Dr. Green

Use Case

Design

Dr. Green: Smart Recycling Device for Schools

Vision-based Recycling Classifier

Easy sorting

Made for Schools

Existing improvable infrastructure, large waste production

Interactive recycling education

Alerts and cues for notification

Prevent Contamination

Reduce waste going to landfill

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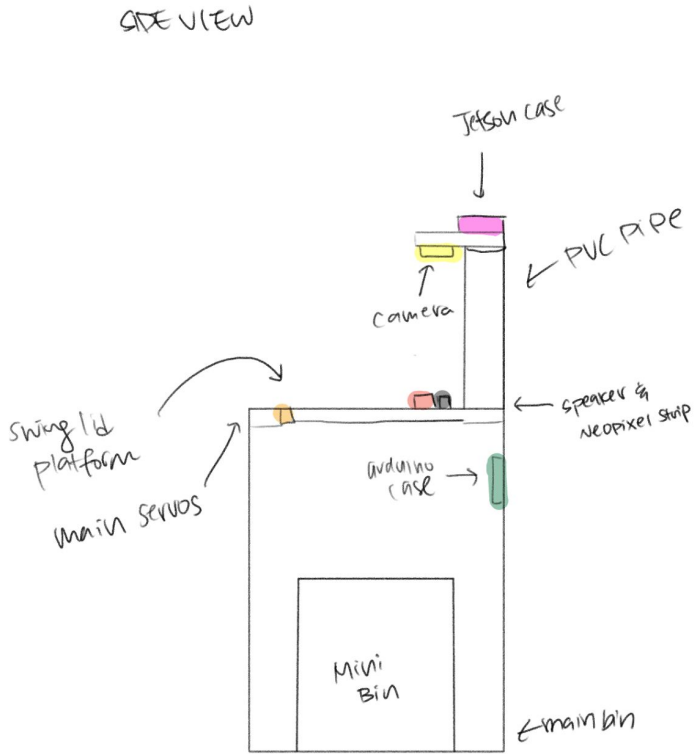
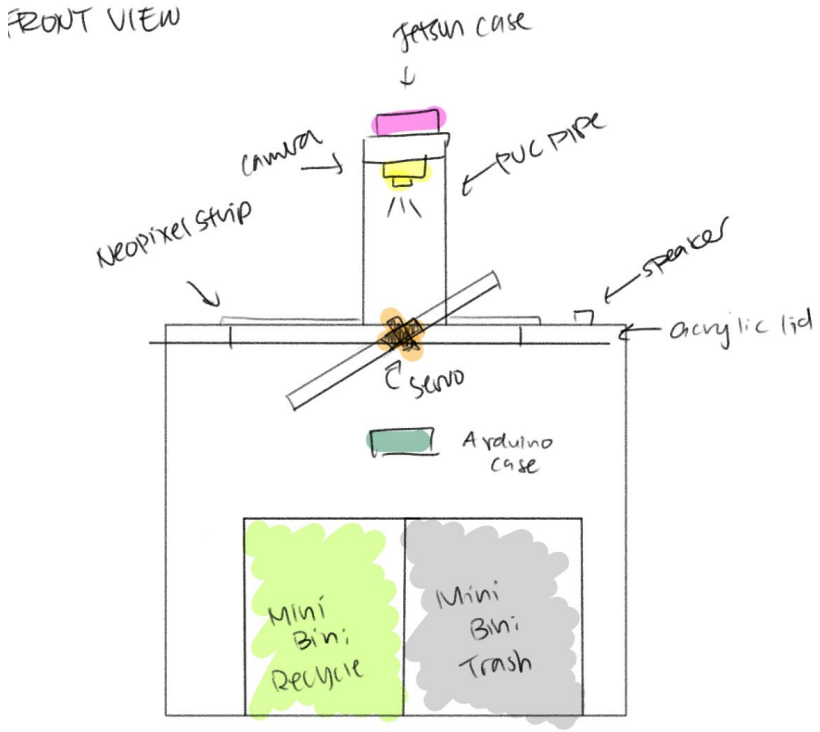
Use Case + Design Requirements

Requirements	Quantitative Metrics
Accurate camera capture, no interference, ease of use	100% accuracy, <1 sec
Detection + Classification Model (YOLO) predicts correct output	>90% accuracy, <2 sec operation time
Provide accurate visual/audible outputs to user	100% performance accuracy, < 1 sec operation time
Accurately self organize recycling to prevent contamination (updated!).	100% correct bin transfer, 80˚ platform turn, (trash & recyclable), < 1 sec operation time
Short op time + fast results to user	under 5 seconds since item placed

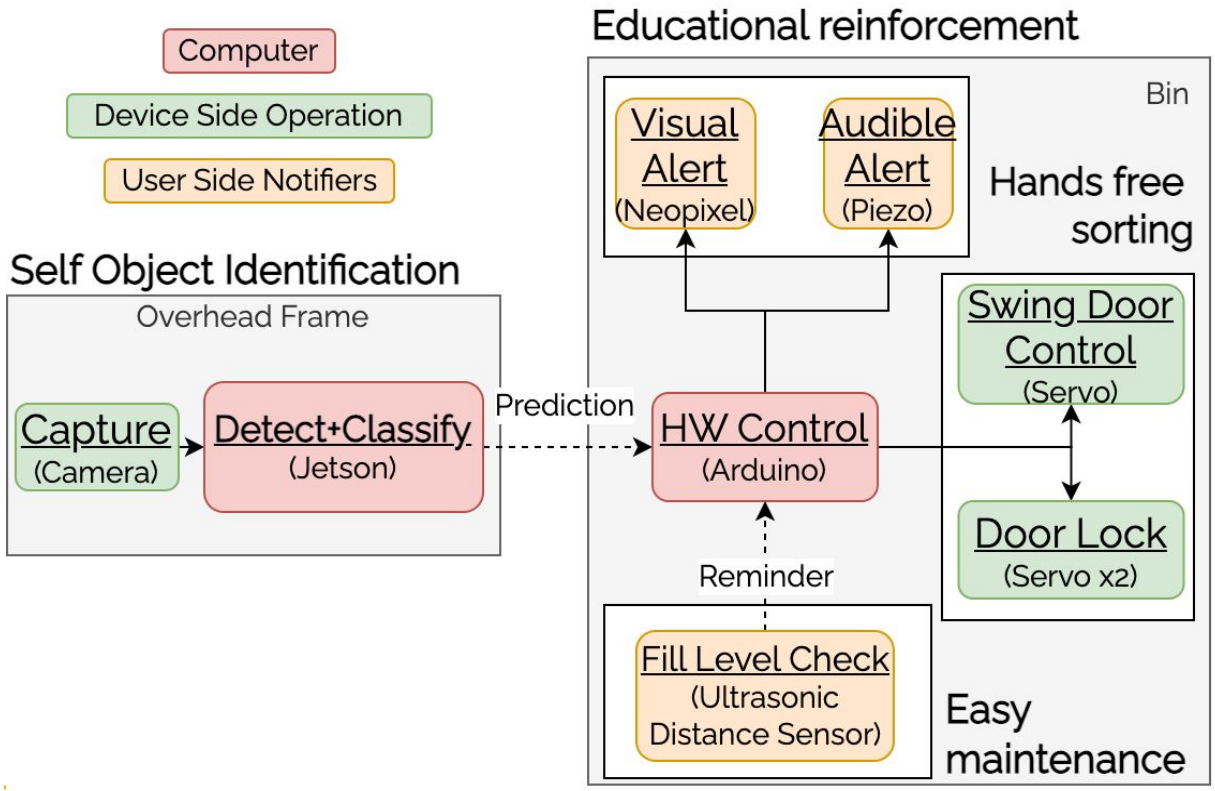
Solution Approach



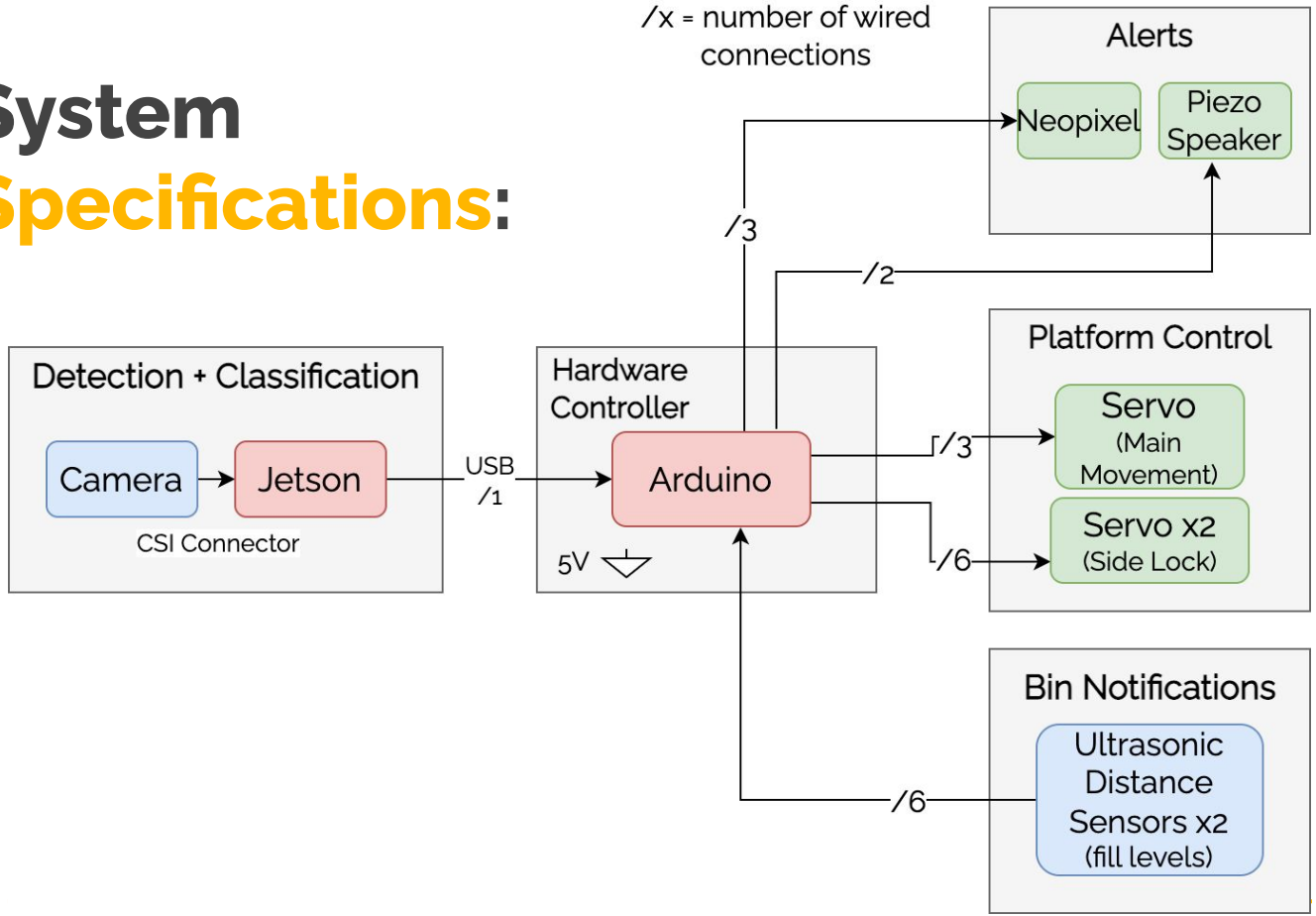


Areas: Software Systems, Signal Processing, Hardware Design

Solution Approach



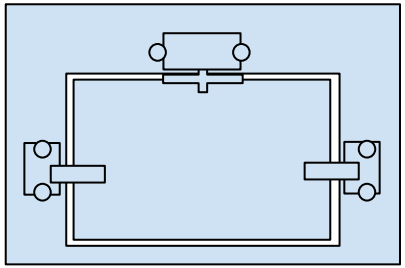
System Specifications:

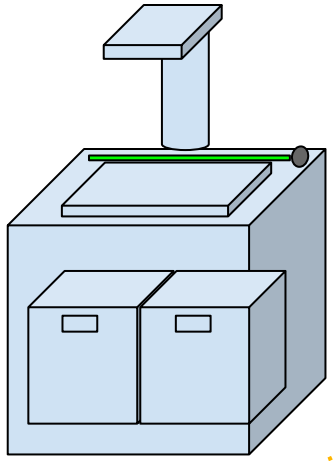


System Specifications: Mechanics

Material	L	W	H
Main Bin	**20.5”**	**15”**	**21”**
Mini Bins (x2)	**8.25”**	**11.75”**	**11.5”**
Swing Door	**16”**	**11.25”**	**0.375”**
Back Frame	**2”**	**2”**	**24”**
Overhead Platform	**7.5”**	**4”**	**0.375”**

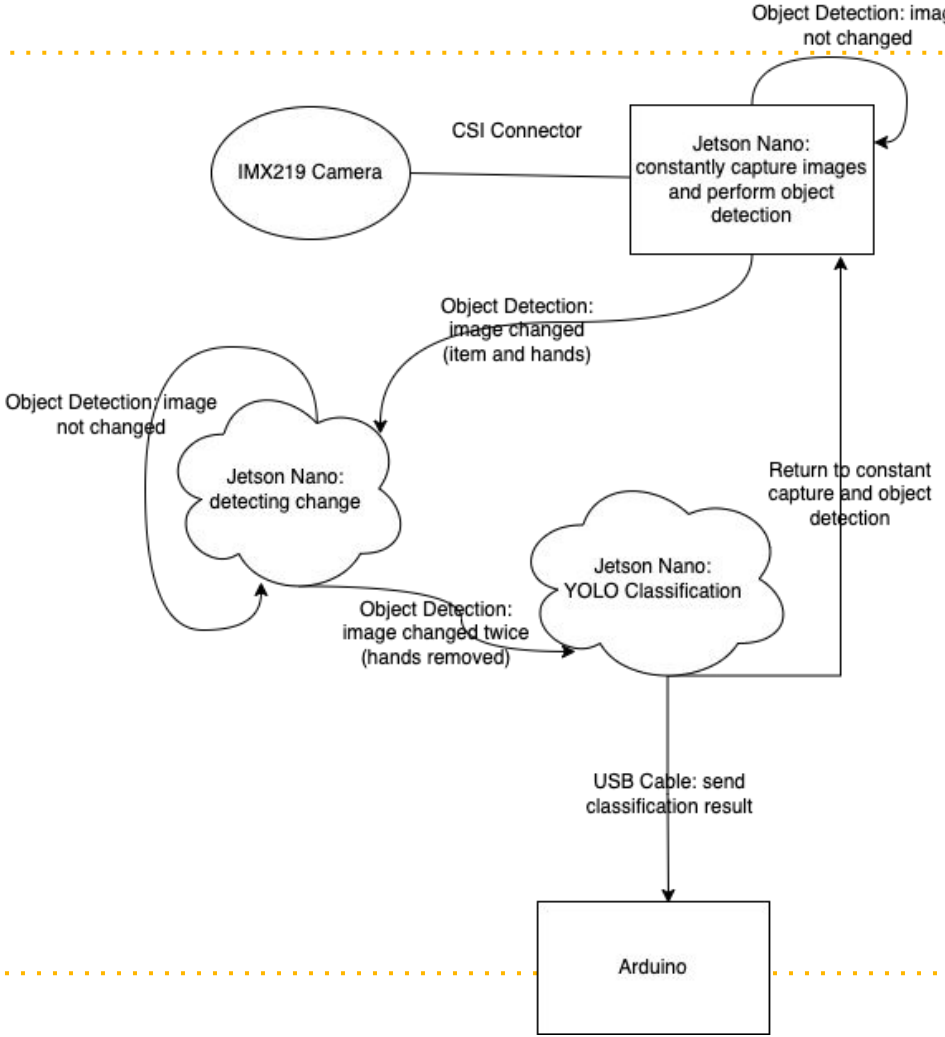
Bottom (Inside) View of Lid





Side view of main bin

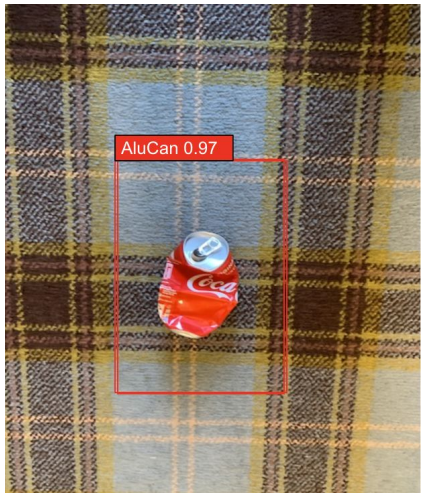
System Specifications:
Jetson - Capture, Detect, & Classify



System Specification : Software

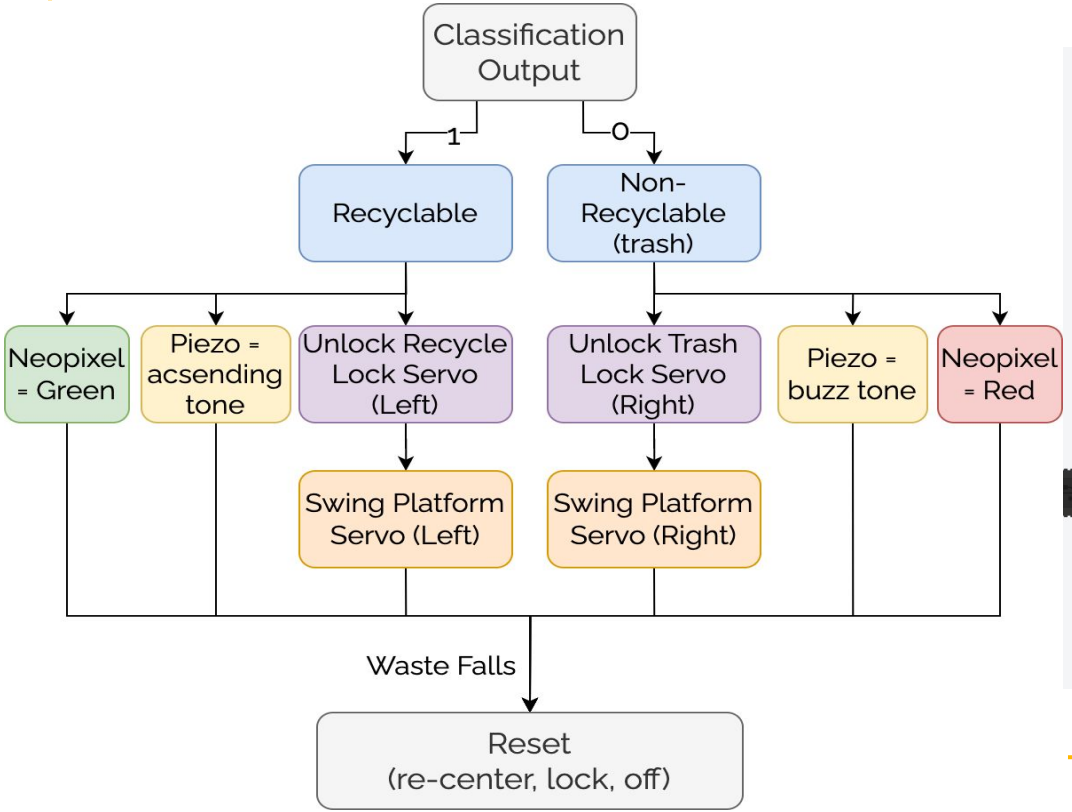
Yolov5 model

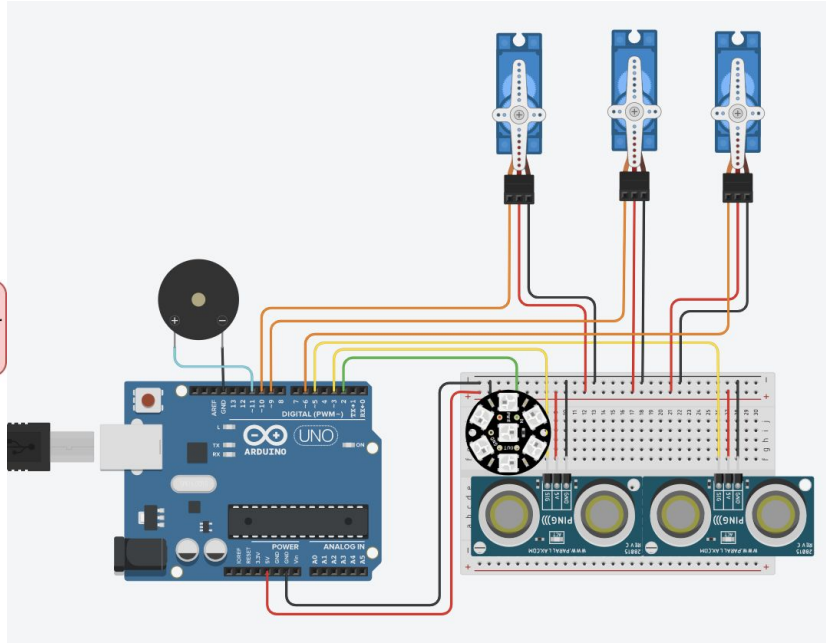
- Real-time object detection + processing
- Better than Resnet (needs detection for multiple objects)
- Modify/Integrate existing model with pre-labeled dataset using transfer learning.



Example of bounding box with label

System Specifications : Hardware





Implementation Plan Overview

	Software	Hardware	Mechanics
Buy	Bought Camera, Jetson	Bought Arduino, Piezo, Servos x3, Ultrasonic Distance Sensors x2, Neopixels, USB Cable	Bought Main Bin, Small bins x2, acrylic platform, pipe/frame, screws
Create/ Modify	Modified Yolov5 model (downloaded dataset)	Self Assemble + Program Circuit (simulated)	Self assemble mechanical parts, connect to hardware for operation

*Risk Management

Test, Verification, and Validation

Quant. Success Metrics	What/How: Unit test, then integrate	Input / Output
Model accuracy > 90% **(*Fine tune model)**	Drinking Waste: Aluminium Cans, Glass, PET and HDPE bottles Commonly Mis-Recycled Trash: Plastic bag, utensils, juice jugs	Recycle -> 0 Trash -> 1
100% accuracy of visual/sound cues **(*Replace parts)**	Component Outputs (Neopixel, Piezo)	0->Green, Jingle 1->Red, Buzz
correct bin placement **(*axel/support servo)**	Swing Door mechanics + servo control side servo locks	0->Left 1->Right
Operation < 5 sec **(*Optimize algs)**	Time capture, classification, alerts, platform	1+2+1+1 secs

Project Management