ENGINEERING 240 |
SPRING 2025

PROGRESS REPORT
AUTOMATED SORTING BINS

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Agenda

Slide No	Topic
03	Client Context
04	Problem Definition
05	Project Timeline
06	Work Completed
12	Challenges Encountered
13	Work Remaining
14	Expected Outcomes
15	Questions & Feedback
16	References

Client Context

- UVic ranks **2nd in Canada** and **4th worldwide** for promoting sustainable cities and communities.
- Increased landfill diversion rate from **58% to 74%** (2009–2018) through recycling and composting initiatives.
- Aiming for an **81% diversion rate** as per the latest Strategic Plan.
- Plastic waste and **improper sorting** account for 18% of landfill trash.
- Hartland Landfill closure by 2040 adds pressure to improve waste management systems.
- Collaborate with neighborhood associations and government for resources and insights.
- Introduce incentives for reusable items (e.g., dining discounts for reusable containers).

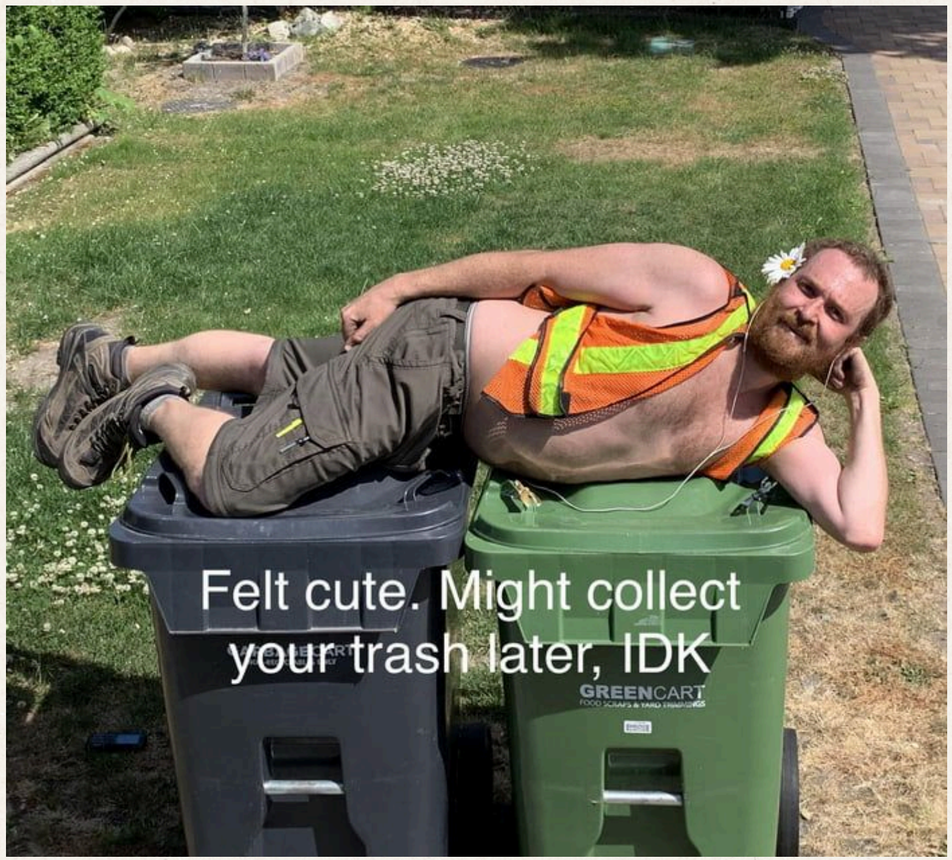


Figure 1. Meme

Problem Definition

Need Statement

Waste management workers at the University of Victoria currently have insufficient sorting aid when collecting waste bins.

Goals & Objectives

The goal would be to create a more streamlined bin to worker experience, reducing manual waste sorting and increasing efficiency.

Figure 3. Meme

Timeline Overall

Date Range	Task Description	Progress
March 11-15	Conduct literature review	Complete
March 13-20	Gather experimental/test data & analyze findings	Complete
March 17-20	Finalize presentation format	Complete
March 18-21	Assign sections & speakers, conduct interviews/surveys	Complete
March 20-22	Design presentation template	Complete
March 22-27	Identify key research questions & draft slides	Complete
March 25-27	Finalize research methodology	Complete
March 27-30	Proofread & include visuals/graphics	In Progress
March 27-April 1	Assign responsibilities for data collection & develop charter	In Progress
April 1	Each team member practices their segment	In Progress

Work Completed

Milestones

1. Team Charter
2. Work Plan & Task Analysis
3. Document Template & Draft
4. Slide Template

Proposed Design Solution

- Evaluation of Object-Identification Technology
- Prototype Development and Testing
- Campus Survey and Feedback

Research Methodology

- Literature review
- Build and test AI-enabled prototype
- User surveys

Findings So Far

- AI with CV most effective
- user-friendly features needed
- real-time feedback suggested

Figure 2. Meme

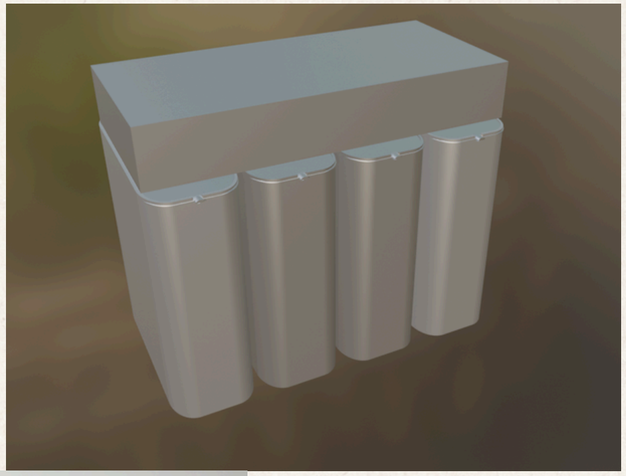
Proposed Design Solution

Work Completed continued....

We propose implementing a modular, attachable system designed to integrate seamlessly with the existing "Sort It Out" bins.

- We use ESP32-CAM module, which captures a photo of the disposed waste
- It then uses image recognition to identify the type of trash
- A pulley-based rotation system is used to deposit the item into the correct bin.

We aim to reduce improper disposal, and promote a more efficient and sustainable waste management system across campus.



DEMO

Work Completed continued....

Alternate Solution
Figure 4. Meme

Carbon Footprint

Work Completed continued....

Components: ESP32CAM + 1 Servo Motor

Power Usage: Idle 0.2W to Active 1.2W

Average: 0.5W

527 Recycling Stations[8] (Total Impact)

Possible improvement: Outdoor stations could be solar powered

Parameters	Single Unit	527 Units
Daily Energy Consumption	0.137 kWh	72.2 kWh
Yearly Energy Consumption	49.9 kWh	26.32 MWh
Yearly Carbon Footprint	**23.7 kg CO_2**	**12.5 metric tons CO_2**

***Above Calculations are estimations and may differ**
(Based on 14 gCO_2e/kWh emission intensity of electricity in British Columbia)[9]

Table 1: Carbon Footprint Estimation[9][10]

Research Methodology

Work Completed continued....

Covering the following:

- Investigated need for Automatic Sorting Bins in Campus
- Investigated Sentiment of Students
- Investigate cost and setup feasibility of the solution
- Gathered Data by Surveying Students in ENGR 240

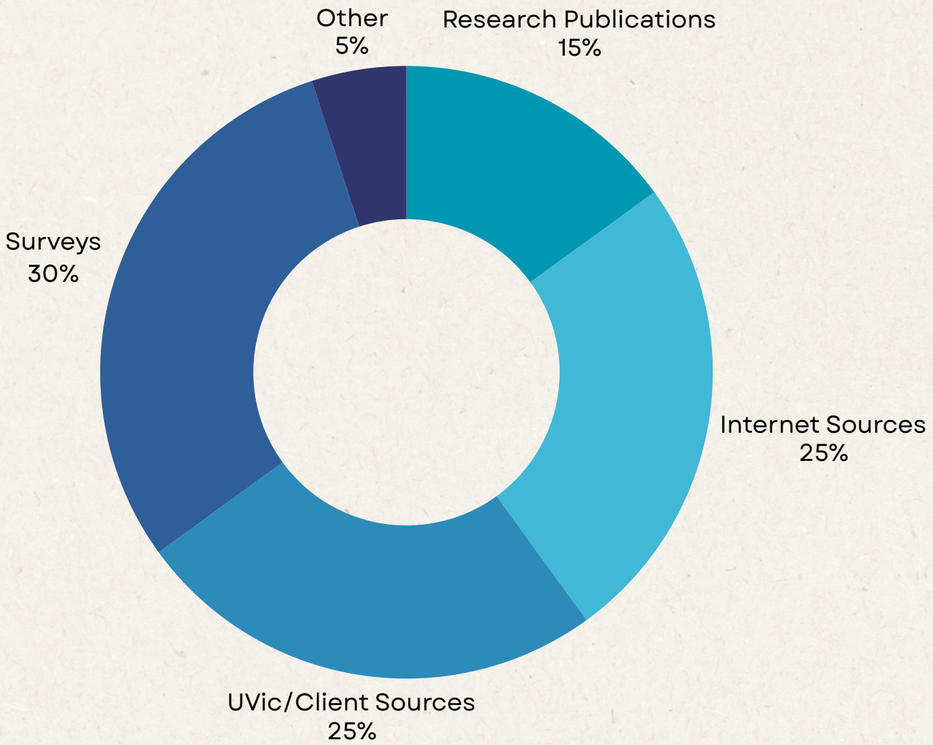


Figure 5. Research Sources

Findings so far

Work Completed continued....

- Sorting trash is tedious for many. - Figure 6
- Our survey of 10 participants showed 100% support for an automated sorting bin, proving its feasibility.
- Suggests high feasibility for our solution
- Per Unit Cost about 70~80$.
- At other campuses, similar systems help increase landfill diversion by upto 60%[5].
- Combined with current UVic sustainability efforts this system can offer a marginal improvement in landfill diversion rate of 74%[1].
- Help reduce Carbon Monoxide emissions
- Maintaing a database of data and publishing it frequently can help improve recycling rates by causing a mentality shift.

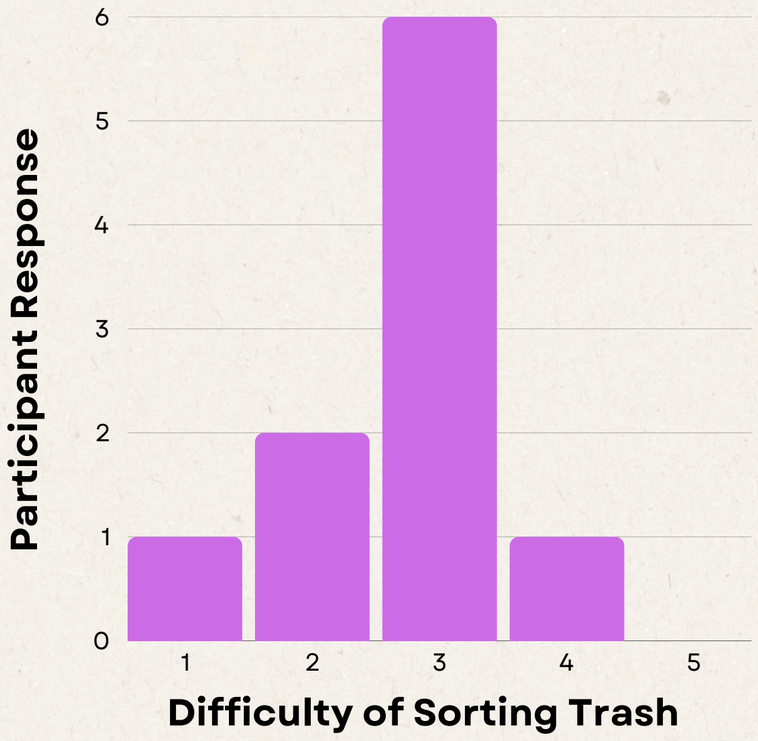


Figure 6. Survey Data
How difficult do you find it to sort your trash?

Challenges Encountered

- Small Sample Size of Survey Responses
- Member Schedule Conflict for Meetings
- Finding a Proper Sorting Design

Figure 7. Meme

Work Remaining

- ENSURE RELIABLE DETECTION OF VARIOUS TRASH MATERIALS.
- COLLECT USER FEEDBACK TO REFINE DESIGN FEASIBILITY
- TEST PROTOTYPE IN A CONTROLLED ENVIRONMENT TO MEASURE SORTING ACCURACY AND IDENTIFY ANY ISSUES
- PRODUCE A COMPREHENSIVE REPORT THAT INCORPORATES ALL DATA AND OUTCOMES GATHERED THROUGH THE PREVIOUSLY DESCRIBED METHODS.

1st Quarter

Finalize sensor calibration and test the prototype

2nd Quarter

Refine design based on early feedback

3rd Quarter

Gather performance data, and address any remaining issues.

4th Quarter

Complete final project report

Expected Outcomes

- CURRENT STATUS OF THE PROJECT
- ARE YOU ON TRACK? BEHIND? AHEAD?
- DO YOU ANTICIPATE COMPLETING EVERYTHING ON SCHEDULE?
- ANY PRELIMINARY EXPECTATIONS FOR FINAL RESULTS?

Reduced user involvement in sorting by ~50%.
Simple LED indicators or touchscreen interface for guidance/feedback.
Expected reduction in landfill contributions and better recycling rates.
Demonstrates core automated sorting capabilities.

Questions & Feedback

Figure 8. Meme

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Figures

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