

# PROJECT CHARTER

## Copy-Waste

**Project Name** Copy-Waste

**Date Produced** Oct 27, 2021

**Project Goals** Our project has two goals:

1. Reduce risks to the public and waste management employees and facilities
2. Reduce the cost to municipalities and waste management companies caused by rare and severe contaminants in recycling waste collection.

**Project Objectives**

1. Develop a universal waste bin classifier that reduces false positive detections.
2. Create an automated pipeline for generating synthetic datasets for rare items using a small number of sample images
3. Create an interactive dashboard for municipalities to track recycling collection statistics on a collection day basis

**Project Budget** \$30000 with items including:

- AWS compute time
- AWS storage
- SuperAnnotate annotations for image segmentation

**Project Sponsor** Prairie Robotics

**Project Manager** Sam Dietrich

## Additional Key Project Stakeholders

### Project Supervisor:

Dr. Macaig: Project Supervisor

### Project Mentors:

Dr. El-Darieby: Project Supervisor

Dr. Trevor Douglas: Project Supervisor

Overall Project Milestones	Dates
- Project Initialization, structuring project management, begin documentation, envision project objectives	Sept. 2021 - Oct. 2021
- Research the waste management community, technological ability of users, continue documentation	Oct. 2021 - Nov. 2021
- Collect and Annotate Images for Bin Detector Categories and train a detection model - Implement experiences driven from community research within the dashboard	Nov. 2021 - Dec. 2021
- Generate service events for recycling bin detections using the bin detector - Start researching implementations of copy-paste image augmentations	Dec. 2021 - Jan. 2022
- Deploy Universal Bin Detector and monitor its performance - Implement MVP 1 to augment data from one image to another - Improve transformation further for MVP 2 of the data augmentation pipeline	Jan. 2022 - Feb. 2022
- Continue to monitor the performance of the bin detector - Implement MVP 3 which produces a small dataset - Audit dataset - Add ability to layer artificially placed objects with objects in the original image for MVP 4	Feb. 2022 - Mar. 2022
- Scale up the Copy-Paste pipeline to generate a large dataset for MVP 5 - Train and Evaluate the Copy Paste Detection Model for MVP 6	Mar. 2022 - Apr. 2022
- Project Closing documents, poster, commercial, lessons learned	Apr. 2022
Overall Project Risks	
<ul style="list-style-type: none"> <li>- Limited/rare occurrences for true positive verification</li> <li>- Poor edge computer processing capacity</li> <li>- Potentially lower performance from an augmented dataset</li> </ul>	

## Golden Circle

### Why

Recycling at its current state is extremely contaminated, expensive, and inefficient. It is estimated that only 9% of all plastics in Canada are recycled and significant portions of the collected plastic are diverted to landfills because of contamination (Deloitte Canada, 2019). This is not sustainable for cities and a large burden on the environment. As aspiring engineers, but more importantly citizens who utilize our planet's benefits, we believe it is also our responsibility to create and improve tools which lead to a more sustainable environment, safeguard the public and protect human life.

### How

Our project's purpose is to increase recycling collection rates and reduce operator costs by identifying severe and rare contaminants at the source. It is difficult to train detection models for rare contaminants as large datasets of images do not exist. Our platform will synthetically create a large image dataset of rare contaminants, allowing it to be possible to train detection models. Detecting these contaminants will lead to safer work environments for waste management workers, educational campaigns for households, reduce costs for municipalities and improve the quality of recycling.

### What

Using the Copy-Paste Algorithm we will generate segmentation datasets for rare contaminants using a small number of sample images. These datasets can be used to train machine learning detection models which will be deployed to computer vision systems installed on waste collection vehicles.

### Impact

Our long term vision for this project is to remove the burden of managing waste and recycling from individuals. Our goal is to allow the automation of this process by enabling the detection of rare items and expanding the number of objects that can be detected with computer vision. We will accomplish this by reducing the number of sample images required to train a machine learning model.

In conjunction with political movements demanding more drastic action on environmental impacts and waste, this project can be used to help society achieve that objective through automation of waste collection facilities.

## References

Deloitte Canada. (2019) Economic Study of the Canadian Plastics Industry, Market and Waste. <https://publications.gc.ca/site/eng/9.871296/publication.html>.