

Team A5: Ting-Hua Hsu, Vasudha Srinivasan, Aichen Yao

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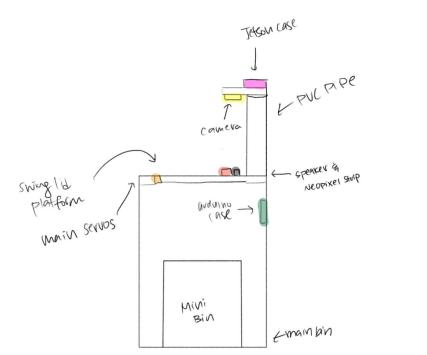


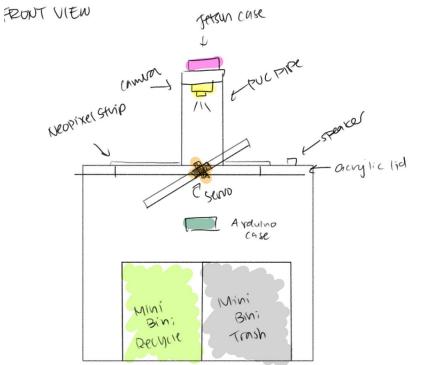
## **Use Case + Design Requirements**

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

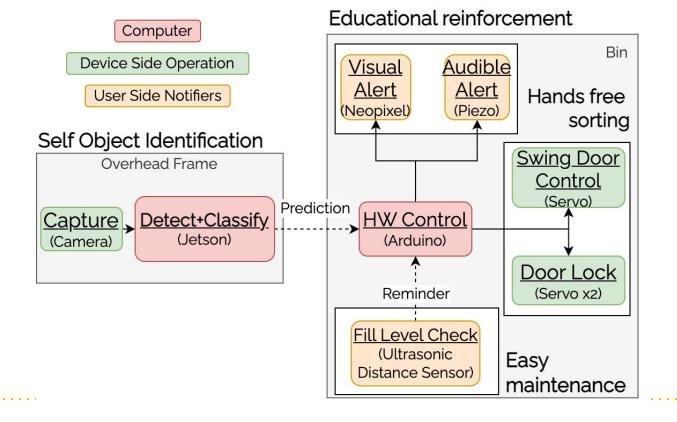
SPE VIEW

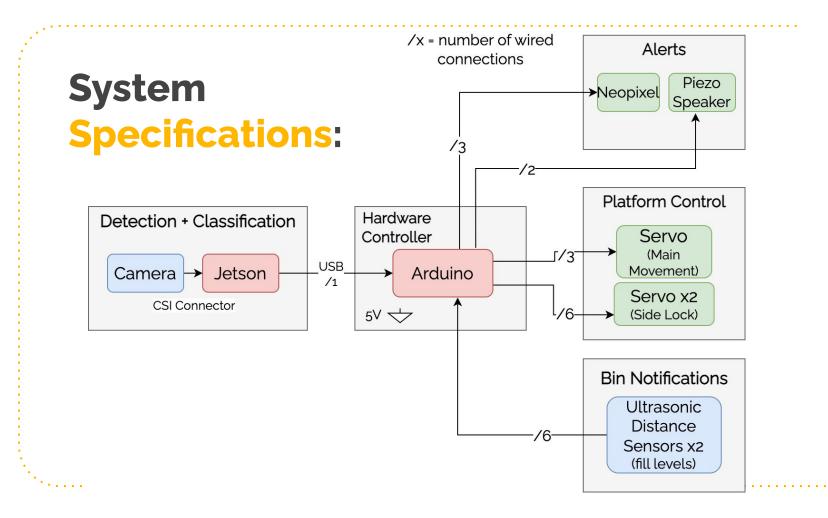




Areas: Software Systems, Signal Processing, Hardware Design

#### **Solution Approach**





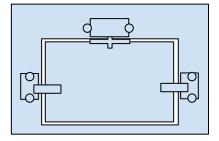




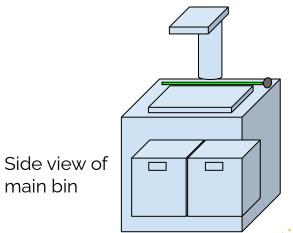
#### **System Specifications: Mechanics**

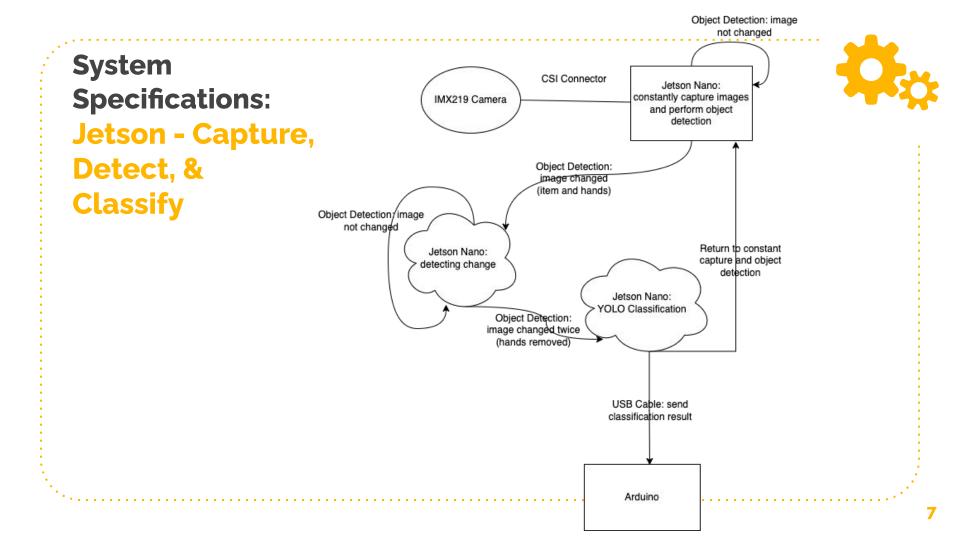
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20.5"	15"	21"
8.25"	11.75"	11.5"
16"	11.25"	0.375"
2"	2''	24''
7.5"	4"	0.375''
	8.25" 16" 2"	20.5" 15"   8.25" 11.75"   16" 11.25"   2" 2"

#### Bottom (Inside) View of Lid



main bin







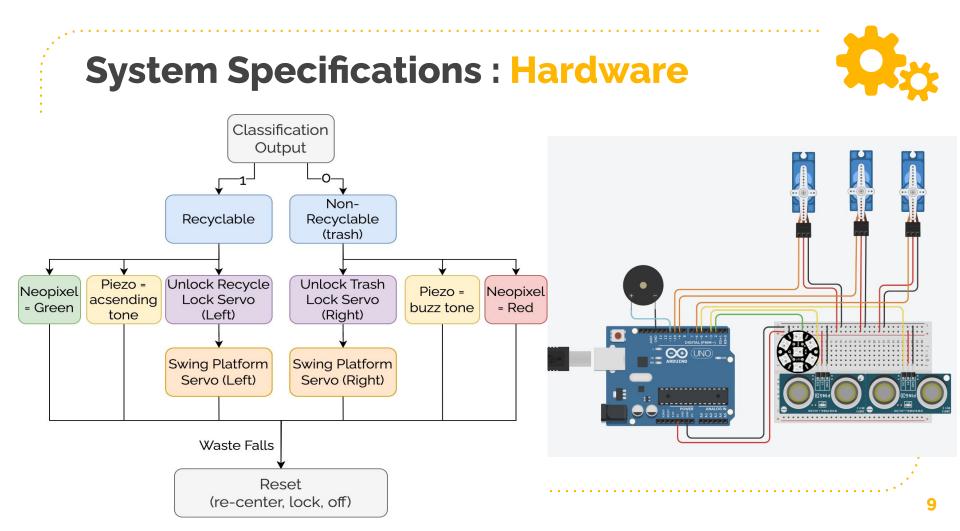
#### **System Specification : Software**

#### 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



## **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			

<b>Risk</b>	Management	
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 <b>(*Replace parts)</b>	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 (* <b>Optimize algs)</b>	Time capture, classification, alerts, platform	1+2+1+1 secs		

# **Project Management**

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	1/18 - 1/20	1/23 - 1/27	1/20 - 2/3	2/6 - 2/10	2/13 - 2/17	2/20 - 2/24	2/27 - 3/3	3/6 - 3/10	3/13 - 3/17	3/20 - 3/24	3/27 - 3/31	4/3 - 4/7	4/10 - 4/14	4/17 - 4/21	4/24 - 4/27	Aichen
RESEARCH																Ting
Ideation																Vasudha
Abstract								Tir		mod		rnina	+ HW	(sot i	in	All
Use case requirements									<b>9</b> . 1*11	_ 11100		ar in ig		3010	iΡ	Ting + Vasudha
Project Proposal				2/5					_							Aichen+Ting
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DESIGN				-									<u> </u>	•		
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Hardware design								1.15	_ 1100		v 100	ung, i			·	
Frontend design																
Design presentation due					2/19			Va	sudha	a: HW	/ + Me	ch se	t up +			
Design revisions																
Design document due							3/3	pro	ogram	nmino	j, C Op	otimiz	ation			
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DEVELOPMENT																
ML model training																
ML model fine tuning																
Mechanical part building																
Hardware setup																
build CV prototype																
Validate CV performance													1			
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post demo review												4/3.4/5				
cv backend integration																
hardware build refinements																
TESTING																
End-to-End testing																
revisions																
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Final presentation due								()								
Final videos/report														4/23	3	