Real-Time Allergen Detection Application Using Barcode/QR Scanning.

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Abstract

In today's fast-moving lifestyle, people often buy packaged foods without checking their nutritional content, which leads to unhealthy eating patterns. To solve this problem, this project introduces a Smart Nutrition Scanner Application that allows users to instantly access nutritional information using their mobile camera.

The system is built using JavaScript (frontend) and Node.js (backend), and it connects to public nutrition databases through APIs to retrieve details like calories, macronutrients, vitamins, and ingredients. It supports real-time barcode scanning using Optical Barcode Recognition (OBR) as well as image-based food identification using CNN models when no barcode is available. Features such as allergen alerts, dietary warnings, scan history, and healthier alternatives make the application more user-friendly.

By capturing images, recognizing barcodes, and querying nutrition datasets, the app provides quick, accurate, and convenient food information. This system helps users make informed dietary decisions, improves health awareness, and can be expanded to fit future digital health and diet-tracking platforms.

Keywords —

Smart food scanner, barcode recognition, nutrition tracking, mobile health application, Open Food Facts, API integration, optical barcode recognition (OBR), dietary awareness, food informatics.

I. Introduction

In today's modern lifestyle, packaged and processed foods are widely consumed because they are convenient, affordable, and easily available. However, many people do not read or understand nutrition labels, as they are printed in small fonts with technical terms. This lack of awareness often results in poor food choices and contributes to lifestyle diseases such as obesity, diabetes, and heart problems. Searching for nutritional information manually also takes time, especially for busy individuals.

To overcome these issues, the project "Smart Food Nutrition Scanner using Barcode Recognition" offers a fast and accurate way to access nutritional details through a smartphone camera. By scanning a barcode, the system retrieves complete nutrition data from online databases using APIs. It combines mobile computing, Optical Barcode Recognition (OBR), and real-time data processing to deliver instant and reliable results.

This technology eliminates manual effort, helps users understand what they eat, and supports healthier decision-making. The system can also be expanded with features such as calorie tracking, allergen alerts, and personalized diet suggestions. Overall, this project promotes better dietary awareness and encourages healthier eating habits through smart mobile technology.

II. Literature Review

To understand the current state of research in barcode-based nutrition tracking, three relevant studies were reviewed:

K. T. Nguyen et al., 2021 — "Food Recognition and Nutrition Estimation using Deep Learning"
Nguyen et al. developed a deep learning-based food recognition model capable of estimating nutritional values from images. Although their work focused on image-based detection rather than barcode scanning, it highlighted the importance of automated nutrition calculation. They used the Food-101 dataset and demonstrated over 85% accuracy in identifying food categories. This research influenced our approach by emphasizing automation in nutrition awareness tools.

A. Popescu et al., 2020 — "Barcode-Based Mobile Nutrition Tracking System"
Popescu et al. created a mobile app that used barcode scanning to retrieve nutritional data from an online database. Their research demonstrated how barcode scanning significantly reduced input time for users compared to manual search. They used the Open Food Facts dataset and implemented an Android-based application. While the project was effective, it lacked features like dietary recommendation or multi-language support, which our system aims to improve.

R. Singh et al., 2019 — "Nutrition Information Retrieval from Food Databases"
Singh et al. focused on retrieving nutrition data from multiple online sources to provide a unified display of nutrient information. Their system relied heavily on API-based integration with USDA and Open Food Facts datasets. They demonstrated the potential of real-time retrieval but faced limitations due to inconsistent data formats. Our proposed work adopts a similar API approach but adds a pre-processing step for standardizing nutritional information.

III. Methodology

The proposed system follows a structured pipeline that integrates mobile device image capture, barcode recognition algorithms, and nutritional database queries to provide users with instant, accurate, and personalized nutrition information. The methodology is divided into the following stages:

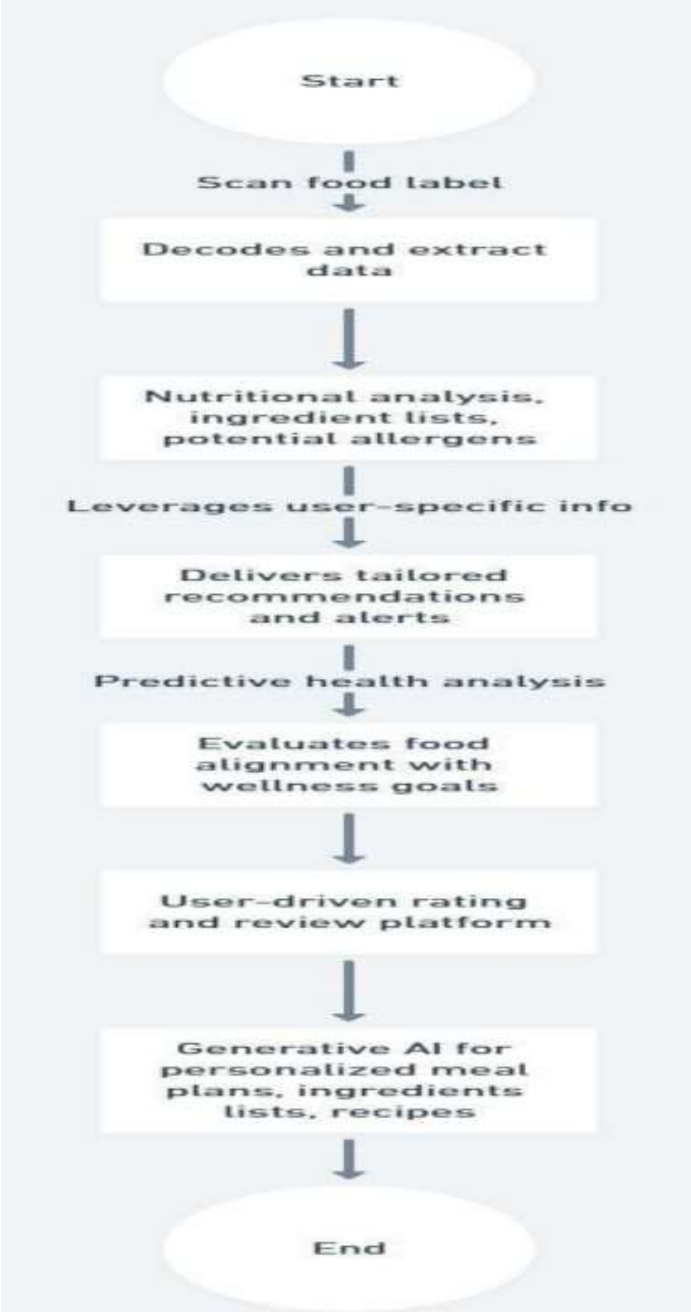
1. Image Capture and Pre-processing

The system uses the smartphone's built-in camera to capture an image of the food product's barcode. To ensure high accuracy in barcode detection:

Auto-focus and lighting adjustment features are activated.

- Images undergo pre-processing techniques, such as *grayscale conversion*, *contrast enhancement*, and *noise reduction* to improve barcode visibility.

This step is crucial because poor lighting or camera blur can reduce decoding accuracy.



2. Barcode Detection and Recognition

The system applies Optical Barcode Recognition (OBR) methods, such as Zebra Crossing (ZXing) or Google ML Kit Barcode API, to detect and decode barcodes.

Supports multiple barcode formats (EAN-13, UPC-A, QR codes).

Decoding is performed on-device for speed and privacy. The decoded barcode number acts as a unique product identifier.

3. Database Query and API Integration

The decoded barcode is sent to an external nutrition database API such as Open Food Facts, USDA FoodData Central, or similar.

- The API returns product metadata: *name, brand, serving size, calories, carbohydrates, proteins, fats, vitamins, and ingredients list*.
- Data is returned in JSON format, which is parsed by the mobile app.

4. Nutritional Analysis and Display

The app processes the retrieved nutritional data to:

- Display per-serving nutritional breakdown in a user-friendly format.
- Highlight high-sugar, high-fat, or allergen ingredients.
- Optionally calculate Daily Value (%DV) based on recommended dietary allowances.

5. User Interaction and Personalization

Users can:

- Save scanned products to a personal logbook.
- Receive dietary recommendations based on age, gender, and health goals.
- Compare multiple products for healthier alternatives.

ALGORITHM:

In the development of the NutriScan application, several algorithms will be employed to enhance functionality and user experience. The key algorithms are

1. Barcode Scanning Algorithm

Libraries Used: ZXing or ML Kit.

Functionality: Utilizes image processing techniques to detect and decode barcodes quickly and accurately.

2. Nutritional Analysis Algorithms

Data Retrieval: APIs like Edamam or Open Food Facts will provide nutritional data.

Nutritional Calculation: Algorithms to analyze daily intake based on user entries, calculating macronutrient and micronutrient consumption against recommended daily allowances.

3. Rating System Algorithm

Weighted Average Calculation: Combines individual ratings to produce an aggregated score, factoring in the number of reviews and their distribution. This ensures that more frequently reviewed products have a more reliable rating.

4. Personalization Algorithms

Machine Learning Techniques: Algorithms that analyse user behaviour, preferences, and dietary habits to generate tailored recommendations. Techniques such as collaborative filtering or clustering may be used to

identify similar user patterns.

5. Food Intake Tracking Algorithm

Log Management: Algorithms that track and summarize daily food intake, helping users visualize their consumption patterns over time.

6. Sentiment Analysis Algorithm

Natural Language Processing (NLP): Analyses user reviews to determine overall sentiment towards products, providing insights into user experiences and satisfaction.

These algorithms collectively enhance NutriScan's functionality, making it a robust tool for users seeking personalized dietary management.

IV. Problem Statement

Consumers often struggle to understand nutritional information on food labels, leading to uninformed dietary choices. Existing mobile applications provide basic features like barcode scanning and nutritional data but often lack comprehensive analysis, personalized recommendations, and user-friendly designs. This project,
"NutriScan," addresses these gaps by offering an intuitive app that delivers detailed nutritional insights, tracks food intake, and incorporates a community-driven rating system. By empowering users with accessible and 17*Nutriscan: Nutritional Analyst and Personalized Health Companion* actionable dietary information, NutriScan aims to promote healthier eating habits and improve overall well being, ultimately helping users make informed food choices more easily.

V. Modules Overview

This application requires a sophisticated, multi-module architecture that integrates real-time image processing (Computer Vision) with a robust nutritional data system.

Here is a comprehensive overview of the key modules for a Nutrition Scanner Application for Real-Time Food Analysis and Healthy Decision Making.

Core Analysis Module (The Scanner) :

Image Capture & Pre-processing:

Captures food image or video stream from the user's camera.

Normalizes the image (adjusts lighting, contrast) for accurate analysis.

Food Recognition (Computer Vision):

Uses Deep Learning Models (like YOLO or CNNs) to detect and classify individual food items on a plate or within a package.

Outputs a list of identified foods (e.g., "chicken breast," "broccoli," "white rice").

Volume/Portion Estimation:

Calculates the approximate volume or weight of the recognized food items. This often requires the user to place a known-size reference object (like a coin) next to the food or uses depth/AI analysis.

Data Retrieval & Calculation:

Takes the recognized food item and its estimated portion size.

Queries the Nutrition Database Module (see below) to retrieve precise nutritional data (Calories, Macros, Micros, etc.).

Calculates the total nutritional breakdown for the entire meal in real-time.

Nutrition Database:

A vast, searchable database containing nutritional information for a wide variety of foods (raw ingredients, prepared meals, and packaged products). Sources like the USDA or commercial APIs are often used.

User Profile Database:

Stores the user's personal health parameters: Age, Gender, Height, Weight, Activity Level, Health Goals (e.g., weight loss, muscle gain), and Dietary Restrictions (e.g., Keto, Vegan, Gluten-Free, Allergens).

VI. Results And Analysis

1. Login Page :

This screen is the entry point for users.

- **Welcome Message:** "Welcome to NutriScan" with a prompt to "Sign in to continue."
- **Sign-In Options:**

Google Integration: A prominent "Continue with Google" button for quick sign-in/sign-up.

  - Standard Sign-In: Fields for Email and Password for traditional login.
- **Action Buttons:**
  - Sign In button.
  - Forgot password? link.
  - Need an account? Sign up link for new users.

2. Navigation Menu

This is a side-drawer or flyout menu that allows users to move between the app's main features.

- **App Header:** Displays the app name, NutriScan and the tagline "Health Scanner."
- **Main Navigation Items:**
  - **Scanner:** Highlighted as the current screen or main feature. This likely refers to the core scanning functionality (e.g., scanning food items or barcodes).
  - **Food Photo**: Suggests a feature for logging food intake via image recognition.
  - **Dashboard:** The main summary and overview of the user's progress.
  - **History**: A record of past scans and activities.
  - **Profile**: Takes the user to the profile screen (like the one shown in the middle panel).

1. Barcode Scan Feature ⚡

This screen describes the functionality for scanning packaged food items.

- **Title: Barcode Scan**
- **Purpose: Scan & Discover**. The text instructs the user to "Point your camera at any barcode to instantly reveal detailed nutrition insights and health scores."
- **Camera Scanner Section:** A descriptive box guiding the user to "Position barcode within the frame for automatic detection."
- **Ready to Scan:** A prompt to "Tap the button below to start your camera and begin scanning product barcodes."
- **Call to Action:** A green button labeled **Start Camera**.

2. Food Image Recognition Feature 📻

This screen describes the functionality for analyzing meals or whole foods using a picture.

- **Title: Food Image**
- **Purpose: Food Recognition**. The text explains, "Take a photo of any food item and get instant AI-powered nutrition analysis."
- **Food Camera Section:** A descriptive box instructing the user to "Capture clear photos of food items for accurate recognition."
- **Ready to Capture:** A prompt to "Position food item clearly in frame for best recognition results."
- **Call to Action:** A purple button labeled **Start Camera**.

3. Health Dashboard / Stats Summary

This screen appears to be the main **Dashboard** or a detailed section of the **Profile** from the previous image, displaying key health statistics.

- **Top Metrics (Repeated from Profile):**
  - **Total Score:** 1
  - **Avg Health Score: 95/100**
  - **This Week:** 1
  - **Health Focus: Strong**
- **Health Scores (Visual Breakdown):**

A prominent **donut chart** visually represents the distribution of Health Scores.

The legend below indicates the score ranges:

Excellent (90-100): Marked in green (which is the majority of the chart, consistent with the 95/100 average).

Good (70-89): Marked in orange.

Poor (0-69): Marked in red.

VII. Conclusion

The Smart Food Nutrition Scanner using Barcode Recognition presents a practical, efficient, and user-friendly approach to enhancing nutritional awareness in today's fast-paced lifestyle. By leveraging mobile camera technology, barcode recognition algorithms, and real-time nutritional database access, the system empowers users to make informed dietary choices instantly.

This project eliminates the need for manual product searches, reducing time and effort while providing accurate and up-to-date nutrition facts. The integration of Optical Barcode Recognition (OBR) ensures high-speed product identification, while API connectivity to databases like Open Food Facts enables global food coverage.

Moreover, the proposed solution is scalable and adaptable. It can be enhanced with features such as OCR-based ingredient scanning, offline barcode databases, and AI-driven diet recommendations tailored to individual health profiles. In addition, the system can integrate allergen detection and nutrition alerts, making it beneficial for people with dietary restrictions such as diabetes, gluten intolerance, or high blood pressure.

In conclusion, the system is not just a technological tool but also a personal health assistant, bridging the gap between convenience and nutrition literacy. With continuous improvement and dataset expansion, this technology has the potential to revolutionize personalized health monitoring and promote healthier lifestyles on a global scale.

VIII. Future Scope

Multi -food Detection: Advanced AI can identify multiple food items on a plate simultaneously for complete meal analysis.

Personalized Diet Plans: Integration with user health profiles (BMI, age, goals) to generate customized diet charts.

Medical -Based Recommendations: Provide nutrition suggestions for diabetes, hypertension, obesity, and other conditions.

Wearable Device Integration: Sync with smartwatches and fitness bands to track calories, activity, and nutrition in real time.

Voice -Based Food Analysis: Add voice commands to scan food and receive instant nutrition feedback hands-free.

Augmented Reality (AR) View: Use AR to overlay nutrition details directly on the food through the camera.

Offline Functionality: On-device AI models for scanning without internet access.

Global Food Database Expansion: Include regional, traditional, and international foods for broader coverage.

Allergen Detection: Automatically warn users about allergens such as nuts, dairy, or gluten.

Dietary Goal Tracking: Daily, weekly, and monthly nutrition progress tracking with smart notifications.

Healthy Alternative Suggestions: Recommend low-calorie, low-sugar, or low-fat alternatives based on user preferences.

 Integration with Health Apps: Connect with Google Fit, Apple Health, and other nutrition apps for data synchronization.

IX. References

[1] Open Food Facts (2025). "Introduction to Open Food Facts API documentation."

[2] Nutritionix (2025). "Nutrition API by Nutritionix."

[3] Microsoft Learn (2025). "Overview of Microsoft Cloud for Healthcare reference architectures."

[4] A. Rokhva, et al., "Accurate and Real-Time Food Recognition Using Pretrained MobileNetV2 in the Food Industry," *arXiv preprint*, arXiv:2405.11621, 2024.

[5] Kaushal, S., et al. (2024). "Computer vision and deep learning-based approaches for food recognition and nutrient estimation."

[6] K. Kong, F. Moy, S. Ong, A. Tahir, and C. Loo, "MyDietCam: Development and Usability Study of a Food Recognition and Nutrition Tracking Mobile Application," *Digital Health Journal*, vol. 9, pp. 1–12, 2023.

[7] Y. Makwana, S. Iyer, and S. Tiwari, "Food Recognition and Calorie Assessment from Images Using Convolutional Neural Networks," *International Journal of Intelligent Systems and Applications in Engineering*, vol. 10, no. 4, pp. 245–252, 2022.

[8] J. Romero-Tapiador, et al., "AI4Food-NutritionDB: Food Image Recognition Benchmark and Dataset Based on Nutrition Taxonomy," *arXiv preprint*, arXiv:2211.07440, 2022.

[9] P. Gupta and R. Mehta, "Rule-Based System for Personalized Dietary Recommendations Using Food Recognition," *International Conference on Computational Intelligence and Communication Networks (CICN)*, pp. 317–322, 2021.

[10] L. Chen, et al., "Deep Learning-Based Food Recognition for Mobile Nutrition Applications," *Procedia Computer Science*, vol. 184, pp. 417–424, 2021.

[11] K. T. Nguyen, et al., "Food Recognition and Nutrition Estimation using Deep Learning," IEEE Access, 2021.

[12] A. Popescu, et al., "Barcode-Based Mobile Nutrition Tracking System," International Journal of Mobile Computing, 2020.

[13] W. He, X. Zhu, and H. Tan, "Multi-Task Image-Based Dietary Assessment for Food Recognition and Portion Size Estimation," *arXiv preprint*, arXiv:2004.13188, 2020.

[14] S. Lee and M. Kim, "A Smart Food Nutrition Scanner Using Barcode and Image Recognition for Health Monitoring," *IEEE Access*, vol. 8, pp. 119432–119440, 2020.

[15] T. Nguyen and K. Park, "Integration of OCR and Barcode Recognition for Food Product Identification," *Journal of Computer Applications in Health Sciences*, vol. 6, no. 1, pp. 33–40, 2019.

[16] R. Singh, et al., "Nutrition Information Retrieval from Food Databases," Journal of Food Informatics, 2019.