Software Requirements Specification (SRS) (IEE 830)

Title : Food Classification System

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1. Introduction

This document follows an IEEE-style Software Requirements Specification (SRS) structure. It defines the purpose, scope, terminology, references, and system overview for the proposed software solution.

1.1 Purpose

The purpose of the **Food Classification System** is to provide an automated solution for identifying food items from digital images. By leveraging Deep Learning, specifically Convolutional Neural Networks (CNNs), the system aims to support dietary monitoring and nutritional analysis by categorizing food into predefined classes (e.g., vegetarian, vegan, healthy/unhealthy).

1.2 Document Conventions

- **FR-#:** Functional Requirements.
- **NFR-#:** Non-Functional Requirements.
- **IEEE-830 Standard:** Structure followed for documentation.

1.3 Intended Audience and Reading Suggestions

This document is intended for:

• Health and Nutrition Professionals: To assist in dietary assessments.

• Software Developers: For system architecture and ML model implementation.

• End-Users: Individuals seeking to track their meals and nutritional intake.

1.4 Project Scope

The system will enable users to upload food images via a web interface. It will perform real-time classification using a trained CNN model (e.g., InceptionV3 or ResNet,Mobilenet) and retrieve nutritional data from a database to provide calories, protein, and fat estimates.

Features such as portion size estimation and ingredient-level transparency are considered future enhancements.

1.5 References

[1] IEEE Std 830-1998 — Software Requirements Specifications

[2] IEEE Std 1016-2009 — Software Design Descriptions

[3] Global Food/Nutrition Databases (e.g., USDA or Nutritionix).

2. Overall Description

This section provides a high-level description of the product and its operational context.

2.1 Product Perspective

The system is a standalone, AI-powered web application that integrates a computer vision backend with a relational or NoSQL database for nutrition metadata. It operates within a cloud-hosted environment for accessibility across multiple platforms.

2.2 Product Functions

Major system functions include:

• Image Acquisition: Capturing images via camera or local upload.

• Automated Classification: Identifying food items from images.

• Nutritional Feedback: Displaying caloric and macronutrient information.

• Dietary Logging: Maintaining a history of user meal logs.

2.3 User Classes and Characteristics

User Class	Description
End-User	Uploads images to get instant classification and nutritional facts.
System Admin	Manages the food dataset, updates the ML model, and monitors system health.

3. System Features (Functional Requirements)

FR-1 Image Recognition

• The system shall use CNN-based models to classify food into specific categories.

FR-2 Nutritional Mapping

• The system shall map detected food labels to a nutritional database to fetch calorie counts.

FR-3 Real-time Inference

• The system shall provide identification results immediately after an image is processed.

FR-4 User Dashboard

• The system shall allow users to view their daily and monthly nutritional trends.

4. External Interface Requirements

4.1 Sensing Layer

• Captures raw food images via camera or user upload.

4.2 Processing Layer

• Preprocesses images (resizing/normalization) and runs them through a CNN model (e.g., MobileNetV2).

4.3 Application Layer

• Maps the model's output label to nutritional data and generates the user interface.

4.4 Data Layer

• Stores user logs, nutritional tables, and the trained model weights in a cloud database.

5. Non-Functional Requirements

NFR-1 Accuracy

• The model shall achieve a minimum of 85% accuracy on validated test sets.

NFR-2 Performance

• Classification results shall be displayed within 3 seconds of the upload completion.

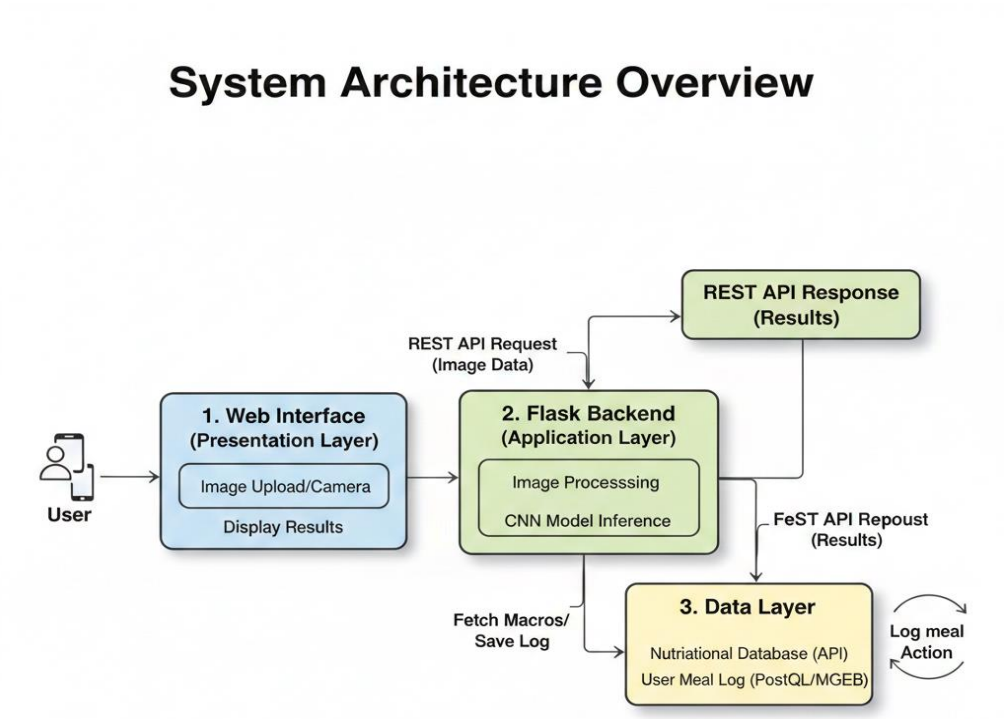
NFR-3 Security

• All user dietary data shall be encrypted both in transit and at rest.

NFR-4 Scalability

• The system shall support concurrent analysis for multiple users without performance degradation.

6. System Architecture Overview



9. Appendices

Appendix-A: Glossary

- **CNN**: Convolutional Neural Network used for image recognition.
- **Transfer Learning**: Adapting a pre-trained model (like InceptionV3) to a new task.
- **Inference**: The stage where the model predicts the food class for a new image.

Appendix-B: Future Enhancements

- Integration with wearable health trackers for real-time calorie burning analysis.
- Ingredient-level transparency for allergy detection.