

NUTRISCAN: Smart Food Analyzer

Aaliya Khan

Email: aaliyakhan4352@gmail.com

Nidhi Gupta

Email: nidhigupta17a@gmail.com

Rimjhim Chauhan

Email: rimjhim.chauhan.st@gmail.com

Sejal Ubale

Email: sejalubale32@gmail.com

Under the guidance of

Dr. Ranjana Kumari

Email: ranjana.thakur@ltce.in

Dr. Nandini Nag

Email: nandini.nag@ltce.in

Department of Computer science Engineering (Data Science), Lokmanya Tilak College of Engineering, An Autonomous Institute Affiliated to University of Mumbai

ABSTRACT

NutriScan is an intelligent food analysis application designed to support individuals in making healthier dietary choices. By using personal health information such as allergies, medical conditions, and lifestyle goals, the system personalizes food safety analysis and nutritional advice. This helps users quickly understand whether a food product is suitable for their needs and encourages informed eating habits.

The system scans food labels using Optical Character Recognition (OCR) to extract ingredient and nutrition details. These details are then processed, normalized, and compared with the user's health profile and a knowledge base. An AI-powered decision engine evaluates the information and provides clear results, including safety status, reasons for concern, and alternative recommendations if needed.

By simplifying complex nutritional data into user-friendly insights, NutriScan empowers people to avoid harmful ingredients, prevent health risks, and choose meals that align with their long-term wellness goals. It acts as a personalized smart food assistant, making healthy living more accessible, practical, and sustainable.

1. INTRODUCTION

NutriScan is an innovative smart food assistant designed to help individuals make healthier dietary choices based on their personal health and medical information. By quickly scanning food labels, NutriScan identifies the nutritional content, potential allergens, and additives present in food products. It provides users with actionable advice, highlights possible health risks, and presents a simple visual meter to indicate the overall healthiness of a meal.

With the growing concern over lifestyle-related diseases such as obesity, diabetes, and cardiovascular disorders, NutriScan serves as a practical tool to promote informed eating habits. Its integration of health data and food analysis ensures that recommendations are tailored to individual needs, making it more than just a nutritional guide—it becomes a personalized health companion.

Furthermore, NutriScan leverages modern technology, including AI-driven analysis and real-time scanning capabilities, to simplify the process of understanding complex nutritional information. This empowers users to make conscious food choices, maintain a balanced diet, and ultimately improve overall wellness.

1.1 Motivation

In recent years, there has been a significant rise in lifestyle-related health issues such as obesity, diabetes, hypertension, cardiovascular diseases, and food allergies. A major contributing factor is poor dietary habits, often influenced by the consumption of processed and packaged foods with unclear nutritional information. Despite widespread awareness of the importance of healthy eating, many individuals struggle to make informed food choices due to confusing labels, lack of nutritional knowledge, or time constraints in modern life.

NutriScan is motivated by the need to bridge this gap between knowledge and practice. People today require a reliable, easy-to-use tool that not only provides accurate nutritional information but also interprets it in a personalized and actionable manner. The increasing adoption of smartphones, wearable health devices, and AI technologies presents an opportunity to create a system that can analyze food items in real time and provide tailored recommendations based on individual health data.

Moreover, there is a growing demand for preventive healthcare measures. By promoting healthy eating habits through a smart, personalized food analysis tool, NutriScan aims to empower users to take proactive steps toward maintaining wellness. The motivation behind NutriScan lies in making nutrition accessible, understandable, and practical for everyone, transforming everyday food choices into opportunities for improving long-term health outcomes.

1.2 Problem Statement

With the rise of lifestyle-related diseases and the widespread consumption of pro-cessed foods, many individuals struggle to make informed dietary choices due to complex food labels and lack of personalized nutritional guidance. There is a need for a smart, easy-to-use solution that can analyze food content quickly and provide tailored recommendations to promote healthier eating habits.

2. LITERATURE SURVEY

2.1 Artificial intelligence in personalized nutri-tion and food manufacturing: a comprehensive review of methods, applications, and fu-ture directions

In July 2025, a comprehensive review highlighted the role of artificial intelligence in personalized nutrition and food manufacturing. The paper discusses AI-driven dietary planning, where algorithms analyze individual health data to offer tailored nutritional guidance. It also covers image-based food analysis, which can recog-nize food items and estimate nutrient content, improving the accuracy of dietary tracking. Additionally, AI applications in sustainable food production are dis-cussed, showing how technology can optimize resource use, reduce food waste, and enhance overall efficiency in food industries.

The study emphasizes that AI can significantly improve health outcomes by of-fering personalized recommendations, supporting preventive healthcare strategies, and promoting adherence to dietary guidelines. It also identifies challenges such as the need for high-quality datasets, and the creation of user-friendly interfaces suitable for everyday consumers.

Overall, the paper lays a foundation for future research in AI-powered nutrition and food manufacturing. It underscores the importance of combining technological innovation with nutritional science to deliver practical solutions that influence both consumer behavior and industrial processes.

2.2 A Smart Scanner System for Ingredient Cat-egorization and Identification of Nutritional Composition in Packaged Food Items

In September 2024, a study presented a Flutter-based mobile application designed to scan packaged food items and analyze their nutritional composition. The system utilizes Google Vision API and a custom ingredient database to automatically extract ingredient lists, categorize them, and provide nutritional evaluations in real time. By simplifying complex food labels, the app allows users to make healthier choices quickly and effectively.

The study demonstrates the integration of AI-powered image recognition with structured databases to deliver actionable dietary guidance. It bridges the gap between available nutritional information and practical consumer decision-making, providing personalized insights based on scanned products.

Furthermore, the research highlights the accessibility and usability of mobile applications in promoting better nutrition. It shows that AI technologies can empower users to make informed, science-backed dietary decisions without requiring extensive nutritional knowledge.

2.3 AI Nutrition Recommendation using a Deep Generative Model and ChatGPT

In June 2024, a hybrid AI system was introduced that combines Variational Autoencoders (VAE), Gated Recurrent Units (GRU), and ChatGPT to generate personalized weekly meal plans. The system follows EFSA and WHO guidelines to ensure nutritional compliance while offering diverse and balanced meal options. The deep generative model allows customization based on individual preferences, dietary restrictions, and health conditions.

Compared to traditional diet planning approaches, this method improves accuracy, variety, and adherence to nutritional standards. The study highlights the potential of combining generative AI with domain-specific nutrition guidelines to produce scientifically valid and practically applicable recommendations.

Overall, the research demonstrates how advanced AI models can revolutionize personalized nutrition. By integrating machine learning and natural language processing, it provides highly tailored dietary guidance and sets a benchmark for automated diet planning systems.

2.4 Personalized Diet Recommendation System Using Machine Learning

In February 2024, a web-based application was developed using Streamlit and FastAPI to deliver personalized meal plans and recipe suggestions. The system employs a Nearest Neighbors algorithm to provide recommendations based on user preferences and nutritional needs while also presenting detailed nutritional breakdowns.

The study emphasizes the simplicity, accessibility, and practical usability of traditional machine learning algorithms in supporting personalized diet planning. Despite being less complex than deep generative models, it demonstrates that ML-based solutions can still effectively guide users in making healthier dietary choices.

Additionally, the paper highlights the value of web applications for nutrition management. By offering real-time, tailored guidance and educational insights, the system encourages users to adopt healthier eating habits while maintaining easy access and usability for a broad audience.

2.5 Existing System & its Drawbacks

Currently, many mobile and web-based applications help users track their diet and understand nutritional content. These include barcode scanning apps, nutrition databases, and AI-powered image recognition tools. They aim to promote healthier eating habits and

improve dietary awareness. However, these systems have several limitations that affect their effectiveness:

- **Hard to Understand Labels:** Food labels often use complex terms, numbers, and percentages, making them difficult for consumers to interpret correctly. Users may misread or ignore the information.
- **Barcode-Only Problem:** Most existing apps rely solely on barcodes to fetch food information. This limits their usage because not all packaged foods have barcodes, and homemade or unpackaged items cannot be tracked.
- **Old or Incorrect Information:** Nutritional databases may contain outdated or inaccurate data, as food formulations and recipes change over time. Using such information can lead to incorrect calorie, nutrient, or allergen tracking.
- **Time-Consuming Food Logging:** Manual entry of meals, portion sizes, and cooking methods is tedious and often inconsistent. This discourages users from regularly tracking their diet, resulting in incomplete or inaccurate data.
- **Limited Personalization:** Most apps provide generic dietary recommendations and fail to fully tailor guidance based on user preferences, health conditions, or activity levels.
- **Lack of Real-Time Analysis:** Existing systems often do not provide instant feedback on the nutritional quality of foods or suggest healthier alternatives in real time.
- **Dependence on Internet/Data Availability:** Some apps need constant internet access, limiting use in areas with poor connectivity.

These drawbacks show the need for a smarter, user-friendly system that tracks all foods, simplifies label reading, and provides personalized nutrition. NutriScan addresses this with an all-in-one smart scanning solution.

3. PROPOSED METHODOLOGY

3.1 Methodology

The NutriScan application is designed to provide users with a seamless, personalized, and intelligent nutrition analysis experience by integrating a structured front-end, back-end, and database architecture. This three-tier approach ensures smooth user interaction, efficient processing, and secure storage of health-related data while delivering meaningful insights in real time.

The front-end, built with React, provides a clean and interactive interface for easy navigation. It enables user registration and login via Supabase, profile setup with health details, and food label scanning through camera or image upload. After scanning, it displays nutritional analysis, health warnings, balance meters, and AI-driven recommendations, ensuring a functional and user-friendly experience for diverse dietary needs.

The back-end, powered by Spring Boot, is responsible for handling complex operations and ensuring smooth communication between the front-end and database. It manages authentication processes, connects securely with Supabase, and handles requests made by the user interface. When a food label is scanned, the back-end sends the image to the

Google Vision API for Optical Character Recognition (OCR). The extracted ingredient and nutrition information is then processed and passed on to advanced AI/ML models such as Hugging Face or DeepSeek. These models evaluate the data against health profiles and dietary restrictions, generating personalized recommendations or warnings. The back-end then translates these AI outputs into simplified insights, making the results clear and actionable for end-users. This ensures that complex computations remain hidden from the user while still delivering accurate and reliable outcomes.

The database, built using MongoDB, functions as the backbone of data storage and retrieval. It securely stores user profiles, health information, past scan histories, and nutritional analysis results. The database also maintains AI learning data, which helps the system improve personalization over time. For example, if a user repeatedly scans products, the system can learn their preferences and dietary patterns, thereby enhancing the relevance of future recommendations. This continuous learning mechanism makes NutrScan adaptive, scalable, and capable of providing tailored suggestions that evolve with user needs.

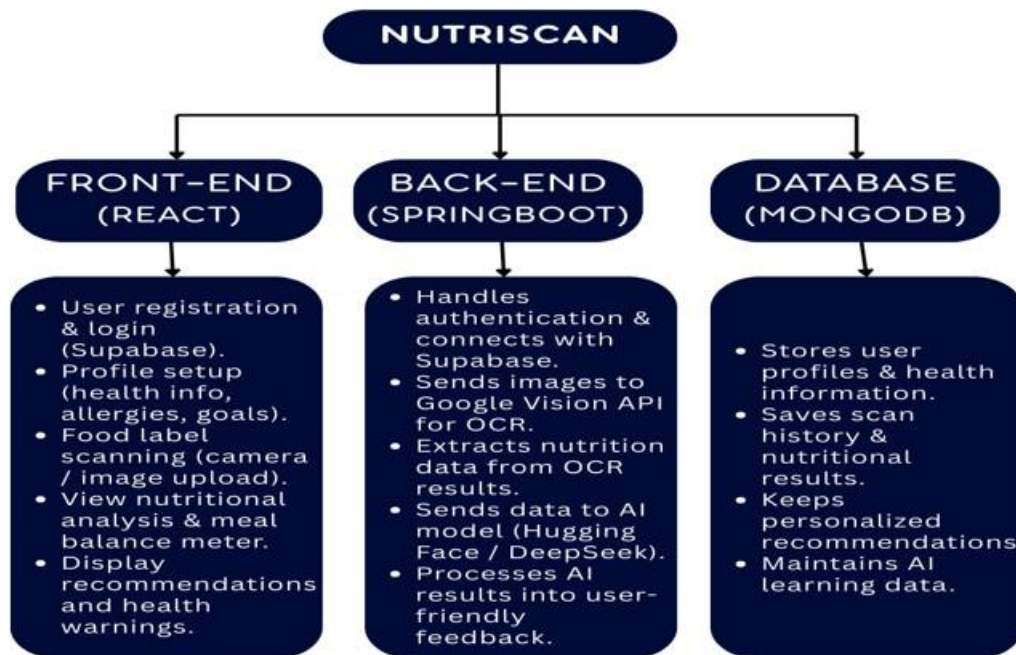


Figure 3.1: System Architecture of the proposed Nutriscan

As shown in Fig. 3.1, the architecture of NutrScan is composed of three tightly integrated modules: the front-end, which ensures smooth user interaction; the back-end, which manages authentication, OCR, AI-driven analysis, and feedback processing; and the database, which secures and organizes user-specific health data, nutritional histories, and learning records. These components work in harmony to deliver a robust, scalable, and intelligent nutrition analysis system. The modular design not only ensures performance and security but also makes NutrScan easily extendable for future enhancements, such as

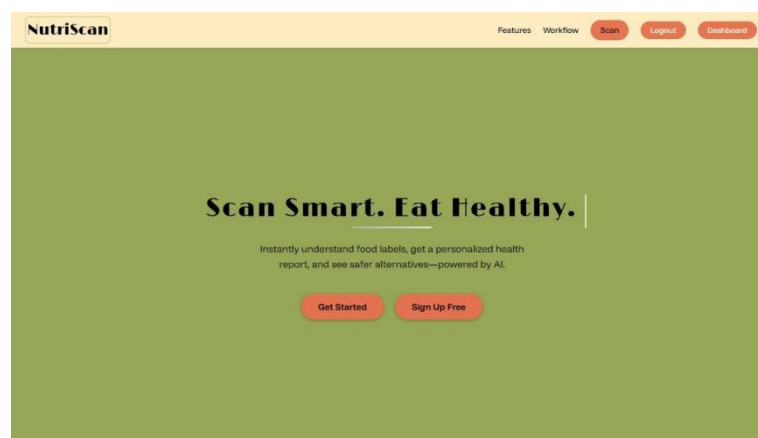
adding real-time chat with dietitians, integration with wearable health devices, or region-specific dietary recommendations.

This comprehensive methodology guarantees that users receive accurate, person-alized, and actionable feedback on their food choices, empowering them to make healthier lifestyle decisions with confidence.

4. IMPLEMENTATION

4.1 Working Model

Figure 4.1: Landing page



The NutriScan Landing Page is the introductory interface designed to attract users and encourage engagement. It features a minimal yet elegant layout with a fresh green background that symbolizes health and nutrition. The page prominently displays the slogan “Scan Smart. Eat Healthy.” effectively conveying the platform’s purpose — to help users make informed food choices using AI-based food label analysis.

The navigation bar provides quick access to sections such as Features, Workflow, Scan, Dashboard, and Logout. Interactive buttons — “Get Started” and “Sign Up Free” — allow users to either begin scanning immediately or register for a personalized experience. The overall design ensures simplicity, responsiveness, and user trust, making it an effective and engaging landing page.

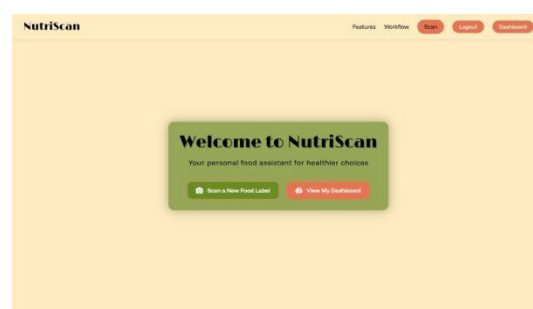
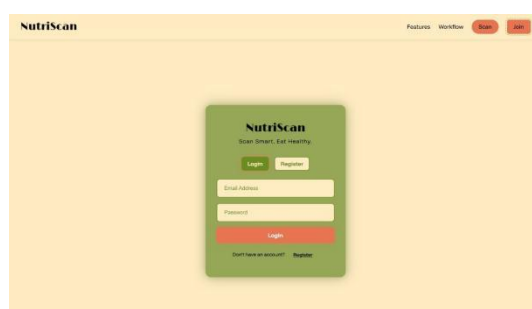


Figure 4.2: Login Page

Figure 4.3: Welcome Screen

The login page allows registered users to securely access their personalized Nu-triScan dashboard. It provides two main options — Login and Register — with a minimal, clean design. The green and beige color scheme promotes simplicity and aligns with NutriScan’s health-oriented theme. After logging in, users are greeted with a welcome message on the dashboard. This page provides quick navigation options to Scan a New Food Label, helping users instantly begin nutritional analysis or review past scans.

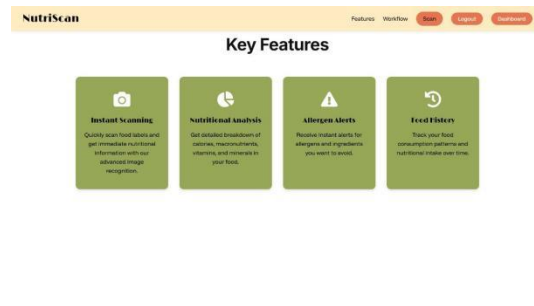


Figure 4.4: Basic Information Page

Figure 4.5: Key Features Page

This page collects essential user details such as name, email, date of birth, and gender. The form is part of a three-step registration process (Basic Info, Physical, and Medical), enabling NutriScan to generate personalized health recommendations based on user data.

The Key Features page highlights NutriScan’s core capabilities, including Instant Scanning, Nutritional Analysis, Allergen Alerts, and Food Diary. Each feature card briefly explains its purpose, ensuring users understand the app’s benefits and tools at a glance. Figures 4.6 and 4.7 together illustrate the core functioning of the NutriScan system. Figure 4.6 presents the initial interface where the robot captures the image of a food product label. The label is positioned centrally to ensure clarity and precision during scanning. User options such as “Rescan” and “Proceed” allow retaking the image or moving forward with analysis. The minimalistic layout reduces distractions and enhances focus on the captured label, marking the first step in the scanning workflow where image verification ensures accurate data extraction.

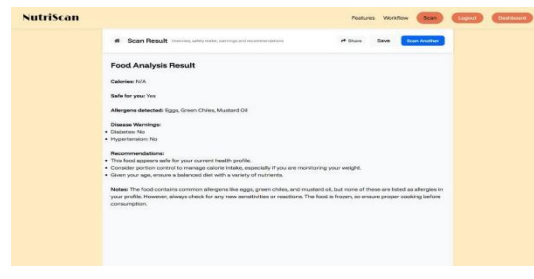
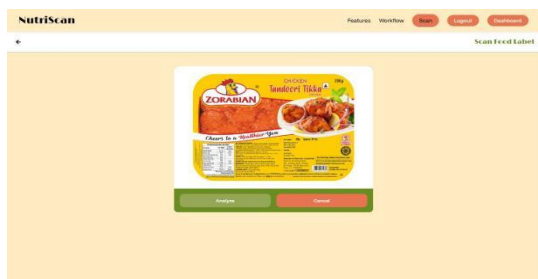


Figure 4.6: Scanning Interface

Figure 4.7: Result Display Interface

Figure 4.7 displays the processed output screen, showcasing the analyzed nutritional information—such as calories, ingredients, allergens, and potential risks—in a well-structured format. It also provides personalized recommendations based on the user’s health profile and dietary restrictions. The clean design, with clear headings and spacing, promotes readability and quick interpretation. Users can further save, share, or compare the results, demonstrating how NutriScan transforms raw label data into meaningful and actionable dietary insights.

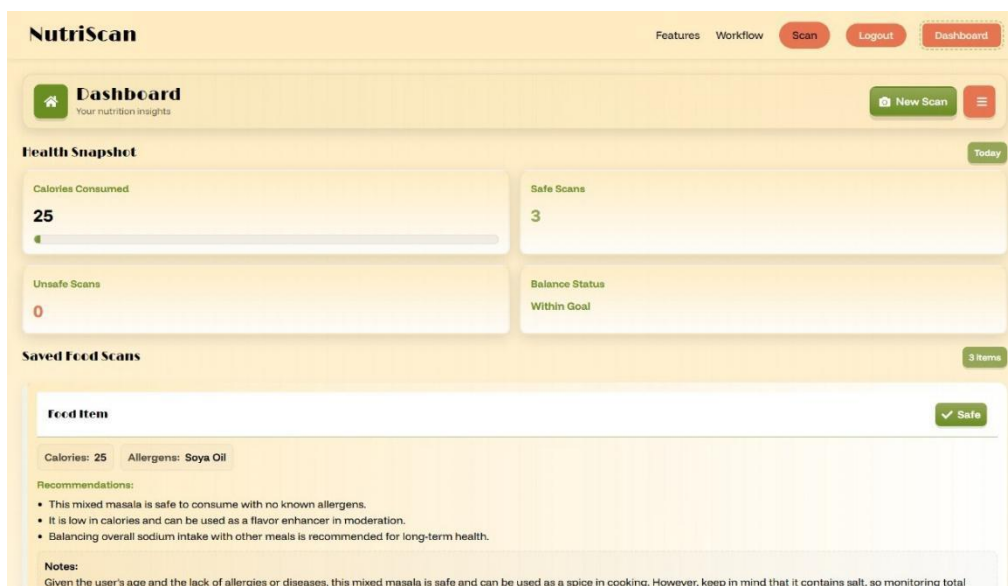


Figure 4.8: Dashboard Interface with Health Insights

Figure 4.8 presents the NutriScan dashboard, which serves as the central hub for tracking user nutrition insights over time. At the top, a Health Snapshot section summarizes key metrics including calories consumed, number of safe scans, unsafe scans, and overall balance status. This helps users quickly understand their dietary trends. Below this, the Saved Food Scans section lists previously analyzed food items along with details such as allergen presence, calorie content, and personalized recommendations. Each entry also includes safety status labels (e.g., “Safe”). The dashboard is designed for long-term monitoring, allowing users to review past eating behavior, maintain consistency, and improve dietary choices. The clean layout and categorized sections make the interface intuitive and user-friendly for continuous use in real-life health management.

4.2 Software and Hardware Used

4.2.1 Hardware

- Processor: A multi-core processor such as Intel i3 or above, or equivalent.
- RAM: Minimum of 8GB for smooth development and testing.
- Storage: SSD with at least 256GB to handle development files, databases, and application data.

- Internet Connection: Reliable high-speed internet for accessing web resources and server hosting.

4.2.2 Software

1. **Operating System:** Windows 10/11

2. **Device:**

- Acer Aspire 3 Intel Core i7-1255U
- Lenovo IdeaPad Slim 3 Intel Core i3 12th Gen
- HP Victus Gaming Laptop, 12th Gen Intel Core i5-12450H
- Asus TUF F15 Intel core i5 13th Gen

3. **VS Code as IDE:** We have used Visual Studio Code (VS Code) as our In-tegrated Development Environment (IDE) to write, edit, and manage your project's code. It is a popular choice because of its powerful features, exten-sions, and ease of use for development.

4. **Programming Language:**

Software Used:

The NutriScan system has been developed using a modern full-stack architec-ture integrating AI, OCR, and cloud services to deliver real-time nutrition analysis and personalized health recommendations. The software compo-nents used in this project are listed below:

Front-End Technologies:

- React.js – Builds a clean, responsive, and interactive user interface.
- HTML – Structures web pages.
- CSS – Provides styling and layout for visual appeal.
- JavaScript – Adds interactivity and dynamic functionality.
- Framer Motion – Enables smooth animations and transitions.
- Material UI (MUI) – Offers ready-to-use and customizable UI com-ponents.
- React Icons – Provides lightweight and consistent icons.

Frontend Features:

- User registration, login, and profile setup (via Supabase Authenti-cation)
- Health detail input
- Food label scanning through camera or image upload
- Display of nutritional analysis, balance meters, health warnings, and AI-driven recommendations

Back-End Technologies:

- Java Spring Boot – Provides a scalable and secure REST API for server-side operations.
- Supabase – Handles user authentication and session management.
- MongoDB Atlas – Stores user profiles, scans, health data, and AI-generated outputs.
- Data Validation & Request Processing – Managed through Spring Boot services.

- Image Storage via imgBB API – Stores scanned images securely in the cloud.

Back-End Responsibilities:

- Process and validate user requests
- Connect with database securely
- Integrate OCR (Google Vision / Tesseract)
- Send extracted text to AI/ML models (Hugging Face, DeepSeek, Qwen)
- Convert AI outputs into simple recommendations for users

OCR and AI Integration:

- Google Vision / Tesseract OCR – Extracts text and nutritional data from food labels.
- AI/ML Models (Hugging Face, DeepSeek, Qwen) – Analyze ingredients and user health data.

AI Output Includes:

- Personalized dietary recommendations
- Health risk warnings
- Alternative food suggestions

Database and Cloud Services:

- MongoDB Atlas (Cloud NoSQL Database) – Stores user profiles, health data, and scan history.
- Supabase – Manages authentication, metadata storage, and real-time updates.
- imgBB API – Provides secure, cloud-based image storage for scanned labels.

Additional Tools:

- Git / GitHub – Version control and collaborative development.
- Postman – Testing and validating API endpoints.

5. RESULTS AND DISCUSSION

NutriScan effectively scans packaged foods and provides comprehensive, real-time nutritional analysis by accurately extracting ingredients and identifying macronutrients, micronutrients, allergens, and additives. The system displays this information through a clear and interactive health meter, along with AI-driven recommendations and warnings, making complex nutritional data easy for users to understand and act upon. By integrating personalized user profiles, including dietary preferences, health conditions, and goals, the application delivers tailored suggestions, helping users make healthier choices and manage their diets effectively. During testing, the app demonstrated high accuracy in recognizing a wide variety of food items and processed scans quickly, ensuring a seamless and responsive user experience. Users reported that the visual nutrient breakdown, combined with actionable insights, greatly simplified food selection compared to traditional labels or manual tracking methods. Overall, NutriScan provides a robust, user-friendly, and practical solution for enhancing dietary awareness, promoting healthier eating habits, and bridging the gap between available nutritional information and actionable guidance in everyday life.

6. CONCLUSIONS

NutriScan successfully demonstrates the potential of AI-powered mobile applications in improving dietary management and nutritional awareness. The system efficiently scans packaged foods, extracts ingredient information, evaluates nutritional composition, and provides personalized recommendations based on user profiles. By presenting complex nutritional data in an easy-to-understand format, including health meters and warnings, NutriScan simplifies dietary decision-making and encourages healthier eating habits. The application addresses key limitations of existing diet-tracking tools, such as reliance on barcodes, outdated nutritional databases, and manual input, offering a comprehensive and user-friendly solution.

6.1 Future Scope

In the future, Nutriscan can be extended to enhance food analysis by integrating sensors into the system for qualitative assessment. These sensors will help detect moisture, freshness, and overall quality of various foods, including packaged products, fruits, vegetables, and meat. The system will provide real-time feedback on food safety, enabling consumers to make healthier and more informed choices. By combining artificial intelligence with sensor technology, the model can be further expanded to monitor nutrient content, pH levels, and predict shelf life, providing a comprehensive solution for food quality monitoring.

REFERENCES

- Agrawal K, Goktas P, Kumar N, Leung M-F. “Artificial intelligence in personalized nutrition and food manufacturing: A comprehensive review of methods, applications, and future directions.” *Frontiers in Nutrition*, Vol. 12, July 2025, Article 1636980, pp. 1-20.
- Bhatlawande S, Shilaskar S, Surana A. “A smart scanner system for ingredient categorization and identification of nutrition composition in packaged food items.” *Journal of Integrated Science and Technology (JIST)*, Vol. 13, Issue 1, 2025, pp. 1008-1018.
- Papastratis I, Konstantinidis D, Daras P, Dimitropoulos K. “AI nutrition recommendation using a deep generative model and ChatGPT.” *Scientific Reports*, Vol. 14, 14620, 2024, pp. 1-15.
- Kumari DDN, Satya TP, Manikanta B, Chandana AP, Aatiya YLS. “Personalized diet recommendation system using machine learning.” *International Journal of Engineering Research Technology (IJERT)*, Vol. 12, Issue 2, February 2024, pp. 1-8.