Project Report

Title:

CleanTech: Transforming Waste Management with Transfer Learning

1. INTRODUCTION

Project Overview:

CleanTech is a smart waste classification system that uses transfer learning with VGG16 to categorize waste images into biodegradable, recyclable, or trash. It is implemented as a web-based platform.

Purpose:

The purpose is to simplify and automate municipal waste segregation using AI, enabling eco-friendly disposal, reducing landfill, and improving recycling practices.

2. IDEATION PHASE

Problem Statement:

Improper waste segregation leads to inefficient recycling and pollution. Manual sorting is error-prone and not scalable.

Empathy Map Canvas:

- User: Municipal workers, citizens

- Need: Simple tool for waste classification

- Pain: Confusion about waste categories, no awareness

- Gain: Easy, instant, image-based classification

Brainstroming:

We explored mobile apps, barcode scanning, and finally chose an AI-based visual classification system due to its efficiency and simplicity.
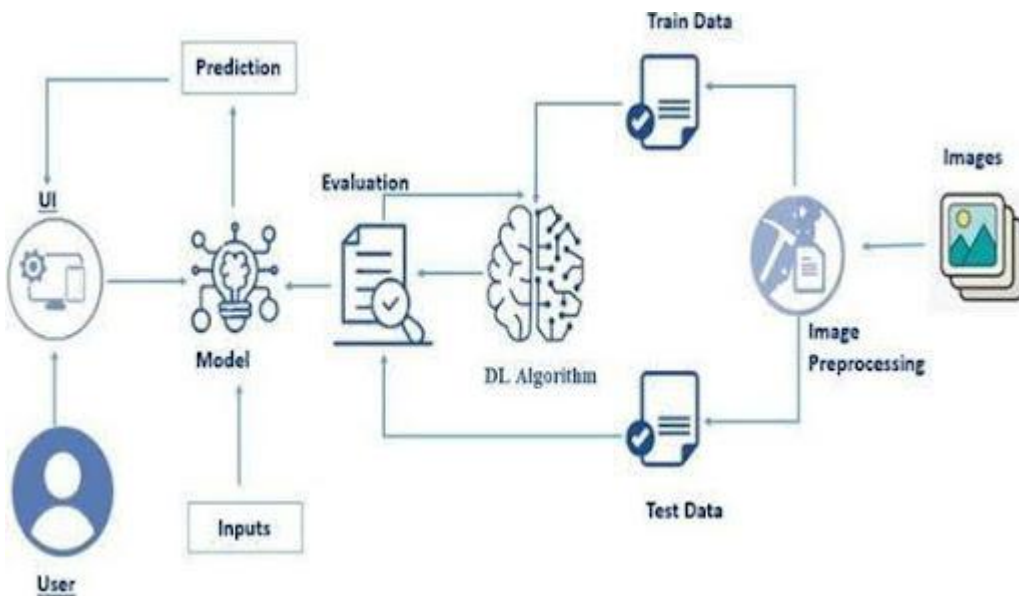
3. REQUIREMENT ANALYSIS

Customer Journey Map:

User visits website Uploads waste image Sees classification Uses info for disposal

Solution Requirement:

- Frontend: HTML, Bootstrap

- Backend: Flask, Python

- Model: VGG16 (Keras)

- Hosting: Local/Cloud

- Accuracy > 90%

Data Flow Diagram:

Technology Stack:

- Frontend: HTML, CSS, JS, Bootstrap

- Backend: Python, Flask

- Model: TensorFlow + Keras (VGG16)

- Tools: Anaconda, Jupyter, VS Code

4. **PROJECT DESIGN**

Problem Solution Fit:

A real need exists for quick waste identification. Our solution fits perfectly as it uses only an image and gives fast results.

Proposed Solution:

A user-friendly platform that uses a CNN model to identify waste category and guide the user in proper disposal.

Solution Architecture:

Frontend uploads image Backend receives and predicts using model Returns prediction UI displays it

5. PROJECT PLANNING & SCHEDULING

Project Planning:

- Week 1: Dataset preparation

- Week 2: Model training

- Week 3: Web app integration

- Week 4: Testing and documentation

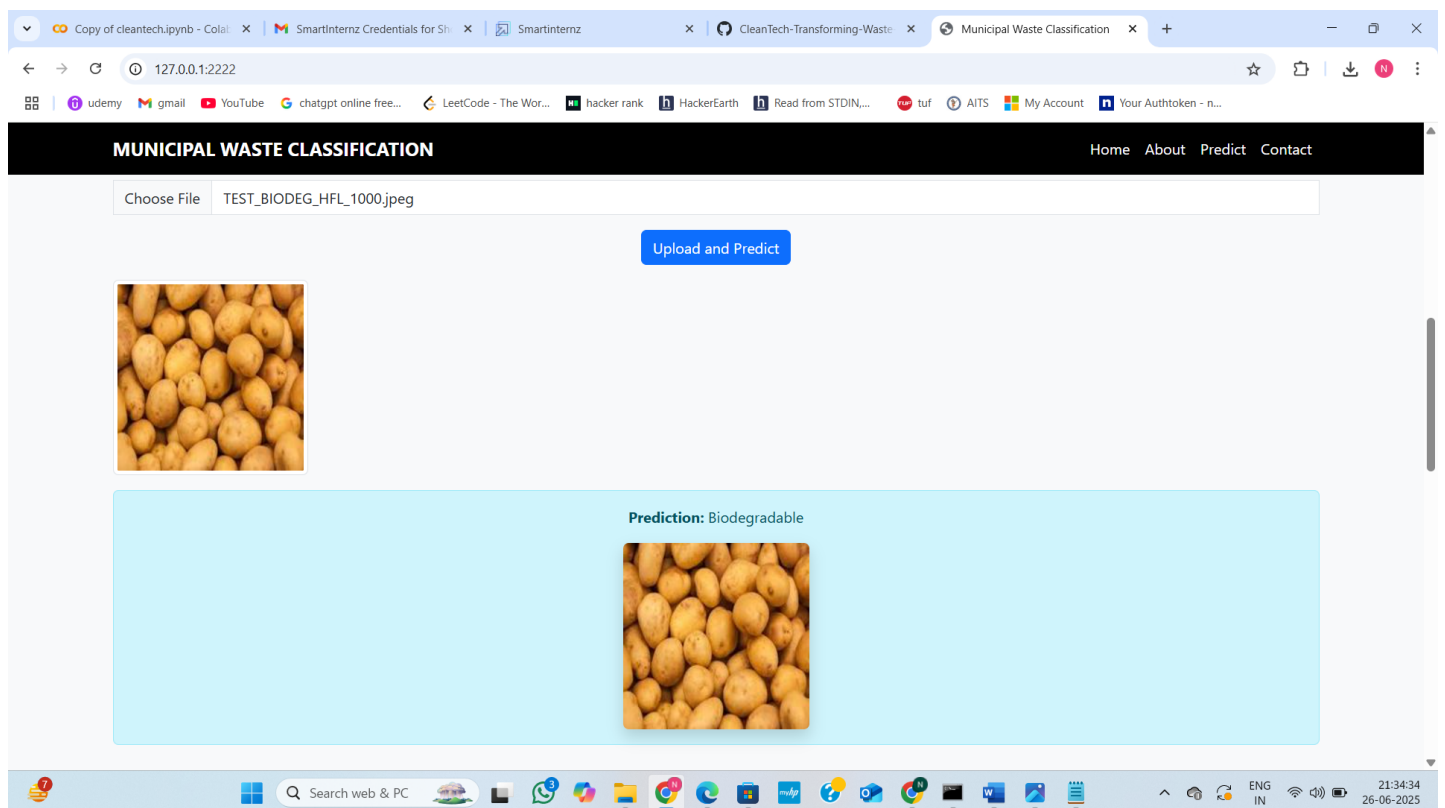## 6. FUNCTIONAL AND PERFORMANCE TESTING

Performance Testing:

Tested with 50+ images. Average response time is under 2 seconds. Accuracy above 90% with proper lighting and image clarity.
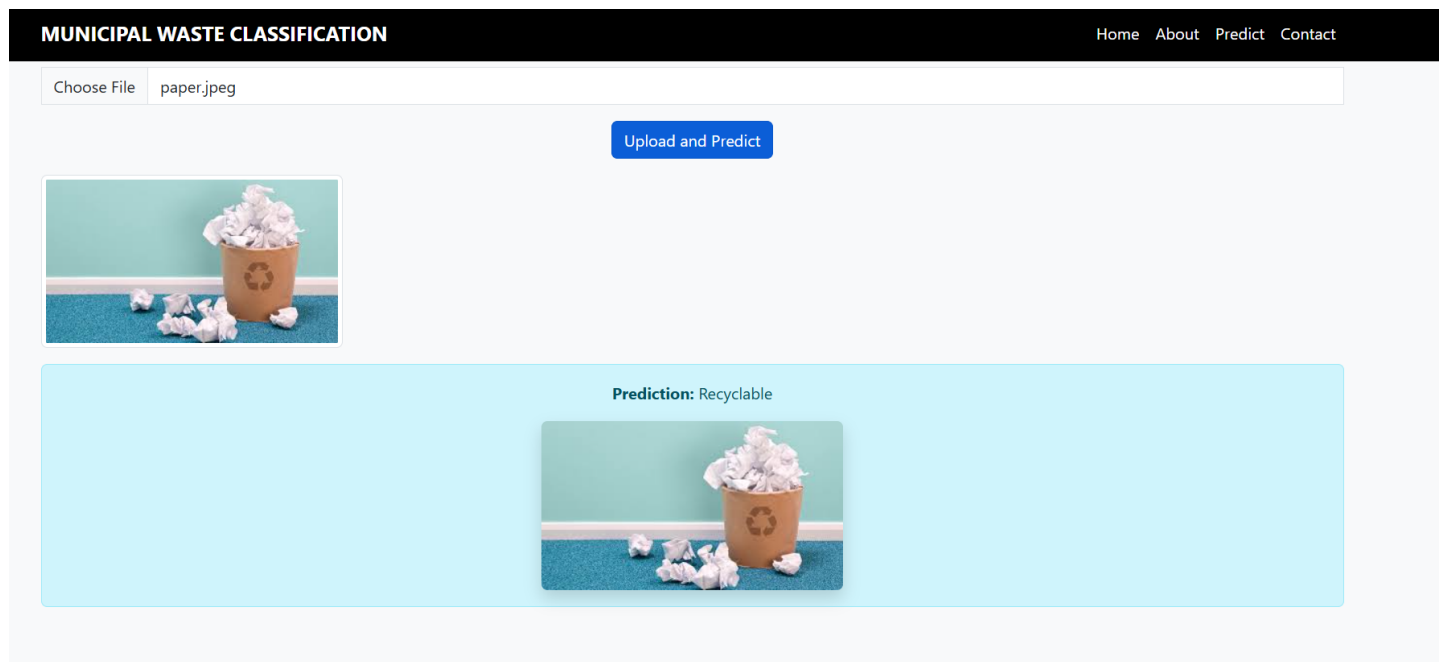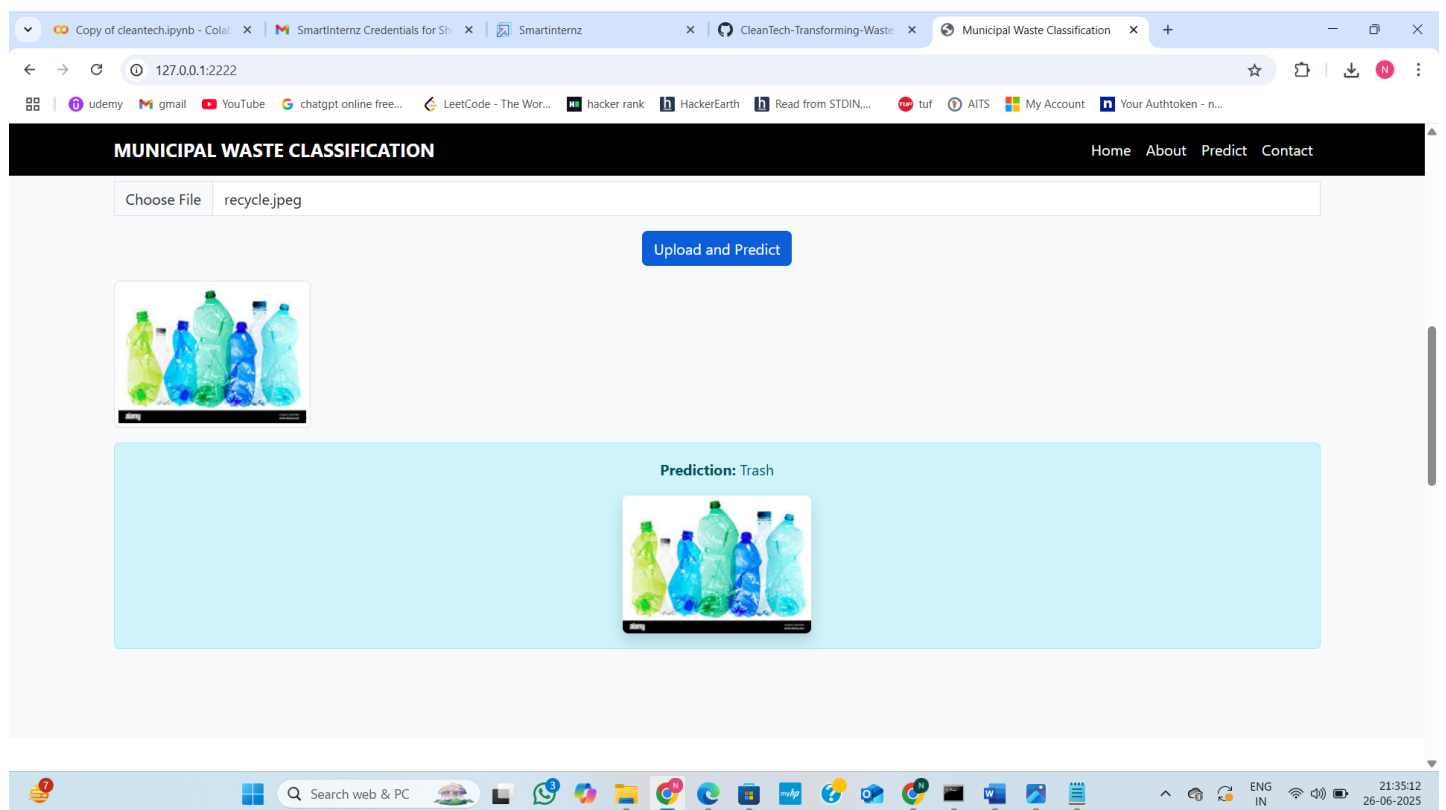
7. RESULTS

Output Screenshots:

Output for biodegradable:

Output for Recyclable:

Output for Trash:

8 ADVANTAGES & DISADVANTAGES

Advantages:

- Accurate prediction

- Easy-to-use interface

- Environmentally beneficial

Disadvantages:

- Needs good image quality

- Model limited to trained classes

9 CONCLUSION

CleanTech bridges technology and sustainability, offering a practical AI solution for everyday waste problems.

It empowers users and municipalities alike.

10 FUTURE SCOPE

- Mobile app version with TensorFlow Lite

- Smart bin integration

- Cloud hosting

- User feedback integration

11. APPENDIX

Source Code: Available upon request

Dataset Link: https://www.kaggle.com/datasets accessed for public waste images

GitHub & Project Demo Link:

Github:

https://github.com/Nandini-muddangala/CleanTech-Transforming-Waste-Management-with-Transfer-Learning.git

Demo link :-

https://drive.google.com/file/d/1MzKP0RcBQ2VvcytN7-3jnnwvgmUqA1OAi/view?usp=drivesdk