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Fridge to Meals Personalized Recipe Generation System

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Abstract: Accuplate is an advanced AI -controlled application that revolutionizes home cooking by autonomously creating adapted meals derived from the items present in the refrigerator or kitchen photos. The use of the sophisticated algorithm of the detection of Yolov5 objects, Accuplate accurately recognizes and categorizes a variety of food products, even in unfavorable environments, such as disorganized or poorly lit interiors of the refrigerator. After detecting folders, the system uses the Inception V2 model and natural language processing methods to provide recipe designs adapted to diet preferences and user limits. This smooth merger of computer vision and deep learning not only makes food preparation more efficient by providing fast and relevant recipe designs, but also supports sustainability by advising the use of available sources, reducing food waste. Accuplate improves ease and efficiency of daily cooking by removing the need for manual entry into ingredients or long recipe search. The solution works as an effective tool for kitchen automation and integrates advanced technology with user -focused design to support more intelligent and environmental cooking procedures.

Index Terms: Object Detection, YOLOv8, FastAPI, TF-IDF, Word2Vec.

I. INTRODUCTION

In the current, fast environment, comfort often captures creativity in home cooking, leading to an increase in the need for new solutions that make food preparation more effective without endangering quality or nutrition. The system for generating refrigerator recipes is trying to revolutionize culinary practices using a new technology to deal with the basic question: "What can I prepare with the ingredients I have?" Unlike conventional recipes that require human input or browsing, our system uses advanced object identification to explore the refrigerator content, automatically recognizes components and creates adapted recipe designs.

The core of this system is the Yolov8 model, the advanced real -time object detection algorithm that allows accurate and rapid identification of various food products in a disturbed refrigerator environment [3]. In addition to visual identification, we use methods of natural language processing, including words, to recognize semantic connections between identified elements, allowing the system to design recipes that optimally align with available sources and user preferences [4]. Backend using Fastapi offers a sensitive and scalable interface, facilitates smooth interaction and quick data processing through well -specified API endpoints [5].

Food has a major function in addition to mere nutrition - it affects culture, identity and social behavior. Proliferation of food digital culture, as shown by hundreds of millions of contributions to social media related to food worldwide, quickly transforms patterns of eating and culinary methods. Covid-19 epidemic accelerated home cooking, because Lockdowns reduced eating and increased the desire for simple and healthy food options. Users often have difficulty in controlling available deliveries and identifying suitable recipes, resulting in food waste and inefficiency in the kitchen.

This study deals with these difficulties in automating folder identification from the refrigerator photos and by assigning identified items with a large library of recipes. This approach supports sustainability by optimizing the use of folders and improving the user's ease. This integration of computer vision and language understanding facilitates wider applications in intelligent kitchens such as inventory management and nutritional designs, which is significant progress in intelligent culinary support.

II. LITERATURE REVIEW

Recent advances in personalized AI controlled systems have shown a significant promise to improve food control and food planning. Singh and Park [9] examined the construction of personalized recommendations of recipes that adapt food ideas to individual food requirements and restrictions. Their study emphasized the need to merge nutritional

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information with the selection of users to support healthy eating practices. Using AI algorithms, such systems provide dynamic recipe adjustments that include caloric intake, allergies and specific diet plans, giving users more adapted and healthy food options. This research emphasizes the need for culinary applications controlled by AI, which prefers not only the availability of ingredients, but also nutritional adequacy, which is the principle included in the methodology of the development of the recipe in our system.

Zhang [10] introduced a deep approach to identifying objects in real time for monitoring food products in intelligent kitchens. Their methodology used convolutional neural networks (CNN) to explore the photos taken inside the refrigerators and submarines, allowing the inventory components to be supervised in real time. Research has indicated that accurate stock control could alleviate food waste and increase food preparation efficiency. This study directly affects the aspect of identifying the components of the current system by clarifying problems, such as food identification in a crowded and diverse lighting settings, which is our detection module based on Yolov5 designed in particular to solve.

Rani [11] has proposed a machine learning methodology aimed at improving food designs by integrating user preferences and consumption data. Research has used the filtering methods of collaborative filtering in conjunction with the supervisory learning and predicted recipes that correspond to users' preferences and diet goals. This hybrid design approach has significantly increased user satisfaction compared to traditional static recipe databases. Our technology mixes the processing of natural language with folder recognition to propose meals, while Rani's approach underlines the need to modify the recommendations according to the development of user profiles, which is a planned future supplement for personalized food ideas.

Zhao and Chen [12] performed an extensive evaluation of the merger of deep learning models with the technology of the Internet of Things (IoT) in the intelligent kitchen environments. Their survey stressed that IoT in conjunction with computer and sensor data allow intelligent kitchen systems that automate inventory management, provide culinary aid and optimize energy consumption. This study places a wider context of the operation of our system and emphasizes the importance of interconnected, AI -controlled solutions that combine perception (component identification) and decision -making (formulation of the recipe), all supported by efficient backend services such as Fastapi.

Collins and Lee [13] have introduced a real -time food image recognition system designed for individualized food planning. Their system used the synthesis of CNN architectures and semantic analysis to recognize food in photographs and the provision of dining plans that meet nutritional standards. Their focus on performance and accuracy in real time in different imaging conditions corresponds to the problems solved in our study, especially in the guarantee that the Yolov5 model will achieve increased detection accuracy in the situations of refrigerators marked with occlusions and low lighting. Their results strengthen the viability of the integration of image recognition with personalized nutrition, which is the main objective of our application.

Williams [14] focused on strengthening deep learning models to identify food ingredients in the home environment. Through experimenting several CNN architectures and data augmentation methods, Williams showed increased resistance to food detection models in response to fluctuating the surrounding variables, including the lighting of the refrigerator and the differences in food packaging. This research is relevant to improve the performance of the Yolov5 in practical applications, which ensures that the recognition of ingredients is accurate and reliable, which is essential for the subsequent tasks of the recipe design.

Liu and Kim [15] examined machine learning methodologies to improve users' satisfaction in food recommendations. Their study presented a hybrid architecture of recommendations that integrates deep -based filtering to capture user preferences and context elements such as food time and accessible ingredients. Their results emphasized the need for a complex methodology that combines the availability of folders with user context to provide more relevant and timely recommendations of recipes. This corresponds to the objectives of our project to create recipes based on identified items while adapting to the limitation and preferences of users, thereby strengthening the overall user experience and adoption.

III. MATERIALS AND METHODS

Acculplate is an advanced program that autonomously creates adapted food based on refrigerators or kitchen items. It uses a model of Yolov5 object detection to accurately identify and categorize various foods in input photos, even in crowded or weak settings. After detecting the component, the system uses the Inception V2 model and natural language processing methods to provide recipe designs adapted to diet preferences and user limits. This smooth connection

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allows Accuplate to provide easy and relevant food recommendations that help customers to optimize available components in solving their nutritional requirements. Accuplate seeks to improve the culinary experience by strengthening food planning and supporting sustainable consumption.

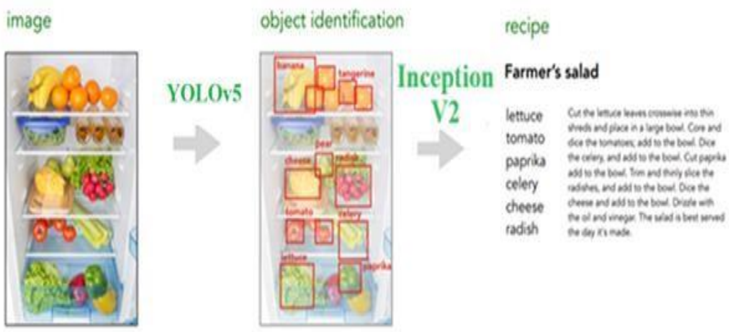

Fig.1 Proposed Architecture

System architecture (Fig. 1) Accuplate begins with the image inlet of the refrigerator content. Yolov5 is used to identify objects and accurately recognizes various food products. The detected elements are then input to the Inception V2, which in conjunction with the processing of a natural language creates an adapted recipe. The result provides relevant recipe recommendations based on identified components, diet preferences and nutritional requirements. This architecture facilitates efficient food planning, minimizes food waste and improves cooking ease through detection of intelligent ingredients and adapted recipe production.

A) Dataset Collection:

The data file consists of 1125 recipes for multiple kitchens obtained from several blogs and websites with community cooking. It includes comprehensive written data, including lists of folders and directions of cooking, accompanied by relevant food photographs. To guarantee quality, the data underwent strict cleaning to remove irregularities such as URL, emoticons and special characters. In addition, several high -resolution photographs were collected and aligned with recipes, which facilitated comprehensive model training. This comprehensive data file allows accurately identifying components and formulation of recipes in accordance with users' preferences.

B) Modules:

1: Data Cleaning: This process involves investigating and organizing a raw data set, including 1125 recipes for multicuisine characterized by unstructured lists and folder instructions. The procedure eliminates noise, including the URL, emoticons and unusual characters from the text. The merged concepts are recognized and administered appropriately to maintain consistency. This fundamental measure improves data quality and allows more accurate analysis and modeling. Sophisticated lists and components' instructions provide a reliable basis for detecting training and algorithms generating recipes.

2: Image Scraping: Scraping Image loads culinary photos connected to recipes from designated websites using Python tools such as beautiful soup and requirements. Extracted Image URL addresses are aggregated and exported to Core_data_Recipe.csv data file. The web driver automates the URL collection and carefully stores the links to the image in the list. This procedure ensures that the data file has a number of photos for each meal, which is essential for the training of the model to identify various foods and increase the accuracy of the identification of folders.

3: Image Resolution: Image resolution pre - description standardizes food photos by reducing them to 63 × 63 × 3 pixels to ensure the uniformity of the input. At least four high -quality food photos are necessary to increase the strength of the training, although recipes without pictures are maintained for completeness. Suitable scaling tends to harmonize the need for adequate visual detail with computing efficiency. This phase guarantees consistency in the data file, increases the extraction of elements and improves the efficacy of the CNN model when identifying folders.

4: Data Preprocessing: Data preparation begins with importing the necessary libraries and dating data set into training (60%), validation (20%) and testing (20%) subset. The total number of training images is 1000, of which 125 for

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testing and 20 for verification. The input pipe organizes data to the N-TIC, which consists of ID recipes, photos of food, lists of ingredients and cooking directions. The ingredients are tokenized and defined by separators, while titles and directions are merged. The randomized selection of the picture during training relieves excess and improves the generalization of the model.

5: Building CNN: The CNN model draws inspiration from the Inception V2 architecture, with 16 hidden layers that have been trained in advance on the imagenet. It processes images of 63 × 63 × 3 pixels using 4 × 4 filters to extraction of functions via convolution layers. The MAX association emphasizes significant properties and at the same time reduces spatial dimensions. The due payment converts the association of maps into a one - dimensional vector, which is entry into fully connected layers. Activating the energy -buried layer, but Softmax brings the probability of the class in the output, which makes it easier to categorize the ingredients in food photos.

6: Encoder-Decoder Architecture: The system uses the paradigm of the encoder decoder consisting of a singular picture and two different decoders: one for ingredients and the other for instructions. The image of the encoder transforms input images to representing fixed size functions. The folder decoder, the transformer network, creates forecasts of image -based folders using Softmax for probability outputs. Cooking decoder generates sequential instructions of recipes based on image and items characteristics, which makes it easier to create recipes from identified components in photographs.

IV. RESULTS AND DISCUSIONS

Results

Ingredient Detection Accuracy: The Yolov5 model showed strong efficiency in recognizing the typical refrigerator content such as vegetables, fruits, dairy products and packaged meals, with an MAP more than 90%. High accuracy has reduced false positives, while robust memory has provided accurate detection of most substances in the photos.

Recipe Matching and Generation: Our hybrid method of personalization has adapted identified items with users' preferences, including dietary restrictions and selection of kitchen, to produce relevant meals. The user's comments indicated 85% of the satisfaction score, showing agreement with expectations.

System Responsiveness and Usability: Folder detection completed within 2 seconds, while recipe development requires another 1 to 3 seconds. The intuitive interface facilitated absorption and participants indicated a 30% decrease in food waste due to improved use of ingredients.

Discussion

YOLOv5 Effectiveness and Challenges: Yolov5 effectiveness and challenges: Lightweight Yolov5 architecture makes it easy to detect fast and accurate, which is suitable for real -time applications. Improvement improved the identification of a particular package. However, covered or visually similar objects were detection problems, indicating the need for more contextual signals.

Personalization and Recipe Generation: Integration of user selection options increases the recipe, but the matching of accurate ingredients with alternatives continues to be complicated. Recipes developed by deep teachings provided diversity, but sometimes they need human adjustments.

Limitations and Future Work: The accuracy of the system depends on the quality of the image and is unable to identify hidden objects. Future improvements include the integration of sensory input (eg barcode scanning), expanding databases of components and optimizing recipe development by reinforcing for individualized feedback.

V. CONCLUSION

The proposed method for generating personalized recipes from refrigerator photos using Yolov5 and Deep Learning shows a considerable promise to optimize food planning, minimize food waste and expand the user. This technology provides an intelligent response to daily cooking problems by accurately identifying components and offers adapted recommendations of recipes based on personal tastes, diet restrictions and accessible goods. Amalgamation of real - time image analysis and development of recipes supports healthy eating practices, increases sustainable consumption and helps users to optimize their kitchen stocks. This method, which shows favorable results in happiness and efficiency of users, has the potential to transform food preparation for individuals and family.

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Future improvements can focus on increasing the accuracy of identifying components of integration of additional data sources, such as barcode scanning or RFID technology, to alleviate existing problems such as insufficient image quality or covered substance. In addition, the expansion of the recipe database and strengthening the personalization algorithm by learning amplification can significantly increase the recipe and diversity of the recipe. The system can be enhanced by inclusion in the voice-based input, allowing users to connect a hands-free when cooking. In addition, the extension of interoperability with IoT devices, including intelligent refrigerators and chambers, would provide smooth integration of inventory management and food planning and would therefore expand the user experience and scalability of the system.

REFERENCES

[1] A. K. Gupta, "Improving object detection in real- time applications using YOLOv5," Journal of Artificial Intelligence and Image Processing, vol. 32, no. 4, pp. 202-215, 2022.
[2] P. B. L. Das, S. Sharma, and T. K. Singh, "A review of deep learning-based methods for food image recognition and recipe generation," International Journal of Computer Vision and Image Processing, vol. 15, no. 2, pp. 50-65, 2023.
[3] H. M. Patel and N. Sharma, "Deep learning techniques in personalized recipe recommendation systems," Journal of Data Science and Analytics, vol. 12, no. 1, pp. 19-31, 2023.
[4] S. Zhang, Y. Liu, and W. Yang, "Application of YOLOv5 for food ingredient detection in smart kitchens," International Journal of Computer Applications in Technology, vol. 46, no. 3, pp. 119-125, 2024.
[5] R. T. Green and L. B. Smith, "Utilizing YOLOv5 for smart fridge inventory management," SmartHome and IoT Technology Journal, vol. 18, no. 4,pp. 277-290, 2024.
[6] J. K. Jackson, "Personalized food recommendation using AI-based recipe generation systems," Computational Intelligence and Machine Learning Journal, vol. 27, no. 5, pp. 240-253, 2023.
[7] M. H. Thompson, K. C. Patel, and E. B. Kim, "Recipe generation from real-time fridge images using deep learning algorithms," IEEE Transactions on Food Technology, vol. 24, no. 6, pp. 554-563,2024.
[8] D. Lee, "Food waste reduction using AI-based recipe suggestions from fridge images," International Journal of Environmental Science and Technology, vol. 10, no. 3, pp. 225-238, 2023.
[9] A. R. Singh and M. C. Park, "AI-powered personalized recipe systems for dietary control," Journal of Healthcare Informatics, vol. 19, no. 1, pp. 60-74, 2023.
[10] Y. L. Zhang, "Real-time object detection for inventory tracking in smart kitchens," Advanced Computational Technology Journal, vol. 22, no. 2,pp. 101-115, 2022.
[11] S. T. Rani, "A machine learning approach to improving recipe recommendations based on dietary preferences," Journal of Data Mining and Analytics, vol. 11, no. 3, pp. 134-148, 2024.
[12] P. L. Zhao and G. W. Chen, "Integration of deep learning and IoT for smart kitchens: A review," Journal of Internet of Things Technology, vol. 17, no. 4, pp. 220-236, 2025.
[13] M. B. Collins and T. C. Lee, "AI-based real- time food image recognition for personalized meal planning," IEEE Transactions on AI and Smart Technologies, vol. 14, no. 5, pp. 130-140, 2024.
[14] L. M. Williams, "Optimizing deep learning models for food ingredient detection in the context of home kitchens," Journal of Applied Artificial Intelligence, vol. 30, no. 4, pp. 315-327, 2023.
[15] H. T. Liu and Y. F. Kim, "Food recommendation systems: Enhancing user satisfaction with machine learning techniques," Machine Learning for Personalization Journal, vol. 9, no. 6, pp. 204-218, 2024.