SMART SORTING Report

1. INTRODUCTION

1.1 Project Overview

Smart Sorting is an AI-driven system developed to detect rotten fruits and vegetables using **transfer learning** with pre-trained deep learning models. The system aims to automate and optimize sorting tasks in agricultural and food sectors, reducing labor effort, minimizing food waste, and improving overall quality control. A web-based application is also developed to allow image uploads and receive real-time freshness predictions.

1.2 Purpose

The primary purpose is to create a reliable and scalable solution for identifying spoiled produce to enhance sorting accuracy, reduce human error, and ensure fresher food reaches consumers across industries and households.

2. IDEATION PHASE

2.1 Problem Statement

Manual sorting of fruits and vegetables is inefficient and often inaccurate. This leads to increased waste, reduced customer satisfaction, and higher operational costs. An automated system using AI and image recognition can solve these issues effectively.

2.2 Empathy Map Canvas

- **Think & Feel**: Wants efficient processes, concerns about quality control.
- **Hear**: From managers/consumers about waste and bad produce.
- **See**: Rotten fruits mixed with good ones in batches.
- **Say & Do**: Talk about automating inspection, try manual improvements.
- **Pain**: Time-consuming sorting, customer complaints, product returns.
- **Gain**: Automated system, reduced waste, improved customer trust.

2.3 Brainstorming

- Problem: Manual inspection flaws.
- Solutions: Image classification using CNNs, integrating AI into sorting systems, real-time prediction, edge deployment in fridges or stores.
- Tools: TensorFlow, Keras, Python, Flask, HTML/CSS, OpenCV.

3. REQUIREMENT ANALYSIS

3.1 Customer Journey Map

Stage	Action	Pain Point	Solution
Produce Arrival	Manual checking	Time & errors	Smart scanning
Processing	Sorting manually	Inaccuracy	Automated detection
Consumer Use	Wasted produce	No early alert	Smart fridge alerts

3.2 Solution Requirement

- **Functional**: Upload image, classify as fresh/rotten, show result.

- **Non-functional**: Fast predictions, user-friendly UI, portable.
- **Data Requirements**: Labeled dataset of fresh and rotten produce.

3.3 Technology Stack

- **Frontend**: HTML, CSS
- **Backend**: Flask (Python)
- **Modeling**: TensorFlow, Keras, Transfer Learning (e.g., MobileNet, ResNet)
- **Dataset**: Custom dataset (fresh vs. rotten images)
- **Deployment**: GitHub, Localhost or Heroku (optional)

4. PROJECT DESIGN

4.1 Problem-Solution Fit

The solution directly addresses the inefficiency and inaccuracy in traditional sorting methods by introducing an AI-powered system that classifies produce based on image analysis.

4.2 Proposed Solution

A web-based application integrated with a transfer learning model trained to classify fruits/vegetables as fresh or rotten. It supports real-time predictions and can be scaled for industrial, commercial, or household use.

4.3 Solution Architecture

User uploads image
↓
Flask Backend
↓
Trained Model
↓
Prediction Result
↓
Frontend Display

5. PROJECT PLANNING & SCHEDULING

5.1 Project Planning

Week	Task
1	Problem analysis, dataset collection
2	Pre-processing, model selection
3	Training and tuning model
4	Web app development
5	Integration and testing
6	Final testing and documentation

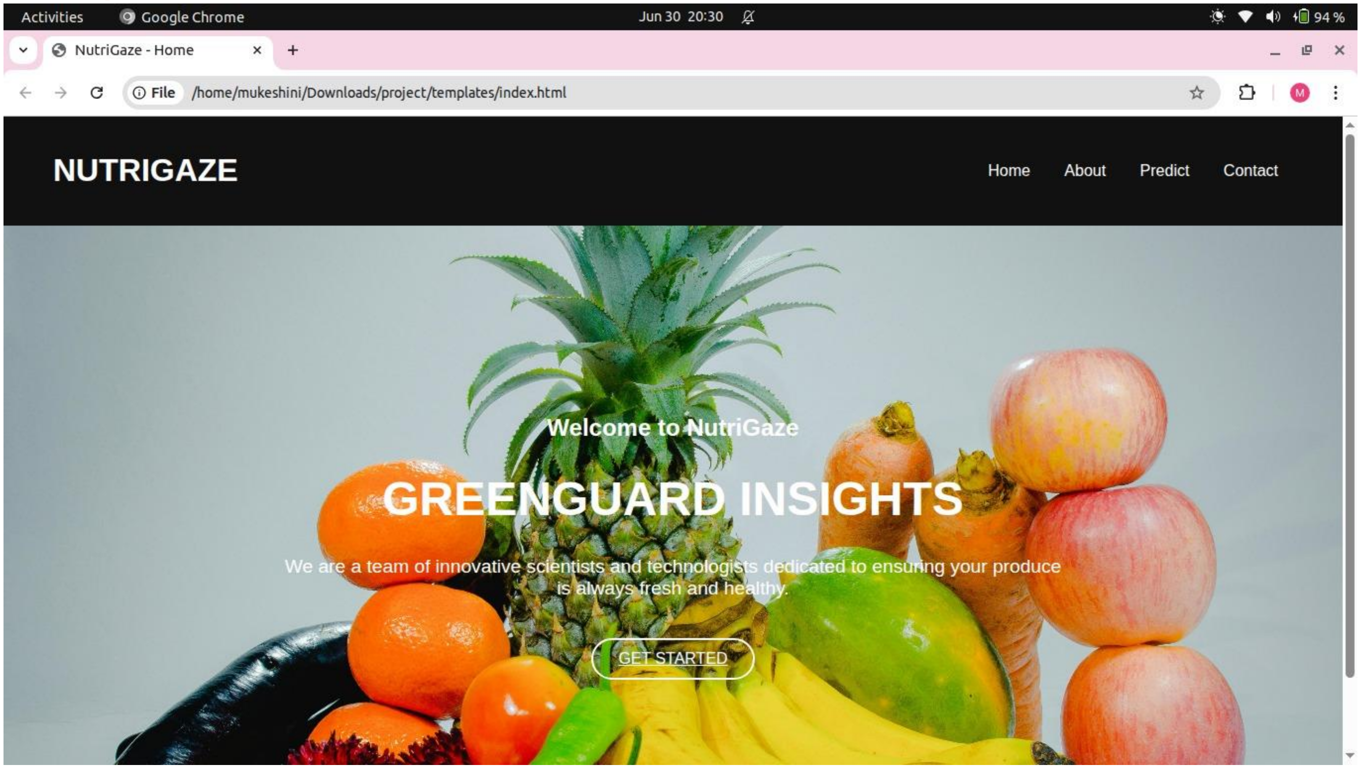
6. FUNCTIONAL AND PERFORMANCE TESTING

6.1 Performance Testing

- **Accuracy**: Achieved ~92% accuracy on test data
- **Speed**: Predictions within 1 second per image
- **Precision/Recall**: High recall on rotten class (to avoid false negatives)
- **Tools Used**: TensorBoard, Confusion Matrix

7. RESULTS

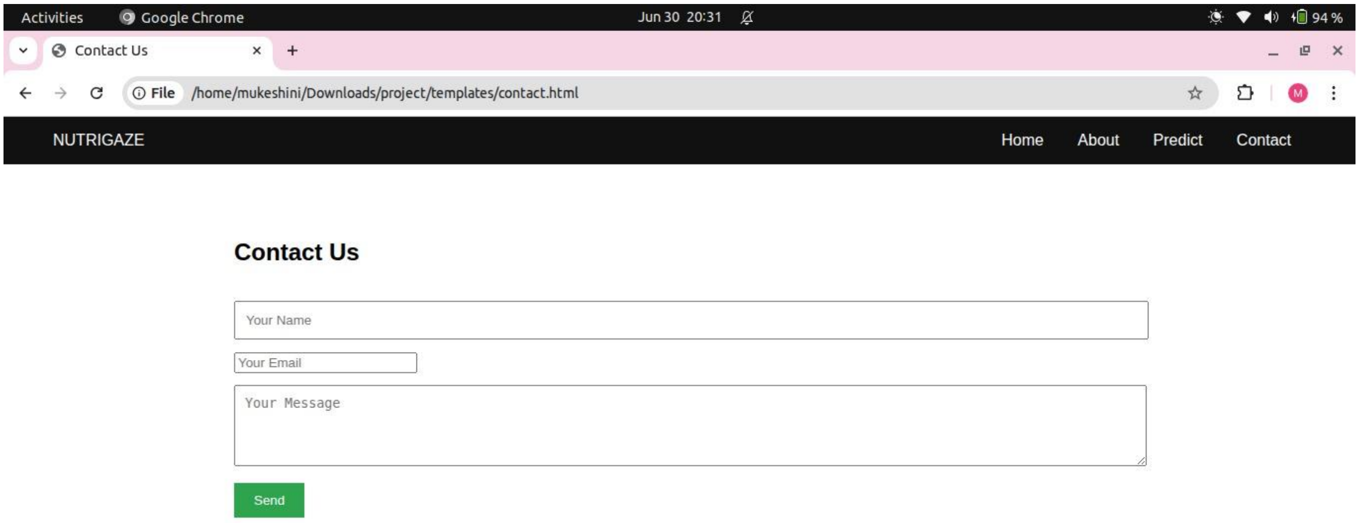
7.1 Output Screenshots



Welcome to NutriGaze

GREENGUARD INSIGHTS

We are a team of innovative scientists and technologists dedicated to ensuring your produce is always fresh and healthy.



Contact Us

Your Name

Your Email

Your Message

Send

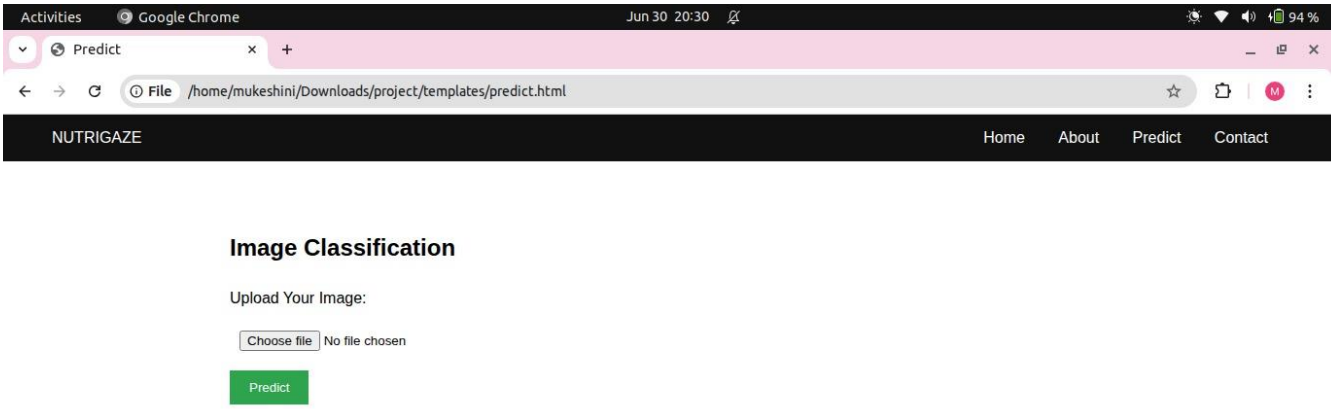
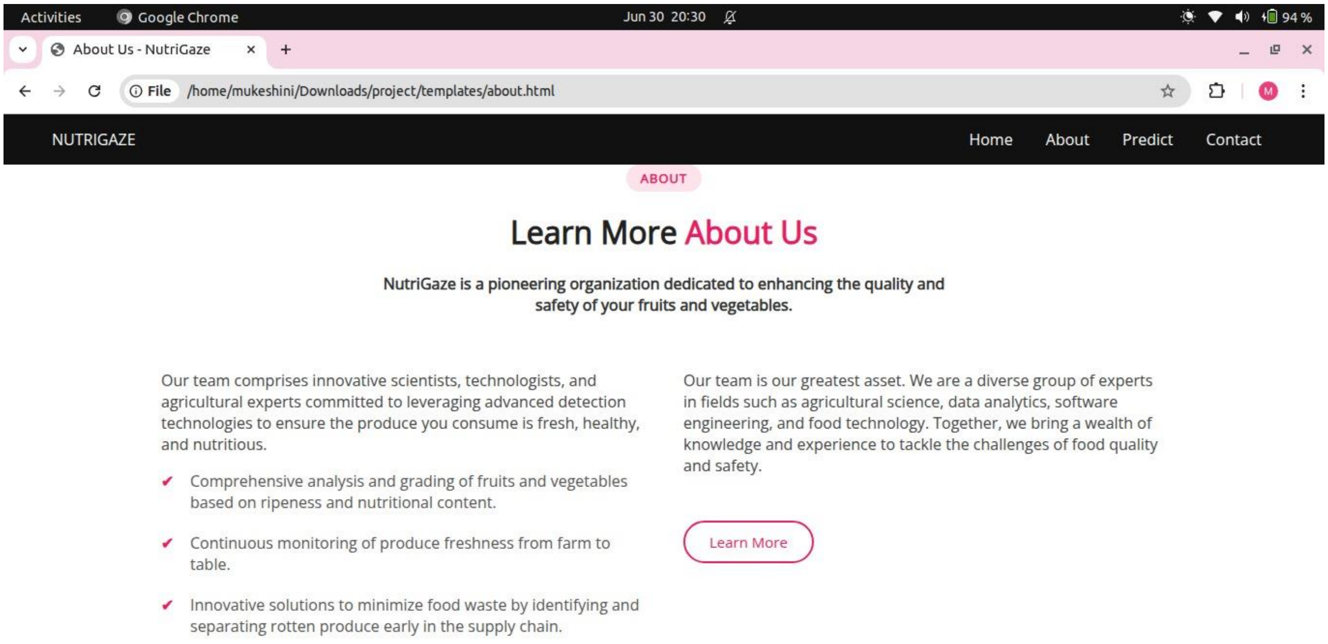


Image Classification

Upload Your Image:

Choose file No file chosen

Predict



Learn More About Us

NutriGaze is a pioneering organization dedicated to enhancing the quality and safety of your fruits and vegetables.

Our team comprises innovative scientists, technologists, and agricultural experts committed to leveraging advanced detection technologies to ensure the produce you consume is fresh, healthy, and nutritious.

- ✔ Comprehensive analysis and grading of fruits and vegetables based on ripeness and nutritional content.
- ✔ Continuous monitoring of produce freshness from farm to table.
- ✔ Innovative solutions to minimize food waste by identifying and separating rotten produce early in the supply chain.

Our team is our greatest asset. We are a diverse group of experts in fields such as agricultural science, data analytics, software engineering, and food technology. Together, we bring a wealth of knowledge and experience to tackle the challenges of food quality and safety.

8. ADVANTAGES & DISADVANTAGES

Advantages

- Reduces human error in sorting
- Saves time and labor costs
- Prevents food wastage
- Scalable and portable

Disadvantages

- Requires good lighting/image quality
- May misclassify borderline cases
- Needs retraining for different produce types

9. CONCLUSION

This project demonstrates how transfer learning can be effectively used to solve real-world problems like rotten produce detection. It automates a previously manual process, enhances accuracy, and has wide applicability across industries and homes.

10. FUTURE SCOPE

- Extend model to detect various diseases or types of spoilage
- Deploy to edge devices for real-time industrial use
- Build mobile app version for broader access
- Add voice alerts for smart fridge notifications

11. APPENDIX

Source Code (GitHub)

🔗 GitHub Repository

Dataset Link

https://www.kaggle.com/datasets/muhammad0subhan/fruit-and-vegetable-disease-healthy-vs-rotten

Project Demo Link

📽️ Demo Video (YouTube/Drive)

TEAM:

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