PROJECT SCOPE STATEMENT

Copy-Waste

Project Name	Copy Waste
Project Deliverables	
Universal Bin Detector	***Activity:*** **Collect and Annotate Images of Classification Categories** Look through the industry partners' image database and extract images containing desired object classes. Once collected, use SuperAnnotate to create bounding boxes around each object and label them with the appropriate class name. ***Activity:*** **Train a detection model in YOLO** Train a YOLOv5 detection model against our new image dataset. ***Activity:*** **Evaluate the Model's Performance** Evaluate the performance of the YOLOv5 detection model with our industry partner. If there are undesirable results, change the model's parameters accordingly and try again. ***Activity:*** **Deploy the Universal Bin Detector** Our industry partner will then deploy our code to the edge computer on waste collection trucks. Once this is done we can continue to evaluate performance using real world data.
Green Screen: Waste Management Dashboard	***Activity:*** **Building Initial Architecture** ***User Story****: As a waste management worker, I would like to view recycling information with an intuitive interface so that I can actively be updated about the quality of recycling within the City of Regina* - Focus on building reusable architecture to display recycling information - Architecture built should be easy to iterate upon ***Activity:*** **Building Initial Architecture** ***User Story****: As a waste management worker, I would like to view recycling collection zones so that I can understand how recycling is collected within the City of Regina* - Focus on integrating waste collection zone layers that City of Regina waste management workers are familiar with - Integration of a map to layer the collection zones upon

	Activity: **Integrate Real World Data** ***User Story:*** *As a waste management worker, I would like to view and interact with recycling collection information as it is collected, so that I can monitor the health and quality of recycling actively and asynchronously* - Build integrations with StreamSight API and Prairie Robotics Database to actively retrieve data and update the dashboard with the most recent information ***Activity:*** **User Acceptance Testing** ***User Story****: As a waste management worker, I would like to test the dashboard to approve or disapprove any changes, so that the components I will use regularly are designed to improve my work experience* - Provide users with the dashboard and an associated questionnaire - Gather insight on which components work well, and which do not - Make changes to the dashboard to improve user experience accordingly

Copy-Paste Augmentation Pipeline	**MVP 1: Paste objects from one image to a different background**
	
	- Research existing implementations of copy-paste augmentation
	- Use one of these implementations to understand how an object is copied using its mask and pasted onto another image using alpha blending
	
	MVP 2: Improve the transformations applied when pasting objects
	
	- Paste objects from one image to a different background with a greater number of transformations.
	  ○ Resizing
	  ○ Rotating
	  ○ Panning
	  ○ Mirroring
	
	MVP 3: Produce a small augmented dataset
	
	- Implement the ability for the tool to loop through images with an annotations file to paste objects onto different backgrounds
	- Export new annotations separately in a new COCO formatted file
	- Convert any masks into polygons to match our industry partner's segmentation standards

	MVP 4: Layering objects from the source and the pasted objects - Implement the ability to paste an object under and/or over objects in the source image. - To do this we must extract annotated images from the background **MVP 5: Scale-up the prototype** - Execute the copy paste method iteratively over a large number of background images in order to create a fully usable dataset. - Implement the ability to log any issues which occur as opposed to failing completely at run-time **MVP 6: Train a machine learning model using augmented images** - Connect the produced dataset to an AWS lambda service which trains a Mask R-CNN detection model - Use this service to evaluate the model and deploy it if detection accuracy and precision is optimal - Implement logic to generate service events for when rare and severe contaminants are detected

Project Exclusions

The dashboard will currently exclude an email notification system when rare contaminants are detected. This is a feature which can be implemented in a future iteration

The bin detector currently only produces service events when a blue bin is detected, however, some municipalities use a black bin. The logic of creating service events on black bins will be excluded from the current version and handled by the industry partner.