AI-Based Food Product Analysis and Healthy Alternative Recommendation System

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Abstract — Choosing healthy food products has become difficult because many packaged food items contain high amounts of sugar, salt and saturated fat. Although nutritional information is printed on product packaging, many consumers find it difficult to understand these details and compare different products. This project presents an AI-Based Food Product Analysis and Healthy Alternative Recommendation System that helps users understand the nutritional value of packaged food products. The system allows users to scan a product barcode or enter the barcode number manually. It uses the Pyzbar library to read the barcode and retrieves product information through the Open Food Facts API. The retrieved information includes the product name, ingredients, nutritional values and allergens. The system then checks the nutritional information using predefined rules and classifies the product as Suitable, Occasionally or Avoid. It also suggests alternative products from a similar category when better options are available. The main aim of this project is to make food product information easier to understand and help consumers make better food choices. The system provides a simple way to check packaged food products without manually reading and comparing every detail on the label.

Keywords: Food Analysis, Barcode Scanning, Nutrition Analysis, Healthy Food Recommendation, Python

I. INTRODUCTION

Food plays an important role in maintaining a healthy lifestyle. However, people often purchase packaged food products without checking their nutritional information properly. Many products contain high amounts of sugar, sodium and saturated fat, which may affect health when consumed frequently.

Food packaging usually contains information about ingredients, calories, nutrients and allergens. However, this information is not always easy for consumers to understand. Comparing different products also takes time, especially when there are many options available in the market.

Recent developments in Artificial Intelligence (AI) and recommendation systems have created new ways to help people make better food choices. These technologies can analyse food-related information and provide suggestions based on different nutritional factors.

The research papers considered in this project discuss different methods used in food recognition, nutritional analysis and food recommendation. They show how technology can be used to understand food information and suggest suitable options to users.

Based on these studies, this project develops a simple system that uses barcode scanning to identify packaged food products. It retrieves their nutritional information from an online database, analyses the available details and provides a result that is easier for users to understand. It also recommends alternative products with more favourable nutritional values.

The system is designed to make nutritional information more accessible and reduce the effort required to compare packaged food products.

II. LITERATURE REVIEW

Several research studies have explored the use of Artificial Intelligence and recommendation systems in the food and nutrition domain. The following papers were studied to understand the existing approaches and identify ideas relevant to the proposed project.

A Survey on AI Nutrition Recommender Systems (2019) presented an overview of different methods used in AI-based nutrition recommendation systems. Their study explains how food recognition, ingredient identification and food quantity estimation can be used to understand food intake. It also discusses how automated systems can analyse food information and provide recommendations based on user needs.

This paper helped in understanding the different stages involved in food analysis and recommendation systems.

Systematic Review of Nutritional Recommendation Systems (2021) studied different nutritional recommendation systems and the technologies used in them. Their review found that collaborative filtering was commonly used in the selected studies. The authors also highlighted problems related to incomplete food information, inaccurate nutritional calculations and a lack of properly described datasets.

The study shows the importance of using reliable nutritional information when developing a food recommendation system.

A Systematic Review on Food Recommender Systems (2024) reviewed 67 studies related to food recommendation systems. Their research identified different recommendation approaches, including content-based filtering, graph-based methods, collaborative filtering and hybrid methods.

The study found that content-based filtering was used in 52.1% of the reviewed systems, while machine learning was used in 64.79% of the systems. It also discussed the importance of food-related features, including nutritional values, when generating recommendations.

This paper helped in understanding how food products can be compared using their features and how recommendations can be generated.

A Comprehensive Review of AI for Food Recognition and Nutrient Estimation with an Obese Children Perspective (2026) reviewed the use of AI in food recognition and nutrient estimation. Their study discussed techniques such as food recognition, image segmentation, portion estimation and nutrient mapping.

The authors also explained that food analysis systems may face difficulties because of poor image quality, different food types and errors in nutritional estimation. They

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highlighted the importance of reliable data and proper testing in real-world conditions.

Although this paper mainly focuses on image-based food analysis rather than barcode scanning, it provides useful information about the challenges involved in identifying food and estimating its nutritional value.

III. Problem Statement

Consumers often find it difficult to understand the nutritional information printed on packaged food products. Important details such as sugar, sodium, saturated fat and allergens may be overlooked while purchasing food items.

Manually checking and comparing the nutritional values of different products can also be time-consuming. Consumers may not always know whether a product is a suitable choice or whether a better alternative is available.

Therefore, there is a need for a simple system that can identify packaged food products, retrieve their nutritional information, analyse the available details and suggest better alternatives. The proposed system aims to solve this problem by using barcode scanning and automated nutritional analysis.

IV. Objectives

The main objectives of the project are:

1) To develop a simple system for analysing packaged food products.
2) To identify food products using barcode scanning or manual barcode entry.
3) To retrieve product details and nutritional information from the food product database.
4) To identify ingredients and allergens present in the product.
5) To classify products into Suitable, Occasionally or Avoid categories.
6) To recommend alternative products with more favourable nutritional values.
7) To help consumers understand food labels and make informed purchasing decisions.

V. Proposed Methodology

The proposed system follows a step-by-step process to identify food products and analyse their nutritional information.

A. User Input

The user can either scan the barcode of a packaged food product or enter the barcode number manually through the application.

B. Barcode Detection

The Pyzbar library is used to read the barcode from the uploaded image. It extracts the barcode number, which acts as a unique product identifier.

C. Product Information Retrieval

The extracted barcode number is sent to the database or the Open Food Facts API. The API is used to retrieve available product details such as product name, ingredients, nutritional values and allergens.

D. Data Processing

The retrieved information is processed using Python. The system checks the available nutritional details and prepares them for analysis.

E. Nutritional Analysis

The system checks important nutritional values, including sugar, sodium and saturated fat. It also checks ingredient information and allergens using predefined conditions.

F. Product Classification

Based on the nutritional checks, the product is placed into one of three categories:

- Suitable: The product meets the system's defined nutritional conditions.
- Occasionally: The product has one or more nutritional values that should be consumed in moderation.
- Avoid: The product has nutritional or ingredient-related concerns according to the system's predefined rules.

G. Alternative Recommendation

The system searches for products belonging to a similar category and compares their available nutritional information. It then displays alternative products that have more favourable nutritional values.

H. Display Results

Finally, the application displays the product information, nutritional analysis, suitability result and available alternative recommendations to the user.

VI. System Architecture

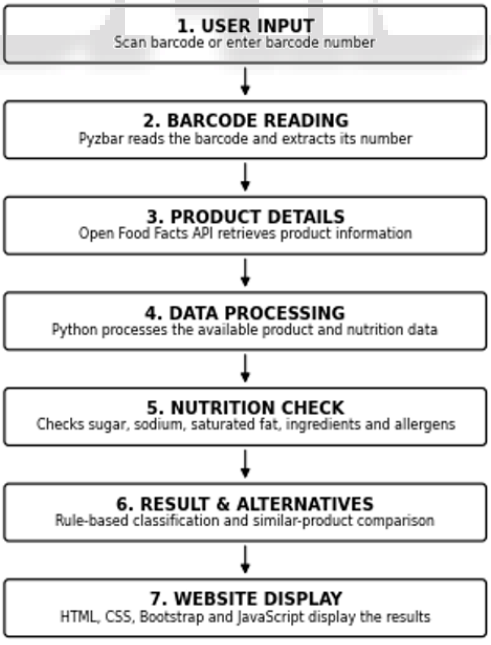


Fig. 1: System Architecture of the Proposed Food Product Analysis and Recommendation System.

VII. Implementation

The system was developed using a combination of programming languages and web technologies. HTML, CSS and Bootstrap are used to create the website layout and make

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the application easy to use. JavaScript is used to handle user interactions, while Java is used for backend operations. Python is used for barcode reading and nutritional data analysis. MySQL is used to store and manage product-related information.

The application allows users to scan a product barcode or enter its number manually. When a barcode image is provided, the Pyzbar library reads it and extracts the barcode number. This number is then used to retrieve the product information through the Open Food Facts API.

After retrieving the details, the system processes the available nutritional information, including sugar, sodium and saturated fat. It also checks the ingredients and allergen details wherever the information is available.

The system uses predefined conditions to analyse the nutritional values and classify the product into three categories: Suitable, Occasionally or Avoid.

It also compares the scanned product with other products from a similar category. Based on the available nutritional information, the system suggests alternative products that have more favourable nutritional values.

Finally, the product details, nutritional analysis, suitability result and alternative suggestions are displayed on the website.

VIII. Results

The developed system provides a convenient way to check the nutritional information of packaged food products. Instead of manually searching for product details and comparing labels, users can enter or scan a barcode to view the available information.

The developed system provides a convenient way to check the nutritional information of packaged food products. Instead of manually searching for product details and comparing labels, users can enter or scan a barcode to view the available information.

The main functions of the system include:

1) Accepting barcode images and manually entered barcode numbers.
2) Identifying products using their barcode numbers.
3) Retrieving product details through the Open Food Facts API.
4) Checking nutritional values, ingredients and allergens.
5) Classifying products as Suitable, Occasionally or Avoid.
6) Displaying alternative products with more favourable nutritional values.

The system presents the results through a web-based interface developed using HTML, CSS, Bootstrap and JavaScript.

The project shows how different technologies can work together to simplify the process of checking packaged food products and comparing their nutritional information.

However, the results depend on the availability and accuracy of product information in the Open Food Facts database. If a product is not listed or its nutritional details are incomplete, the system may not provide a complete analysis or alternative suggestions.

The current nutritional classification is based on predefined rules. Therefore, the results are intended to provide general food information and should not be considered medical or professional dietary advice.

IX. Conclusion

The AI-Based Food Product Analysis and Healthy Alternative Recommendation System was developed to make it easier for consumers to understand the nutritional information of packaged food products.

The system identifies products using barcode scanning, retrieves their details through the Open Food Facts API and checks their nutritional values. Based on the analysis, it provides a suitability result and suggests alternative products with more favourable nutritional values.

The project combines different technologies, including Java, Python, JavaScript, MySQL, HTML, CSS and Bootstrap, to develop a web-based application.

Overall, the system provides a simple approach to checking food products and comparing their nutritional information. It can help users become more aware of the products they purchase and make better-informed food choices.

X. Future scope

The system can be improved further by adding the following features:

1) Machine Learning Integration: Machine learning algorithms can be introduced to improve nutritional analysis and product recommendations.
2) Larger Product Database: More Indian packaged food products can be added to improve product coverage.
3) OCR Technology**:** OCR can be included to read nutritional information directly from product packaging when barcode details are unavailable.
4) Personalised Recommendations: Recommendations can be provided based on users' food preferences and dietary requirements.
5) Improved Product Comparison: More nutritional factors can be considered while comparing products and suggesting alternatives.
6) Mobile Application: The website can be developed into a mobile application for easier use while shopping.
7) Better Database Management: The product database can be expanded and regularly updated to provide more complete information.

These improvements can make the system more useful and help users make better food choices.

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