PHASE-2: REQUIREMENT ANALYSIS

OBJECTIVE

The aim of this phase is to clearly outline both the technical and functional requirements necessary for the successful development and implementation of the Smart Sorting system. This includes selecting appropriate technologies, defining key features, and identifying any constraints or risks that may arise during the project.

TECHNICAL REQUIREMENTS

The Smart Sorting system requires the use of specific tools, technologies, and platforms that align with the goals of real-time image classification and automation. Below are the proposed technical components:

- Programming Language: Python
- Deep Learning Framework: TensorFlow / PyTorch
- Transfer Learning Models: MobileNetV2, ResNet50 (pre-trained on ImageNet)
- Dataset: Images of rotten and fresh fruits and vegetables (from Kaggle, custom collection)
- Image Processing: OpenCV for real-time camera input
- Interface: Streamlit / Flask for demo UI
- Hardware (if applicable): Raspberry Pi or industrial camera integration

FUNCTIONAL REQUIREMENTS

The system must fulfill the following functions to meet user expectations and industry relevance:

- Load and preprocess images for analysis
- Classify produce into categories (e.g., fresh, partially rotten, rotten)
- Provide a confidence score for each prediction
- Visual feedback through UI (upload image / live camera)
- Store classification results for review
- Enable performance tracking (accuracy, speed, error rate)

CONSTRAINTS & CHALLENGES

Several limitations and potential risks should be anticipated:
- **Data Quality:** Limited or imbalanced datasets for certain fruit types may impact accuracy.
- **Lighting Conditions:** Poor lighting or background noise can affect image clarity.
- **Hardware Limitations:** Real-time sorting on embedded devices may require optimization.
- **Model Overfitting:** Risk of overfitting if not properly regularized and validated.
- **Scalability:** System should be able to adapt to different fruits, regions, and environments.
- **User Training:** Non-technical users may need simple interfaces and guidance.