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"A Machine Learning Approach to Assessing Packaged Food Healthiness and Recommending Healthier Alternatives via Mobile Application"

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Abstract - *This research presents an AI-powered Android application designed to assess the healthiness of packaged food products and offer healthier alternatives based on nutritional data. Users can scan barcodes to retrieve product information via the OpenFoodFacts API, including details such as sugar, fat, and salt content. The application evaluates these values using a machine learning model, predicting a health score out of 100. A key innovation of this system is its ability to recommend alternative products that score higher in health value, aligning with the user's dietary preferences and wellness goals. The backend is powered by Firebase for real-time data storage and user authentication, while barcode scanning is implemented using Google ML Kit. A custom ML model hosted via Flask provides score predictions dynamically. This mobile solution bridges the gap between consumer convenience and nutritional awareness, aiming to promote informed food choices and healthier consumption habits through intuitive technology integration.*

Key Words: machine learning, barcode scanner, packaged food, food health assessment

1.INTRODUCTION

Packaged food consumption has grown rapidly due to modern lifestyle demands, but many consumers face difficulty interpreting complex nutritional labels. This often leads to uninformed dietary choices and long-term health risks. To address this issue, a machine learning-based mobile application has been developed. It allows users to scan product barcodes, retrieve nutritional data via the OpenFoodFacts API, and assess food healthiness using a trained ML model. A unique feature of the application is its ability to suggest healthier alternatives based on the predicted health score. This solution aims to enhance consumer awareness, simplify food evaluation, and promote healthier eating habits through technology-driven insights.

2. METHODOLOGY

The proposed system is an Android-based mobile application designed to evaluate packaged food healthiness using machine learning. The methodology includes barcode scanning, data retrieval, health score prediction, and alternative suggestions.

Initially, users authenticate using Firebase and scan food product barcodes through Google ML Kit. The scanned barcode fetches nutritional information from the OpenFoodFacts API, including values such as sugar, salt, fat, and energy. These parameters are sent to a cloud-hosted Flask API that runs a regression-based machine learning model to calculate a health score out of 100.

Based on the predicted score, the system suggests healthier alternatives from a curated dataset. All scanned product data and user history are stored securely using Firebase Realtime Database, ensuring a personalized experience. The methodology ensures real-time analysis, fast prediction, and informed product comparison.

3. MODELING AND ANALYSIS

Model The application uses a regression-based machine learning model to predict the health score of packaged food items. The model was trained using nutritional features such as sugar, salt, fat, and energy values collected from publicly available datasets like OpenFoodFacts.

Initially, multiple algorithms including Linear Regression and Support Vector Regression were evaluated, but Random Forest Regression was selected for its higher accuracy and better handling of non-linear data. The model was trained and deployed using Python and Flask, and hosted on a cloud platform to ensure real-time response.

The mobile app sends nutritional values as input to the API, which processes them through the model and returns a health score. Based on this score, the app classifies the product (e.g., Healthy, Moderate, Unhealthy) and suggests better alternatives accordingly. The evaluation results were verified by comparing predicted scores against known nutritional benchmarks to ensure model reliability.

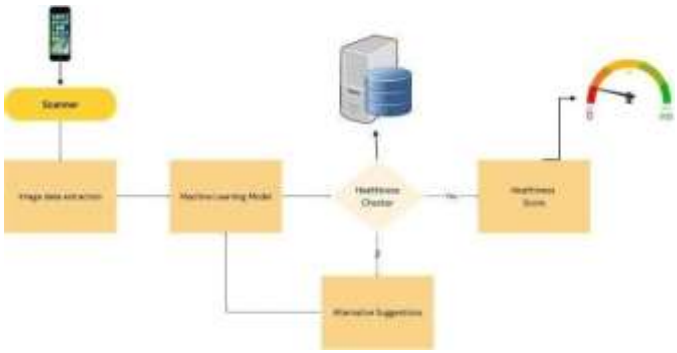

Fig -1: System Architecture for Packaged Food Health Evaluation Application

4. RESULTS AND DISCUSSION

The developed mobile application was tested across various packaged food items to evaluate functionality and accuracy. Upon scanning product barcodes, the app successfully retrieved nutritional data and predicted health scores within seconds. Products were classified into categories such as "Healthy," "Moderate," and "Unhealthy" based on score thresholds.

The machine learning model demonstrated consistent performance, with Random Forest Regression providing more stable predictions compared to simpler linear models. For example, items with high sugar and saturated fat content received low scores, while low-fat, low-sugar products scored higher, validating the model's expected behavior.

A notable outcome was the alternative suggestion feature, which provided users with healthier product recommendations in real time. These suggestions were based on scoring comparisons within a dataset of common packaged items. The feature proved effective in guiding users toward more nutritious choices.

Overall, the application functioned smoothly in real-time testing scenarios, with efficient barcode scanning, accurate data retrieval, and responsive score prediction, thereby meeting the project objectives.

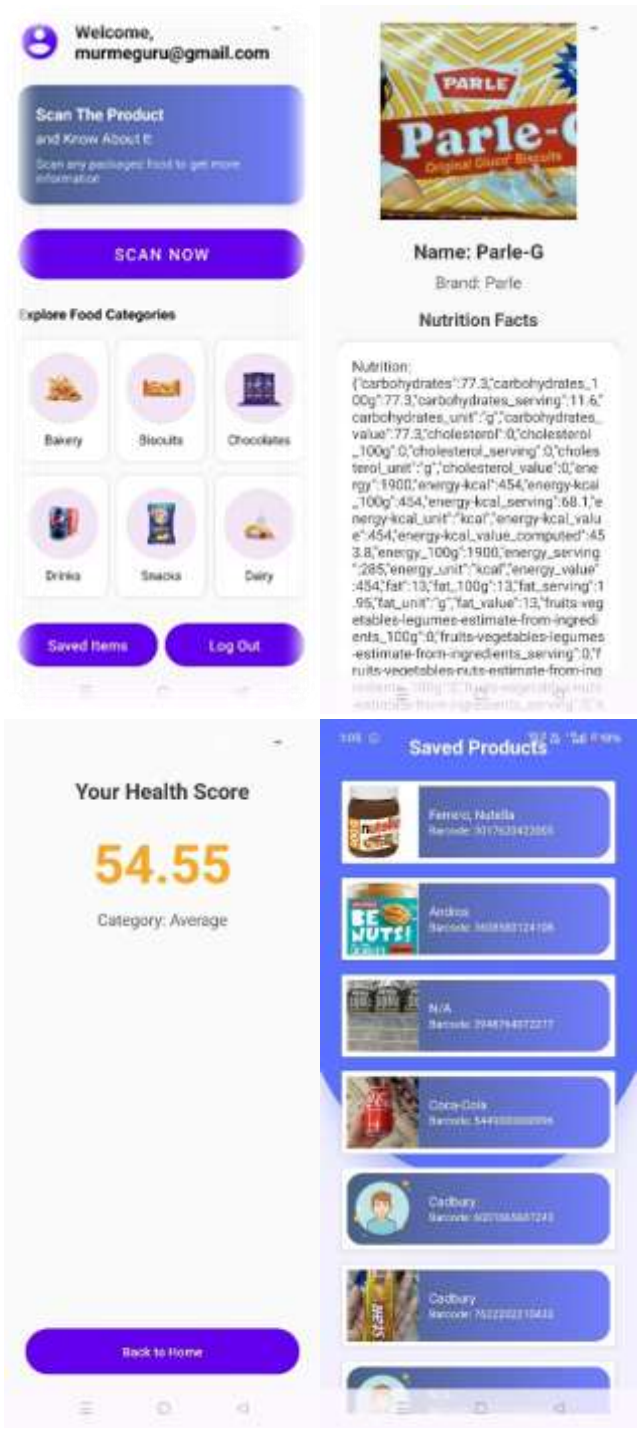

Fig -2: Sample Health Score Output and Product Classification

4. CONCLUSION

This research resulted in the successful development of a machine learning-based mobile application that evaluates the healthiness of packaged food products and suggests healthier alternatives. By integrating barcode scanning, nutritional data retrieval, cloud-hosted score prediction, and personalized suggestions, the system helps users make informed food choices.

The application not only simplifies the process of understanding food content but also promotes healthier consumption habits. The combination of Firebase, OpenFoodFacts API, and Random Forest Regression ensures reliable performance. This project lays a strong foundation for

future enhancements such as advanced dietary profiling, real-time alerts, and expanded product databases.

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