Final Report – Controls

# Mapping of your design back to the design specifications

See Info from Video Design Verification – Notes in Other Folder

* Design specifications of having a model that is greater than 75% accurate. This is important to ensure that the accuracy constraint is met to ensure that we are not sorting any recyclables into the garbage, or worse sorting garbage into the recycling bins. The current dataset of images contains about 5400 images spread out throughout 8 different image recognition classes. The current model has an accuracy rate of about 85-90% on most common household items but will mis-identify the class of an item if the lighting or poor or if there is too much glare on the top of the item making it look shiny causing it to say it is a different class of item. To correct this problem and to ensure that we meet the 75% accuracy threshold more images will need to be added to the dataset to create a dataset of ideally 20,000 images among the 8 image classes. By adding more images to the dataset, the model can be trained on with more data to help produce a better more accurate model. These new images will need to be images of the common household recyclables as well as in various lighting conditions as well as in all orientations.
* Another constraint of the system is to be able to identify and sort at least 6 items per minute which means that each item should be processed in under 10 seconds. With the current control strategy, the jetson will continuously be processing images, if an image is detected other than the background image, the jetson will verify that the object is one of the classes by checking 10 continuous images to ensure that the object is the same class and that the certainty rating for all of the images is above the threshold of 75% as stated in the constraints. After ensuring that an object is there and selecting what bin to sort it to, the Jetson will send the signal to the motors and actuators to sort the item to the proper bin.
  + The current model is able to classify about 75-90 images per second from the camera, but as the model size increases the number of images the Jetson can process in a second will be reduced. A larger model of about 20,000 images was tested, and the jetson was able to classify about 25-35 images per second which is fast considered the hardware on board the Jetson Nano.
* Another constraint was that the system must not misidentify glass/Styrofoam/trash into the wrong bin more than 10% of the time. To resolve this issue, glass and Styrofoam were each created to be a class to allow the best chance of the Jetson to determine what type of item it is. To ensure that we do not sort garbage or Styrofoam into the recycling bin, the jetson will sort any item without an 80% certainty value into the garbage, because it is most likely not recycling as the Jetson did not recognize it, as well as it is better to place a recycling item into the garbage then to place a garbage item into the recycling. If the garbage item is placed into the recycling bin, then this can lead to contamination of the recycling which sometimes results in the entire recycling pile being trashed at the recycling centre.
* The final objective is that the system should be open source. All of the code and code modules that we have used for the testing and development stages for the jetson were provided from GitHub. The code that is planned to be developed to run the open-source training and models code will be placed onto GitHub as well to support the opensource nature of the project.

# Key features of the model

# Drawings, algorithms, flowcharts,

* See Major Flowchart for the overall Controls Algorithm

# Material Selection

* \*Check if Ryan sourced the USB or CSI webcam, if not source a webcam
* Will need to also source a Micro-SD Card
* Explain why Jetson Nano was used (Look at previous reports)

# Component ordering and delivery times

# Construction, fabrication, manufacturing plan

# Testing plan?