University Teaching Department

Chhattisgarh Swami Vivekanand Technical University, Bhilai

B.Tech. (HONS.)

Computer Science and Engineering(AI)

Session: 2025

Semester:5th

Minor-Project Report

Faculty In-charge:

Mr. Rishabh Shukla

Submitted by: -

Group : 9

Branch: CSE(AI)

CERTIFICATE

This is to certify that the Minor Project titled **"Garbage Classifier for Waste Management"** has been completed and submitted by the following students of **B.Tech (Hons.) in the Department of Computer Science and Engineering [A.I], 5th Semester**, **University Teaching Department**, during the academic year **2025–2026:**

1. **Abhay Singh Sisoodiya**
2. **Abhinav Anand**
3. **Aditya Verma**
4. **Anshul Yadav**
5. **Aman Banajre**
6. **Harsh Kumar Chandrakar**

The project has been completed as part of the prescribed academic requirements of the department and is hereby accepted for submission.

Internal Signature **External Signature**

DECLARATION

We, the students of B.Tech (Hons.) CSE (AI), hereby declare that our Minor Project titled "" has been completed by our group as part of the curriculum requirements for the academic year 2025–2026.

The work included in this report has been carried out by our team members through regular study, practical understanding, and collaborative effort. Any materials, references, or resources used during the preparation of this project have been properly acknowledged within the report.

Team Members:

1. Abhay Singh Sisoodiya | 3000127230
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Date:
Place: University Teaching Department

ACKNOWLEDGMENT

We would like to express our sincere thanks to the **Department of Computer Science and Engineering of University Teaching Department**, for giving us the opportunity to work on our Minor Project titled **"Garbage Classifier for Waste Management"** as part of our academic curriculum.

We are grateful to the faculty members and staff of the department for providing guidance, support, and a helpful learning environment throughout the duration of this project. Their encouragement and cooperation made the completion of this work possible.

We also appreciate the support of our classmates, friends, and families for motivating us during the project. Lastly, we acknowledge the efforts and teamwork of all group members in successfully completing this Minor Project.

Team Members
(Group of 6 Students)

INDIVIDUAL CONTRIBUTION REPORT

Abhay Singh Sisoodiya

Garbage Classifier for Waste Management

AI-Powered Garbage Segmentation System

Primary Roles

- Model Development
- Cloud Deployment
- System Integration

BTech (Hons.) CSE - Artificial Intelligence

5th Semester | Group 09

University Teaching Department (UTD)

CSVTU, Bhilai

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Contents

1 Role Overview

Assigned Responsibilities:

▷ **Model Development** — YOLOv8 training and optimization

▷ **Cloud Deployment** — Hugging Face Spaces deployment

▷ **System Integration** — End-to-end pipeline development

1.1 Contribution Summary

Area	Key Contributions
Model Development	Trained YOLOv8-Large segmentation model
Training Config	Optimized hyperparameters for 200 epochs
Cloud Deployment	Deployed on Hugging Face Spaces
System Integration	Created unified inference pipeline

2 Model Development

2.1 Model Selection

Selected **YOLOv8-Large Segmentation** (yolov8l-seg) for:

✓ State-of-the-art instance segmentation performance

✓ Balance between accuracy and inference speed

✓ Pre-trained weights for effective transfer learning

✓ Native polygon mask generation support

2.2 Training Configuration

Table 1: Optimized Training Hyperparameters

Parameter	Value	Rationale
Base Model	yolov8l-seg.pt	Large model for accuracy
Epochs	200	Sufficient for convergence
Batch Size	16	GPU memory optimized
Image Size	640×640	Standard YOLO input
Optimizer	AdamW	Better weight decay
Learning Rate	0.0003	Tuned for stability
Weight Decay	0.001	Regularization
Patience	50	Early stopping

2.3 Training Implementation

Listing 1: YOLOv8 Training Script

```python
from ultralytics import YOLO

# Load pre-trained model
model = YOLO('yolov8l-seg.pt')

# Train with optimized configuration
results = model.train(
    data='data.yaml',
    epochs=200,
    imgsz=640,
    batch=16,
    optimizer='AdamW',
    lr0=0.0003,
    lrf=0.01,
    weight_decay=0.001,
    patience=50,
    cos_lr=True,
    amp=True,  # Mixed precision
    project='garbage_segmentation',
    name='yolov8l_seg_best'
)
```

3 Cloud Deployment

3.1 Platform Selection

> **Deployed on Hugging Face Spaces**
>
> https://huggingface.co/spaces/Shisodiya/garbage-segmentation

3.2 Deployment Process

Step 1: Created Space with Gradio SDK configuration

Step 2: Configured Git LFS for 92MB model file

Step 3: Resolved Gradio/huggingface_hub version conflicts

Step 4: Tested and validated live deployment

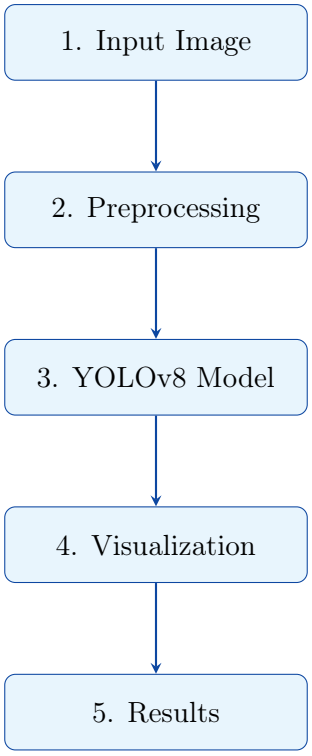
3.3 Configuration Files

Listing 2: Hugging Face Space Configuration

```
---
title: Garbage Classifier for Waste Management
emoji: trash_can
sdk: gradio
sdk_version: 3.50.2
app_file: app.py
license: mit
---
```

4 System Integration

4.1 Pipeline Architecture



4.2 Core Integration Code

Listing 3: Integrated Inference Pipeline

```
class GarbageSegmentor:
    def __init__(self, weights_path='results/best.pt'):
        self.model = YOLO(weights_path)
```

```
        self.class_names = [
            'biological', 'cardboard', 'glass',
            'metal', 'paper', 'plastic'
        ]

    def segment(self, image):
        results = self.model.predict(image)
        masks = results[0].masks
        boxes = results[0].boxes
        return masks, boxes

    def visualize(self, results):
        return results[0].plot()
```

5 Technical Achievements

Key Accomplishments:

⋆ Successfully trained YOLOv8-Large on 481 images

⋆ Achieved high mAP scores for all 6 garbage classes

⋆ Deployed production-ready application on cloud

⋆ Created efficient, modular inference pipeline

⋆ Resolved complex deployment dependencies

6 Skills Demonstrated

Category	Skills
Deep Learning	PyTorch, YOLOv8, Transfer Learning
Computer Vision	Segmentation, Object Detection
Cloud/DevOps	Hugging Face Spaces, Git LFS
Programming	Python, OOP, Modular Design
Tools	Ultralytics, Gradio, OpenCV