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PROJECT TITLE: AI-EBPL-Quality Control in Manufacturing

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Problem Definition & Design Thinking

**Title: Smart Freshness Detector for Fruits and Vegetables**

# **Problem Statement:**

In the agriculture and food industry, determining the freshness of fruits and vegetables is crucial to reduce food waste, ensure consumer health, and maintain supply chain efficiency. Traditional methods of assessing freshness are often manual, subjective, and time-consuming. There is a pressing need for an automated, objective, and accessible solution to assess produce quality in real time.

# **Target Audience:**

- Farmers and suppliers ensuring post-harvest quality.

- Retailers and supermarkets monitoring inventory.

- Cold chain logistics companies optimizing storage and transportation.

- Consumers aiming to identify spoilage before purchase or use.

# **Objectives:**

- To develop an AI-powered system capable of detecting the freshness level of fruits and vegetables using image input.

- To enhance detection accuracy by integrating sensor data (temperature and humidity).

- To build a user-friendly Streamlit app for accessibility across devices.

- To enable real-time feedback and freshness tracking, reducing food waste.

- To ensure secure handling of collected data and provide multilingual support.

# **Design Thinking Approach:**

## **Empathize:**

Understanding the pain points of farmers, vendors, and consumers who face losses due to unnoticed spoilage or poor storage conditions.

## **Key User Concerns:**

- Accuracy and trust in AI predictions.

- Accessibility for users with limited tech knowledge.

- Ease of use on mobile and low-resource devices.

- Real-time updates without internet dependency in remote locations.

**Define :**

Consumers, vendors, and storage facilities need a reliable, real-time solution to monitor freshness and environmental conditions. The lack of automation in freshness detection limits efficiency and accuracy in decision-making, especially in large-scale or remote operations.

Our project addresses this gap by developing a Smart Freshness Detector that combines image-based AI analysis with environmental sensor data to deliver an accurate, real-time assessment of fruit and vegetable freshness.

# **Key Features Required:**

- AI model (CNN) trained on image datasets to classify produce as Fresh, Moderately Fresh, or Spoiled.

- DHT11 sensor integration to factor in environmental conditions.

- Simple and intuitive Streamlit-based interface for real-time predictions.

- Graphical and color-coded results to indicate freshness status.

- Historical logging and visualization of freshness trends.

- Support for edge deployment (e.g., Raspberry Pi) for offline use.

- Optional voice assistance and multi-language support for inclusive access.

# **Ideate:**

- A mobile/web-based app where users upload an image and get freshness feedback.

- Integration of IoT sensors (like DHT11) for enhanced contextual analysis.

- Alert system for notifying about spoilage in bulk storage.

# **Brainstorming Results:**

- AI-driven image classification using CNN for high-accuracy predictions.

- Sensor-based enhancement using DHT11 to assess spoilage risk due to temperature/humidity.

- Dashboard interface to show freshness status, temperature, and humidity.

- Real-time alerts for spoilage risk using thresholds.

- Multilingual and voice-assist features for better accessibility.

- Gamification (e.g., freshness score tracking) to engage users in reducing food waste.

# **Prototype:**

1. Upload an image of a fruit/vegetable.
2. The AI model classifies freshness.
3. The app displays:
   * Predicted freshness category
   * Current temperature and humidity
   * Recommendation (e.g., "Consume soon", "Store in fridge", "Discard")

# **Key Components of Prototype:**

- CNN model trained on annotated image dataset.

- DHT11 sensor with Arduino/Raspberry Pi to capture real-time environmental data.

- Streamlit interface to display results and collect user input.

- Logic to combine image and sensor data for more accurate outcomes.

- Database (optional) for storing historical records and trend analysis.