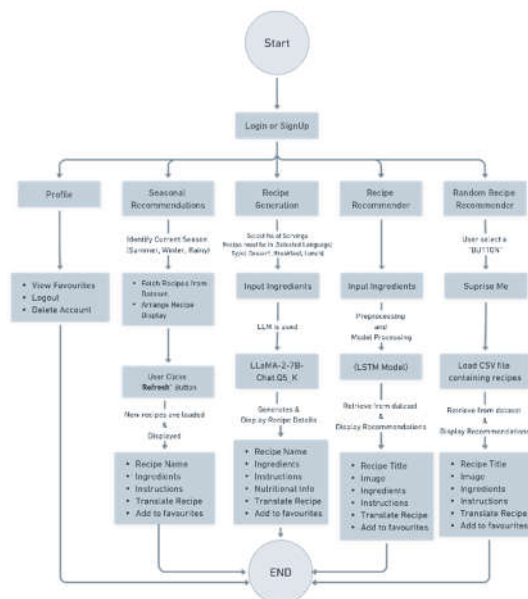


Figure 3.1.1 Flow Chart

3.2 Recipe Generation

Smart Chef's Recipe Generation functionality assists users in creating a customized recipe based on the ingredients provided and preferences selected number of servings, type of meal (Breakfast, Lunch/Dinner, or Dessert) and language. Smart Chef enhances the user experience by generating recipes using Large Language Model (LLM). Smart Chef provides structured recipes consisting of the recipe title, recipe ingredients, cooking instructions and nutritional information, in the selected language (English, Hindi, or Telugu). The user must provide at least three ingredients in order for the LLM to

produce reasonable recipes. The users can also save their favourite recipe in their profile that they created or generated.

For generating the recipes, we have used the Llama-2-7B-Chat model which is a robust pre-trained language model found on Hugging Face. Among the available variants, we chose llama2-7b-chat.Q5_K_M.gguf because it provides great performance within a computationally lean framework. With its 7 billion parameters, this model is designed for chat and structured text generation, making it particularly suited to designing elaborate, context-rich recipes. Every recipe starts off with a title, which then is followed by the ingredient section listing all the ingredients with precise quantities. The steps for cooking are provided in a stepwise manner. Cooking times are provided, along with some basic gap nutritional values.

3.3 Recipe Recommender

We used the "Food Ingredients and Recipe Dataset with Images" from Kaggle. The dataset includes a CSV file and a folder with 13,582 recipe images. The CSV file contains five key columns: the recipe title, ingredients, step-by-step instructions, and a cleaned ingredients list for better processing. It also has an image name column that links each recipe to its corresponding image in the zipped folder, making it easier to connect visual and textual data.

Our recipe recommendation system uses a deep learning model LSTM to provide more accurate suggestions. We trained it using the "Food Ingredients and Recipe Dataset with Images" from Kaggle, which contains recipes along with their images. For training the LSTM model, we divided the dataset into 80% training and 20% testing. The model's performance was evaluated using accuracy as the primary metric.

The LSTM model analyses the ingredient lists, understanding patterns and relationships between different ingredients. The LSTM model was trained on the cleaned ingredients column, where the ingredient text was first tokenized and then padded to ensure uniform sequence length. The model creates a more reliable and precise recommendation system. The final output includes the recipe title, image, ingredients, and step-by-step instructions, helping users easily find recipes that match their inputs.

3.4 Random Recipe Recommender

The "Surprise Me" function allows users to view randomly-selected recipes sourced from the same dataset that the recipe recommender accesses. Each button-click will produce a new recipe. Users can refresh the page to generate random recipes.

3.5 Seasonal Recipe Recommender

The seasonal recipe recommendation system is able to suggest dishes according to the current season, as the system will recommend dishes that match the current weather. The original dataset is built with ChatGPT. The dataset includes title, description, ingredients list, step-by-step instructions and season. The seasonal suggestion system and will display recipes of all 3 seasons. There is also a refresh button, that helps the user load a new recipe with one click. This works to provide variety in the recipes it suggests.

3.6 Implementation

The design of the current system utilizes a combination of state-of-the-art web technologies and AI-based models. The frontend of the system is built in React.js to allow for a user-friendly, smooth, and interactive experience across devices. Prior to development, UI/UX designs were prototyped in Figma

to establish a visual direction and an easy-to-use interface. In terms of the backend, the system utilizes Python and Flask to handle primary functionalities including processing user input, communicating with the recommendation model, and processing API requests. Flask is a lightweight framework that utilizes a model for communicating with both the front and backend of the system. Data storing is completed with the use of MongoDB, which is a NoSQL database, to manage users, created recipes, and recipes marked as favourites. MongoDB allows for quick and efficient data retrieval and interaction with the application, regardless of the number of users and recipes stored.

4. Results

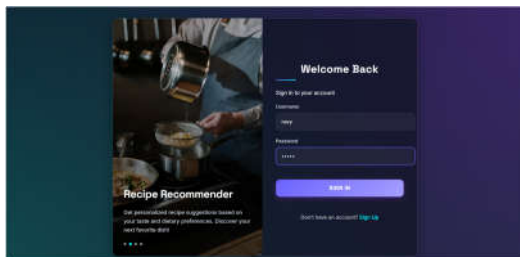


Figure 4.1 Sign in Page

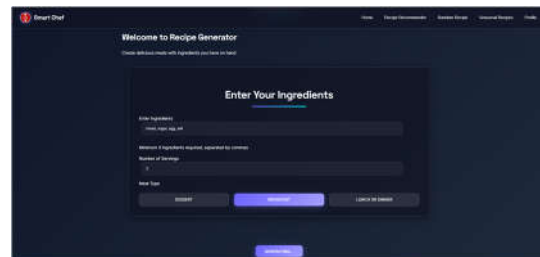


Figure 4.2 Recipe Generator Page

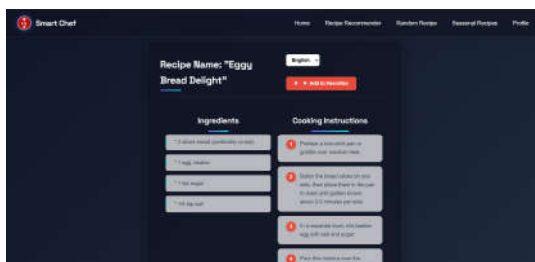


Figure 4.3 Recipe Generator Output



Figure 4.4 Recipe Language Translation

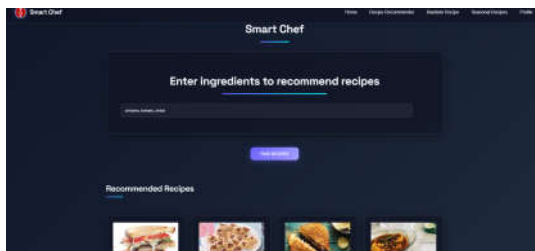


Figure 4.5 Recipe Recommender

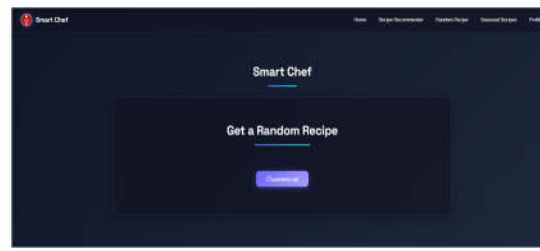


Figure 4.6 Random Recipe Recommender

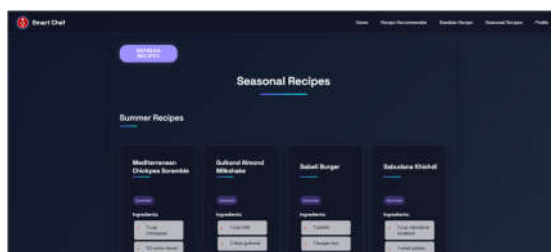


Figure 4.7 Seasonal Recipe Suggestions

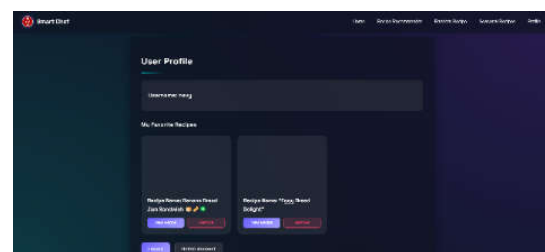


Figure 4.8 Profile Page

5. Conclusion

Smart Chef exemplifies how artificial intelligence and machine learning can change people's relationship with food and the meal-planning process. The smart combination of natural language processing and vast language models to generate recipes and recommendations based on food already in users' possessions is an effective way to instil creativity in food preparation, utilizing what is available, encouraging creativity, and minimizing food waste. With all the components that Smart Chef offers—recipe generation, smart recommendations, a system that works at the fun end "Surprise Me" option, seasonal recipes, and responsiveness. Smart Chef uses technology to make daily cooking easier and more enjoyable, while helping people use ingredients wisely and reduce food waste.

6. Future Scope

Looking ahead, the system could be improved by incorporating ingredient detection from images, which would allow users to upload images of ingredients, the system would automatically recognize them. We could also include a voice assistant capability, so that users could generate recipes based on a voice command, which would otherwise require some typing. An expansion of support for other languages will increase the system's versatility, allowing users to enter ingredients in the language of their choice and receive recipes in that language as well.

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