Project Design Phase
Solution Architecture

Date	15 February 2025
Team ID	LTVIP2025TMID35093
Project Name	mart Sorting & Transfer Learning for Identifying Rotten Fruits and Vegetables
Maximum Marks	4 Marks

Solution Architecture:

🔍 Overview

This solution architecture bridges the gap between the **problem of manual fruit and vegetable sorting** and a **smart, AI-powered sorting system** using **transfer learning and embedded hardware**. The system automates the identification and separation of rotten items from fresh ones in real time.

🎯 Goals of the Solution Architecture

- Automate the detection of spoiled fruits/vegetables using AI.
- Reduce food wastage and improve quality control.
- Provide real-time results using edge devices.
- Minimize manual effort and human error.

🧩 Components of the Solution

1. **Image Acquisition**
    a. Camera Module (e.g., Pi Camera or USB Cam) captures images on a conveyor belt or sorting table.
2. **Edge Device**
    a. Raspberry Pi or Jetson Nano runs the trained transfer learning model.
    b. Handles real-time image processing and prediction.

3. **AI Model**
    a. MobileNetV2 (or ResNet50) with transfer learning classifies images as *fresh* or *rotten*.
    b. Model is trained using a labeled dataset of fruit and vegetable images.
4. **Sorting Mechanism**
    a. Servo/motor-based mechanism moves items based on classification result (e.g., fresh → left bin, rotten → right bin).
5. **User Interface**
    a. Optional web/mobile dashboard for visualizing predictions and statistics.
    b. API endpoints for remote monitoring and system control.
6. **Cloud (Optional)**
    a. For storing historical data, training logs, or re-training models.

🔄 Data Flow / Architecture Diagram (Textual Representation)

```
less
CopyEdit
[Camera Module]
     ↓
[Edge Device (Raspberry Pi)]
     ├──> [Pre-trained CNN Model (Transfer Learning)]
     │          ↓
     │     [Classification: Fresh / Rotten]
     ↓
[Motor Control Unit / Sorting Arm]
     ↓
[Bin A: Fresh]       [Bin B: Rotten]

Optional:
     ↓
[Web/Mobile Dashboard] ← API → [Cloud Storage / Analytics]
```

☑ Features & Development Phases

Phase	Key Activities
Phase 1	Data Collection & Image Labeling
Phase 2	Model Selection, Training & Validation
Phase 3	Hardware Integration (Camera + Raspberry Pi + Motors)
Phase 4	Edge Model Deployment
Phase 5	UI/API Dashboard & Testing
Phase 6	Final Integration and Field Testing