# 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

# Aditya Verma

*Garbage Classifier for Waste Management*

AI-Powered Garbage Segmentation System

**Primary Roles**

Utility Development
Deployment Support
Presentation

**BTech (Hons.) CSE - Artificial Intelligence**

5th Semester | Group 09

University Teaching Department (UTD)
CSVTU, Bhilai

**December 2025**

# Contents

# 1 Role Overview

**Assigned Responsibilities:**

**Utility Development** — Preprocessing and visualization

**Deployment Support** — Cloud deployment assistance

**Presentation** — Project presentation preparation

# 2 Utility Development

## 2.1 Image Preprocessing Module

Developed comprehensive image enhancement utilities:

### 2.1.1 CLAHE Implementation

Listing 1: Contrast Enhancement

```python
import cv2

def apply_clahe(image):
    """Apply CLAHE contrast enhancement."""
    lab = cv2.cvtColor(image, cv2.COLOR_RGB2LAB)
    l, a, b = cv2.split(lab)

    clahe = cv2.createCLAHE(
        clipLimit=2.0,
        tileGridSize=(8, 8)
    )
    l = clahe.apply(l)

    lab = cv2.merge([l, a, b])
    return cv2.cvtColor(lab, cv2.COLOR_LAB2RGB)
```

### 2.1.2 Sharpening Filter

Listing 2: Image Sharpening

```python
import numpy as np

def sharpen_image(image):
```

```
    """Apply convolution sharpening."""
    kernel = np.array([
        [0, -1, 0],
        [-1, 5, -1],
        [0, -1, 0]
    ], dtype=np.float32)
    return cv2.filter2D(image, -1, kernel)
```

### 2.1.3 Auto Brightness

Listing 3: Brightness Adjustment

```
def auto_brightness(image):
    """Automatic brightness correction."""
    gray = cv2.cvtColor(image, cv2.COLOR_RGB2GRAY)
    mean = np.mean(gray)

    if mean < 100:  # Too dark
        factor = min(127 / (mean + 1), 2.0)
        return cv2.convertScaleAbs(image, alpha=factor)
    return image
```

## 2.2 Visualization Module

Created result visualization utilities:

| Function | Purpose |
|---|---|
| create_pie_chart() | Generate class distribution chart |
| draw_masks() | Overlay segmentation masks |
| format_summary() | Create detection summary text |

# 3 Deployment Support

## 3.1 Requirements Management

✔ Identified compatible library versions

✔ Resolved Gradio/huggingface_hub conflicts

✔ Created requirements.txt with pinned versions

✔ Tested deployment dependencies

### 3.2 Testing

- Tested local Gradio server functionality
- Verified Hugging Face Spaces compatibility
- Debugged runtime errors
- Validated model loading process

## 4 Presentation Preparation

### 4.1 Content Created

| Section | Content |
|---|---|
| Introduction | Problem statement, motivation |
| Architecture | System design diagrams |
| Implementation | Technical details, code highlights |
| Demo | Screenshots, live demo link |
| Future Scope | Roadmap and improvements |

## 5 Technical Achievements

**Key Accomplishments:**

- Developed robust image preprocessing pipeline
- Created reusable visualization components
- Assisted in successful cloud deployment
- Prepared comprehensive project presentation

## 6 Skills Demonstrated

| Category | Skills |
|---|---|
| Image Processing | OpenCV, NumPy, PIL |
| Visualization | Matplotlib, Chart generation |
| Python | Module development, OOP |
| Deployment | Dependency management |
| Communication | Presentation design |