**Project Report**

**Project Title: A Smart Waste Classification System**

**1. Introduction**

In today's world, proper waste segregation plays a crucial role in environmental conservation and recycling. However, most people struggle with classifying waste into the correct category (Organic, Plastic, Glass, etc.).

This project aims to solve that problem by building a **menu-driven, rule-based waste classifier**. It allows users to:

* Identify the category and action for any waste item
* Add new classification rules
* View all existing rules
* See a summary of waste types

The system is written in **Python** and uses the pandas and numpy libraries.

**2. Objectives**

* Classify a waste item into its correct category
* Suggest the correct disposal method
* Allow users to add new rules dynamically
* Display all classification rules and category summaries
* Build an interactive menu for user input

**3. Tools & Technologies Used**

| **Tool** | **Purpose** |
| --- | --- |
| Python | Programming language |
| pandas | Used for storing and managing rules as a table |
| numpy | Used for counting and summarizing categories |
| PowerShell / Terminal | Running the program |

**4. Features**

* Menu-driven user interface
* Rule-based classification using a table
* Option to add new items and update rules
* Category summary using NumPy
* Simple and beginner-friendly code structure

**5. Code Overview**

**Key Functions:**

* classify(item) – returns the category and action of the item
* add\_rule(item, category, action) – adds a new item to the rules
* show\_rules() – prints all rules
* show\_summary() – counts how many items fall into each category
* show\_menu() – provides user options to interact with the system

**Sample Menu:**

--- Waste Classifier Menu ---

1. Classify a waste item

2. Add a new rule

3. Show all rules

4. Show category summary

5. Exit

**6. Sample Output**

Enter item to classify: plastic bottle

plastic bottle -> Plastic, Recycle

Enter item to classify: tin can

tin can -> Unknown item.

Do you want to add a new rule for this item? yes

Enter category: Metal

Enter action: Recycle

Rule added: tin can -> Metal, Recycle

**7. Team Members**

| **Name** | **Work Done** |
| --- | --- |
| Muneeb ur Rehman | Rule handling, classification logic |
| Emaan Gull | Menu system, user input, summary output |

**8. Conclusion**

This waste classification system makes it easier for users to understand how to properly dispose of everyday waste. It is customizable, easy to extend, and serves as a great learning project for beginners in Python.

**9. Future Improvements**

* Add fuzzy matching or synonyms for better input recognition
* Save and load rules from a file (CSV or JSON)
* Build a graphical user interface (GUI)
* Add AI-based classification using machine learning