AI Driven Personalized Recipe Generator

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Abstract: The purpose of the study is to explore the applications of AI in the field of culinary, especially new recipe generation from the existing ones. The paper presents a thorough background study in the AI field of culinary and the existing applications in the recipe generation domain. Authors came across various recipe recommendations and cuisine-specific recommendations. However, none focused on Recipe Generation, which could be a new field to explore. Generating recipes using artificial intelligence (AI) techniques has gained significant attention in recent years due to its potential to automate and enhance culinary creativity. This article provides an overview of state-of-the-art methods and challenges in AI based recipe generation. We discuss various approaches, including natural language processing (NLP) models, recommender systems used in recipe generation. Key challenges such as ingredient combinations, cultural sensitivity and integration of user feedback are addressed, along with ethical considerations in formulation development. In addition, we explore future research opportunities and the potential impact of AI technologies on the culinary domain.

Keywords: Artificial intelligence, NLP, Impact of AI technologies, Recipe generation

Introduction:

The AI-Driven personalized recipe generator represents a novel approach to revolutionize the culinary experience, blending cutting-edge artificial intelligence (AI) technologies with culinary arts. This overview provides a comprehensive introduction to the system's key components, functionalities, and the motivation behind its development.

recipe generation is an important real-world application of natural language processing. Given a user's personal and/or health taste restrictions, the task is to suggest a healthy and tasty dish that the user would like to eat. This task has been approached with knowledge-based. Knowledge-based systems typically start with a nutritional model of the food domain and a set of health goals (e.g. a target number of calories or a set of foods to avoid). The system then searches for a recipe that satisfies the constraints and is similar to a given input recipe. If the system has access to a cost model, it can suggest recipe modifications that are cheap and require few ingredient substitutions.

A recipe recommendation engine that is health-driven and provides recipe revision suggestions is a flexible and powerful tool for nutritionists. It is also observed that the use of online media and digital medium makes cooking more accessible. This gives us more reason to find solutions to simple problems such as recipe generation using deep learning. Cooking is considered no less than art, it is a creative process, procuring recipes consisting of the right combination of flavors. By creating a recipe generator, we can allow the creation of unique dishes with unique combinations, it is a system that combines Artificial intelligence along with knowledge contributing to computational creativity. The system should be able to learn how to imitate human creativity, to be able to generate a recipe. In this

paper, we propose a cooking recipe generator which will produce a recipe as output when the user inputs ingredients. A deep learning model is created and trained to generate the recipe. Our project focuses on creation of a number of unique and creative recipes based on the ingredients entered by the user, thus providing recipes as per the user's ingredient availability.

Literature Survey:

Paper Name	Authors (Publication, Year)	Methodology	Advantage	Disadvantage/Future Scope
AI-Based Recipe Generator	Devarasetty Tejaswini, V Sankar Reddy (May 2024) (IJCRT)	AI-based recipe generation with personalized recommendations.	Personalized meal planning and step-by-step cooking help.	Privacy concerns, recipe accuracy, diverse dietary needs.
Enhancing Recipe Generation Using AI & ML	Akshara Pareek et al. (April 2024) (IJNRD)	AI/ML models to analyse ingredient patterns and user data.	Improved user experience with custom recipes.	Needs more dietary customization and recipe diversity.
Recipe Generator using Deep Learning	Disha Moolya et al. (May 2022) (IJRASET)	Deep learning for recipe generation and hyperparameter tuning.	Better user interaction and feature-rich generation.	Requires more accurate text generation and search filters.
ChefAI.IN: Indian Recipe Generation	Smriti Chaudhary et al. (Oct2022) (IEEE)	Evolutionary AI model for Indian recipes.	High user acceptance for generated Indian recipes.	Limited to Indian cuisine, needs scalability.
Food Image-Based Recipe Generation	Tejas D & Varun C M (Feb 2024) (IJARSCT)	Image-to-recipe generation via AI/ML techniques.	Useful for home cooks and restaurants.	Accuracy and real-time platform integration issues.
Prompt Optimization for Recipe Generation	Aadya Jha (Nov 2024) (IJRASET)	AI-based recipe generation with ingredient filtering.	Customization for dietary preferences and ingredients.	Needs refinement in flavour profiles and regional diversity.
Smart Cuisine: Nutrition and Recipe Assistance	Ponrawin Kansaksiri et al. (Oct 2023) (ELSEVIER)	AI-generated recipes with nutrition and sustainability tips.	Promotes sustainable cooking and reduces food waste.	Needs more dietary restriction integration.
FIRE: Food Image to Recipe	Prateek Chhikara et al. (Feb 2023) (ResearchGate)	Food title and recipe generation from images.	Accurate image-to-recipe generation.	Limited to food images; customization needs work.
NutriNet: Food Image Recognition	Simon Mezgec & Barbara Koroušić Seljak (June 2017) (ResearchGate)	Deep CNN for food image recognition in dietary assessment.	High classification accuracy.	Needs real-time recognition and broader dataset integration.
Personalized Food Image Classifier	Shota Horiguchi et al. (Aug 2015) (ReseachGate)	Personalization for food image recognition through incremental learning.	Adapts to user preferences over time.	Needs better domain adaptation and scalability.

Proposed Work:

The development of the AI-driven recipe generator follows a structured process, starting with research and development through literature reviews and user surveys to understand user needs. In the system design phase, the architecture is planned, and intuitive UI/UX designs are created. Data collection involves building a diverse recipe database while allowing users to input preferences and available ingredients.

Algorithm development focuses on machine learning models for personalized recommendations and nutritional analysis. A prototype is developed and tested with users for feedback, leading to iterative improvements based on insights gathered. Once refined, the system is deployed on web and mobile platforms, supported by a targeted marketing strategy. Post-launch support ensures ongoing user assistance and regular updates. Success is measured by evaluation metrics like user engagement and the system's impact on cooking habits and health outcomes.

1.Data Collection and Preparation:

Recipe Database: Create a comprehensive database of recipes in multiple languages, including ingredients, instructions, and nutritional information.

Ingredient Database: Create a database of ingredients with their attributes (e.g., type, flavor profile, nutritional value).

Language Data: Collect language-specific data for recipe translation and generation.

2. NLP Model Development:

Ingredient Analysis: Develop a model to analyze ingredients, extract quantities, and understand relationships between ingredients.

Language Processing: Develop models for language translation and text generation in Hindi, Marathi, and English.

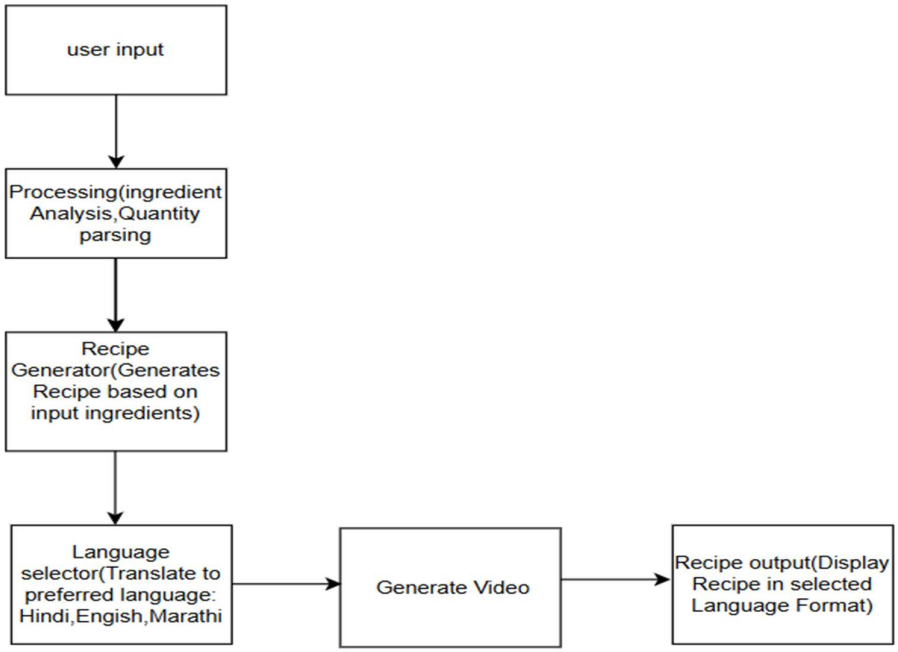

Fig. Block Diagram

3. Backend Architecture

Database:

A robust database (e.g., PostgreSQL, MongoDB) to store recipes, user preferences, and feedback.

API Integration:

Connect to external recipe APIs for expanding recipe options dynamically.

AI Model Hosting:

Use frameworks like TensorFlow Serving, PyTorch Serve, or APIs like Hugging Face for deploying ML models.

4. Frontend Interface

User Dashboard:

Provide a clean and intuitive interface for recipe search, recommendations, and cooking steps.

Filters:

Allow filtering recipes by cuisine, dietary preferences, ingredients, preparation time, etc.

Interactive Cooking Assistant:

Step-by-step cooking instructions with timers, tips, and real-time guidance.

5. Personalization

User Profile Management:

Enable users to set dietary preferences, allergens, favorite cuisines, and disliked ingredients.

Meal Planning:

Offer weekly meal plans based on user preferences and nutritional needs.

Feedback Mechanism:

Collect user feedback on recipes for improving recommendations.

Conclusion:

In conclusion, the development of AI-based recipe generators holds significant promise for revolutionizing the way people discover, prepare and enjoy food. Through advanced algorithms and machine learning techniques, these systems can offer personalized recipe recommendations, assist users in meal planning and grocery shopping and provide step-by-step guidance during the cooking process.

However, while AI-powered culinary assistants offer exciting opportunities, several challenges and considerations must be addressed. These include ensuring the accuracy and reliability of recipe recommendations, accommodating diverse dietary preferences and restrictions and maintaining user privacy and data security.

Moreover, the success of AI-based recipe generators ultimately depends on their ability to enhance the overall cooking experience for users. This involves not only providing practical assistance but also fostering creativity, exploration and enjoyment in the kitchen.

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