

## Project Design Phase

### Solution Architecture

#### Solution Architecture – Rotten Fruits and Vegetables Detection System

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##### 1. Input Layer (Data Ingestion)

- **Sources:**
    - High-resolution images from cameras (conveyor belt, drone, mobile app)
    - IoT sensors (for temperature, humidity, gas emission)
  - **Tools:** Raspberry Pi / Arduino (for sensors), smartphones, CCTV
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##### 2. Data Storage

- **Raw Image Data:**
    - Cloud Storage (AWS S3, Google Cloud Storage)
  - **Structured Data:**
    - Metadata + sensor data (time, location, temperature) in databases
    - **Database:** Firebase, MySQL, PostgreSQL
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##### 3. Data Processing

- **Preprocessing:**

- Image resizing, augmentation, normalization
- Noise reduction in sensor data

- **Tools:**

- OpenCV, TensorFlow/Keras preprocessing layers, NumPy, Pandas
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#### **4. Model Layer (AI/ML Engine)**

- **Model Type:**

- CNN (Convolutional Neural Network) for image classification
- Optional: Object Detection (YOLOv8, SSD) for marking spoiled areas

- **Model Framework:**

- TensorFlow, PyTorch, Scikit-learn

- **Training:**

- Labeled dataset of fresh vs rotten produce
  - Techniques: Transfer Learning, Data Augmentation
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#### **5. Model Serving & Inference**

- **Real-Time Inference:**

- On Edge (NVIDIA Jetson, mobile) or cloud (AWS SageMaker, GCP Vertex AI)
  - **Batch Inference:**
    - For daily or batch quality checks in warehouses
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## 6. Decision Layer

- **Outputs:**
    - Classification (Rotten / Fresh / Mildly Spoiled)
    - Quality score (0–100)
  - **Action Triggers:**
    - Notify staff
    - Automatic sorting
    - Disposal alert
    - Re-routing in supply chain
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## 7. User Interface

- **Dashboard:**
  - Quality trends, real-time camera feed, batch inspection results
- **Mobile App:**

- Upload image, view results, feedback
- **Tools:**
  - Web: React / Angular + Flask / Node.js
  - App: Flutter / Android Studio

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## 8. Monitoring & Feedback Loop

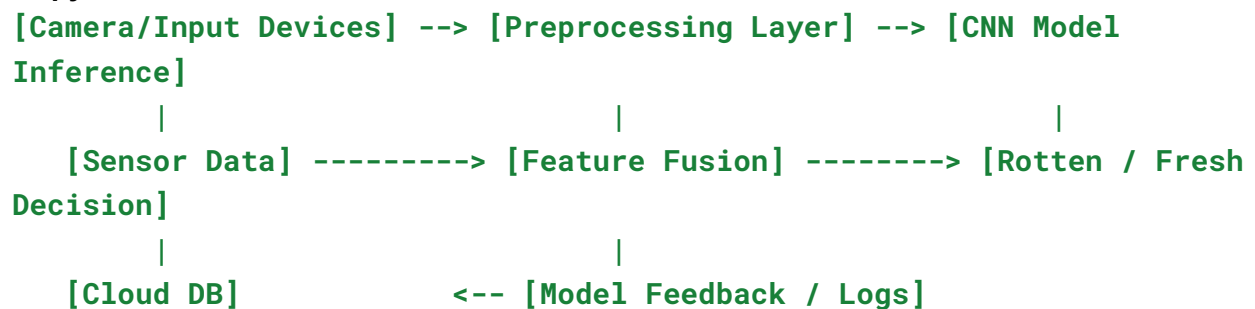
- **Monitoring:**
  - Model drift
  - Accuracy tracking
  - Manual override logs
- **Feedback Loop:**
  - Human review of misclassified data
  - Re-train model with new images

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### Diagram Suggestion

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## Technologies Summary

Layer	Tools/Tech
Input	Cameras, IoT Sensors, Raspberry Pi
Storage	AWS S3, Firebase, SQL
Processing	OpenCV, Pandas, TensorFlow, NumPy
AI/ML Model	CNN, PyTorch, TensorFlow, YOLO
Inference	Edge Devices, Flask APIs, AWS/GCP/Azure
Dashboard/App	React, Angular, Flutter, Power BI, Tableau
Monitoring	Prometheus, Grafana, custom logging