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
2. Abhinav Anand | 3000127230
3. Aditya Verma | 3000127230
4. Anshul Yadav | 3000127230
5. Aman Banajre | 3000127230
6. Harsh Kumar Chandrakar | 3000127230

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

Harsh Kumar Chandrakar

Garbage Classifier for Waste Management

AI-Powered Garbage Segmentation System

Primary Roles

Data Collection
Model Development
Integration Support

BTech (Hons.) CSE - Artificial Intelligence

5th Semester | Group 09

University Teaching Department (UTD)
CSVTU, Bhilai

December 2025

Contents

1 Role Overview

Assigned Responsibilities:

Data Collection — Dataset preparation and verification

Model Development — Training support and tuning

Integration Support — Component integration assistance

2 Data Collection

2.1 Dataset Preparation

Prepared and validated the training dataset:

- ✔ Downloaded dataset from Roboflow Universe
- ✔ Verified annotation quality and format
- ✔ Organized train/validation splits
- ✔ Created data.yaml configuration file

2.2 Data Configuration

Listing 1: Dataset Configuration File

```yaml
# data.yaml for YOLOv8
path: ./data
train: train/images
val: valid/images

# Class definitions
names:
  0: biological
  1: cardboard
  2: glass
  3: metal
  4: paper
  5: plastic

nc: 6  # Number of classes
```

2.3 Annotation Verification

Table 1: Annotation Quality Checks

Check	Count	Status
Total images	481	✔
Missing labels	0	✔
Invalid polygons	0	✔
Class balance	Acceptable	✔
Image quality	Good	✔

3 Model Development Support

3.1 Hyperparameter Experiments

Table 2: Training Experiments Conducted

Experiment	LR	Batch	mAP	Status
Baseline	0.01	8	0.72	Baseline
Higher batch	0.01	16	0.74	Improved
Lower LR	0.001	16	0.76	Better
Final	**0.0003**	**16**	**0.78**	Best

3.2 Augmentation Configuration

Listing 2: Data Augmentation Settings

```
augmentation_config = {
    'hsv_h': 0.015,       # Hue variation
    'hsv_s': 0.5,         # Saturation
    'hsv_v': 0.3,         # Value/brightness
    'degrees': 10,        # Rotation
    'translate': 0.1,     # Translation
    'scale': 0.25,        # Scale variation
    'fliplr': 0.5,        # Horizontal flip
    'mosaic': 0.5,        # Mosaic augment
    'mixup': 0.05,        # MixUp
    'copy_paste': 0.3,    # Copy-paste
}
```

3.3 Training Monitoring

Tracked loss curves during training

- Identified convergence patterns
- Monitored GPU memory usage
- Logged training metrics per epoch

4 Integration Support

4.1 Component Testing

- Verified model loading functionality
- Tested preprocessing pipeline
- Validated visualization output
- Confirmed Gradio interface operation

4.2 Bug Fixes

Table 3: Issues Identified and Fixed

Issue	Solution
Color space mismatch	Fixed BGR/RGB conversion
Model path error	Corrected weights file path
Class mapping issue	Aligned IDs with names
Output format	Standardized return types

5 Technical Achievements

Key Accomplishments:

- Prepared and validated training dataset
- Contributed to hyperparameter optimization
- Supported model training and monitoring
- Assisted in component integration
- Identified and fixed integration bugs

6 Skills Demonstrated

Category	Skills
Data	Preparation, validation, annotation
ML	Training workflows, hyperparameter tuning
Debugging	Troubleshooting, bug fixing
Collaboration	Team coordination