DEPARTMENT OF COMPUTER ENGINEERING

FACULTY OF ENGINEERING, UNIVERSITY OF JAFFNA

EC9570 – DIGITAL IMAGE PROCESSING

Assignment

Image Processing Based Smart Waste Management System

Students are required to form their own groups consisting of two members per group. This project carries a total of 15 marks toward the final assessment.

The allocated time for project completion is 12 hours.

INSTRUCTIONS:

You are required to design and implement a smart waste classification system using digital image processing techniques. The objective is to classify waste items into different categories based on images and simulate or automate sorting actions accordingly.

Each member must take responsibility for one or more core modules, such as:

- ✓ Image acquisition and preprocessing
- ✓ Waste item classification
- ✓ Statistical analysis and report generation

Minimum Functional Requirements:

- Accept and process images containing waste items
- Apply image processing techniques to identify and classify items into categories
- Count classified items and categorize them
- Maintain a statistical log/report of the waste processed
- Simulate or visualize sorting or processing actions (e.g., graphical indicators, console messages) — actuator hardware control is optional

Note: Real-time image processing and use of a conveyor belt are optional. Pre-collected datasets or manually captured images are acceptable for classification.

SYSTEM REQUIREMENTS & LIMITATIONS:

Software:

- Python (OpenCV, NumPy, and optionally TensorFlow/PyTorch for classification)
- All datasets used must be cited
- Optional: Any embedded system (e.g., Arduino, Raspberry Pi) for actuator control

Hardware (Optional):

- Camera/webcam for live capture (optional)
- Servo motors or indicator LEDs for sorting (optional)

Limitations:

- System should work for one object per image
- At least 80% accuracy for classification (with validation/testing)
- Local processing only; cloud-based solutions are not allowed
- Use of pre-trained models is allowed only if properly explained and integrated into the system pipeline

Collaboration requirement:

- Use GitHub from the beginning of the project.
- Each team member must work on a separate feature/module and use pull requests for contributions.
- The GitHub contribution history will be reviewed during the demo to verify individual contributions.
- Collaborative planning, modular design, and clean commits are expected.

Submission & evaluation:

- No formal report is required
- Final evaluation will be based on a 10-minute demo and viva
- You must clearly explain the part you contributed during the demo

Marking criteria:

Marks will be awarded based on the functionality demonstrated and your understanding of the work you contributed. GitHub logs will be used to evaluate team collaboration.

No.	Criteria	Max Marks
01	Basic classification pipeline on static images	30
02	Image classification with statistical output	50
03	Correctness and clarity of classification categories chosen by team (marks allocated proportional to correct classification)	70
04	Full demo with proper explanation and GitHub contribution verification	90
05	All above + scalable/efficient design + good collaboration practice and code modularity	100

Bonus Points (Up to 10):

- Recyclability detection
- Efficient use of computational resources
- Use of embedded edge devices
- Model robustness and testing practices