PROJECT REQUIREMENTS

Copy-Waste

Project Name	Copy-Waste

Functional Requirements

Green Screen Dashboard:

1. Reflect most recent information of recycling collection
2. Allow interaction with waste collection zones within a map to provide more detailed analysis of a region
3. Provide comparison of data within waste collection regions to indicate progress towards sustainability
4. Notify waste management workers when hazardous waste is detected in the recycling stream

Universal Bin Detector

1. Collect and annotate images of bins to create a training dataset
2. Create and train a detection model using YOLOv5
3. Evaluate performance of the new model versus the previous one using test data
4. Deploy the YOLOv5 model to actual waste collection trucks
5. Evaluate real world performance

Copy-Paste Data Augmentation Pipeline:

1. Synthetic generation of new contaminant datasets using the copy paste algorithm
2. Train machine learning models in Mask R-CNN to detect the new contaminant
3. Evaluation of Model accuracy and precision using real data, as compared to synthetic data
4. Launch the new detection model to the production environment
5. Live model training using collect images of detected contaminants
6. Provide alerts on the front-end dashboard when rare or severe contaminants are detected
7. Provide thorough analysis of each recycling collection day

Technical/Performance Requirements

Green Screen:

- **Technical Requirements:**
  - Integrate with StreamSight API to retrieve data
  - Conform to Prairie Robotics technology stack and standards
  - Integrate with Copy Waste Hazardous waste detection system
- **Performance Requirements**
  - Perform heavier calculations in the API to improve performance on the front-end. The dashboard must be lightweight and run effectively on any machine with limited internet speeds

Universal Bin Detector:

- **Technical Requirements**
  - Create a detection model using YOLOv5
  - Use SuperAnnotate to create bounding box annotations on images
- **Performance Requirements**
  - Must outperform the existing bin detection model
    - Less false positive detections
    - More true positive/negative detections
    - Little to no confusion between classes

Copy-Paste Data Augmentation Pipeline:

- **Technical Requirements**
  - Control whether a model is stable to be published into the production environment
  - Store the detected rare and severe contaminant and initialize process to re-train and strengthen the object detection model
- **Performance Requirements**
  - The pipeline must be automated and not require manual correction through each stage
  - The pipeline should complete dataset generation, model detection, evaluation within a timespan of 1 day