Project Design Phase  
Proposed Solution Template

Project Name: Smart Sorting: Transfer Learning for Identifying Rotten Fruits & Vegetables

Team Id: LTVIP2025TMID35471

Maximum Marks: 2 Marks

1. Problem Statement  
   Manual sorting of fruits and vegetables remains extremely time-consuming, error-prone and labor-intensive across food-processing plants, supermarket receiving docks and even within households. This outdated process leads to inconsistent quality control, increased inventory waste and higher operational costs at every stage of the supply chain.
2. Idea / Solution Description  
   We propose an AI-powered “smart sorting” system that leverages transfer learning on a pre-trained VGG16 convolutional neural network to classify produce as “fresh” or “rotten” in real time. High-resolution cameras mounted on conveyor belts in processing plants, at supermarket docks and inside smart refrigerators will continuously capture images of incoming or stored items. These images feed into a lightweight, fine-tuned CNN model trained on 28 classes of fruits and vegetables. As soon as spoilage is detected, the system issues immediate alerts—industrial operators receive signals on their control panels in plants and stores, and households receive push notifications on a companion smartphone app—enabling rapid removal of spoiled items and drastically reducing waste.
3. Novelty / Uniqueness  
   This solution stands out in three ways. First, it applies domain-adapted transfer learning across 28 distinct produce categories, achieving high detection accuracy with minimal additional training data. Second, it uses a unified AI model and alerting framework across three very different contexts—industrial, retail and consumer—eliminating the need for separate systems. Third, it is the first approach to embed real-time spoilage detection directly into consumer refrigerators, empowering households to proactively manage perishables and minimize food waste.
4. Social Impact / Customer Satisfaction  
   By automating spoilage detection throughout the supply chain, the smart sorting system dramatically cuts food waste, generating significant environmental benefits and cost savings. Food-processing plants and supermarkets improve their reputations through more consistent quality assurance, while households enjoy lower grocery bills and reduced kitchen anxiety. Real-time alerts and recipe suggestions for items nearing spoilage further boost user satisfaction by turning potential waste into timely meal ideas.
5. Business Model (Revenue Model)  
   • B2B Licensing: Annual or per-scan fees for software and camera module deployments in food-processing plants and supermarket chains.  
   • B2C Subscription: Monthly or annual subscription for households to access the smart-fridge integration, mobile app notifications and recipe recommendation service.  
   • Data-as-a-Service: Subscription-based analytics platform offering spoilage trend reports and inventory optimization insights to suppliers and retail partners.
6. Scalability of the Solution  
   Our architecture is designed for rapid scale-up and extension. New produce classes can be easily added by fine-tuning the existing model on additional image datasets. Deployments can run on cloud servers for large operations or on edge devices (e.g., Raspberry Pi, NVIDIA Jetson) where bandwidth or cost constraints exist. A modular API enables seamless integration with existing conveyor systems, point-of-sale terminals and IoT appliances, ensuring fast adoption across diverse customer environments.