1.INTRODUCTION

1.1 Project Overview
CleanTech is a full-stack web-based application that classifies waste into categories like *trash*, *biodegradable*, and *others* using an image uploaded by the user. By leveraging machine learning and computer vision, the system aims to promote responsible waste segregation and environmental awareness through an easy-to-use online interface.

1.2 Purpose
The core objective of CleanTech is to simplify and automate the waste classification process. It provides users with immediate feedback on waste type through image-based AI predictions, encouraging sustainable disposal practices.

2.IDEATION PHASE

2.1 Problem Statement
Manual waste segregation is error-prone, time-consuming, and often overlooked, especially in urban households. There is a need for a simple tool that can classify waste efficiently and reduce human error in segregation.

2.2 Empathy Map Canvas

- **Think**: "Where should I throw this?"
- **Feel**: Confused and unsure about disposal categories
- **See**: Unsorted trash bins and overflowing waste
- **Say**: "I wish I knew what type of waste this is."
- **Do**: Throw all waste together, skip segregation
- **Gain**: Knowledge and habit of proper disposal
- **Pain**: Lack of awareness and classification tools

2.3 Brainstorming
Potential Features Identified:

- Web interface to upload waste images
- AI model to predict waste category
- Instant display of classification result
- Educational info or tips based on waste type

3.REQUIREMENT ANALYSIS

3.1 Customer Journey Map

User Flow:
Open Website → Upload Image → Classification Result → Suggested Disposal Inf

3.2 Solution Requirements

Functional:

- Image upload and preview
- Backend ML model for waste classification
- Display of result on the same page

Non-Functional:

- Mobile-responsive UI
- Fast model inference (<2 seconds)
- Secure file handling

3.2 Data Flow Diagram (Level 1)

User uploads image → Frontend sends to backend → ML model predicts class → Result returned and displayed

3.4 Technology Stack

Frontend: React.js or HTML/CSS + JavaScript
Backend: Flask or Node.js
ML Model: CNN-based model trained using TensorFlow/Keras
Others:

- Python for model logic
- Numpy, OpenCV for preprocessing
- REST API for integration between frontend and model

4.PROJECT DESIGN

4.1 Problem Solution Fit
CleanTech bridges the gap between citizens and eco-friendly disposal by classifying waste instantly through AI, making segregation more accessible and scalable.

4.2 Proposed Solution
A lightweight web app that allows users to upload an image and get immediate classification feedback using a trained deep learning model.

4.3 Solution Architecture

- **Frontend:** Handles file input and UI
- **Backend:** Receives image, preprocesses it, and uses model to classify
- **Model:** Outputs class (e.g., biodegradable, non-biodegradable, recyclable)
- **Response:** Classification result shown to user with guidance

5.PROJECT PLANNING & SCHEDULING

5.1 Project Planning Timeline

Week Task Description

1   Dataset collection and preprocessing

2   Model design, training, and evaluation

3   Backend Flask API for image classification

4   Frontend UI and integration

5   Testing, optimization, and bug fixes

6.FUNCTIONAL AND PERFORMANCE TESTING

- Image inference time: ~1s
- Accuracy: ~90% on test set
- Model size: Optimized for deployment (~20MB)
- UI Load Test: Checked on mobile and desktop

7.RESULTS

7.1 Output Screenshots

- Home Page with Upload Option
- Waste Image Upload (e.g., banana peel)
- Classification Output: **Biodegradable**
- Suggested Message: "Dispose in compostable bin"
- (Screenshots should be attached in the report or appendix.)

8.ADVANTAGES & DISADVANTAGES

Advantages:

- Promotes waste segregation
- Easy and fast to use
- Educational for users of all ages

Disadvantages:

- Requires clear image input
- May misclassify rare or ambiguous items
- Internet required for usage

9.CONCLUSION

CleanTech provides a simple, AI-powered waste classifier accessible through any web browser. By enabling users to classify their waste, it contributes to better environmental practices and awareness, especially in urban areas.

10.FUTURE SCOPE

- Support for more waste categories (e-waste, hazardous)
- Mobile app version with camera integration
- Multilingual support
- Integration with smart bin systems
- Gamified rewards for responsible disposal

11.APPENDIX

- **GitHub Repo:** https://github.com/Nagababu23/CleanTech.git
- **Demo Link:**
  https://drive.google.com/file/d/1ooXKiXfBQ_MuZMjs5D6PSGrsD1gdSTzt/view?usp=drive_link
- **Dataset Used:** [WasteNet / Custom Labeled Images]
- **Model Type:** CNN (ResNet/MobileNet-based classifier)