

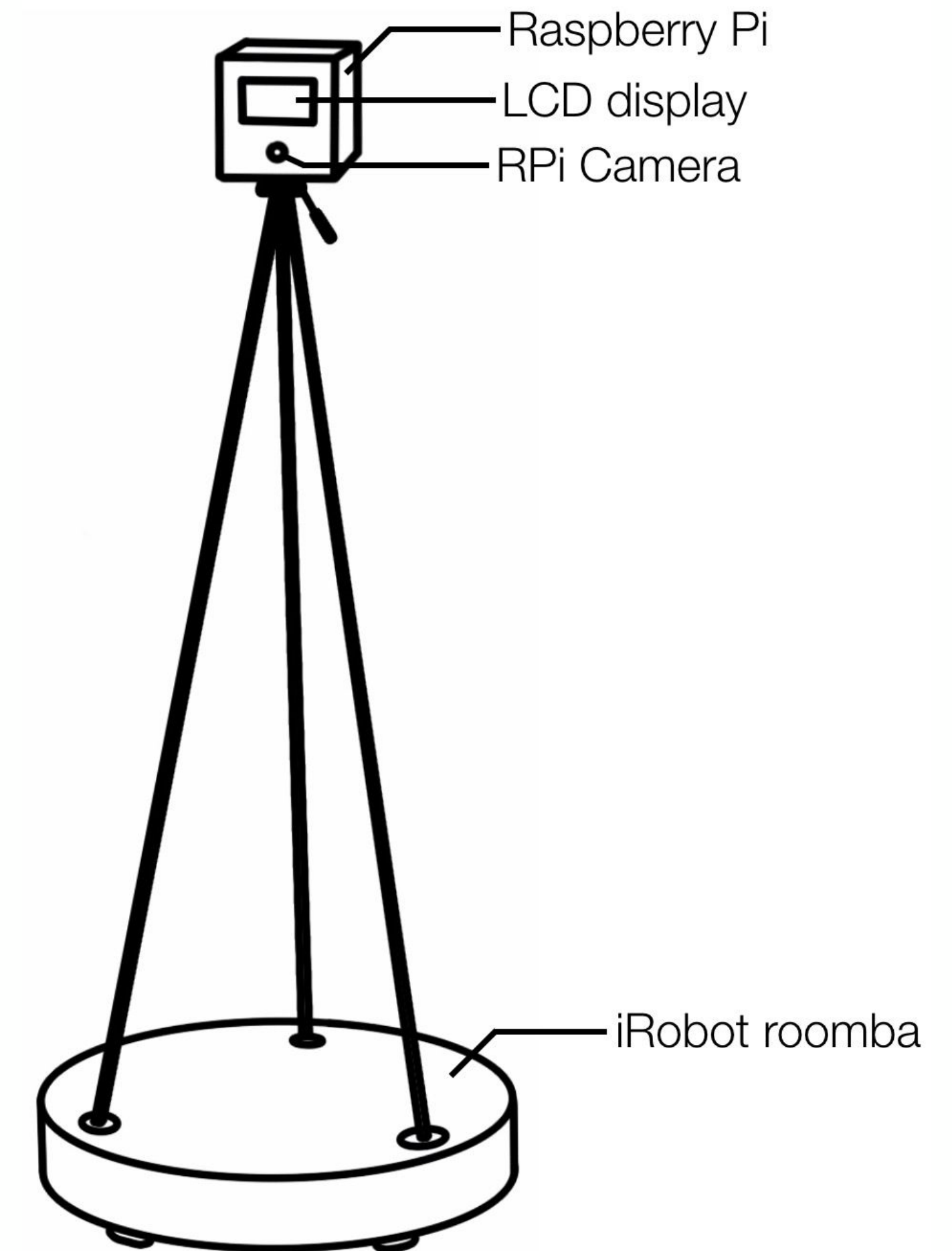
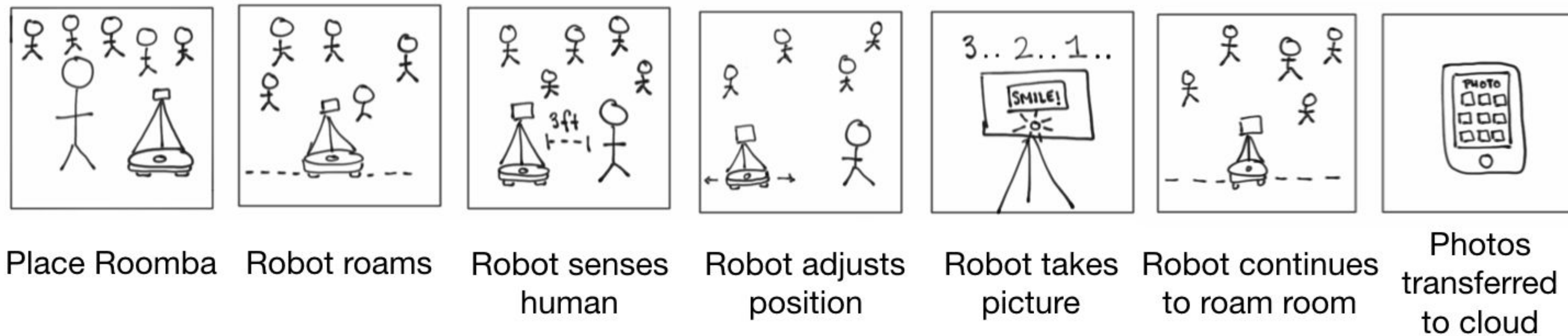
Camerazzi

Design Review

Team B3: Mimi Niou, Cornelia Chow, Adriel
Mendoza

Application Area

- Autonomous robotic photographer
 - Comfortable / unintrusive
 - Consistent / unbiased
 - Available
 - Reliable
 - Instant access to photos
- Hardware & Software



Solution Approach

Hardware:

- iRobot Create 2
 - automatic collision detection mechanism (for objects)
- Raspberry Pi 3 Model B+
- Raspberry Pi Camera Module V2
 - easy integration with RPi
 - 8MP pictures
- Adafruit AMG8833 8x8 Thermal Camera Sensors
 - collision detection mechanism (for humans)



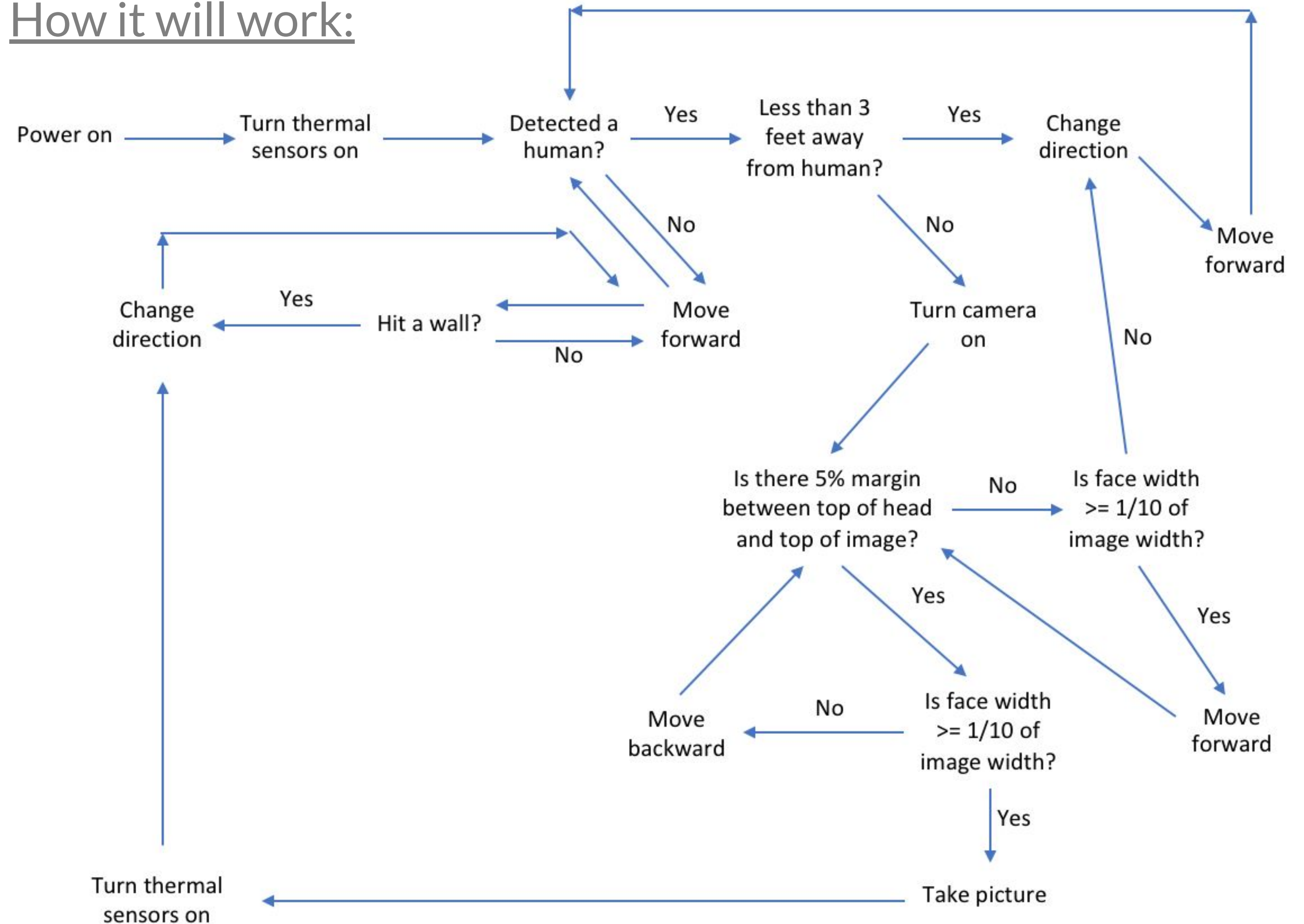
TITLE	SPECIFICATIONS FOR Infrared Array Sensor		PAGE	3/26
NAME	Infrared Array Sensor "Grid-EYE"		AMG88**	
4-5	Characteristics			
Item	Specification			
	High gain	Low gain		
Temperature Accuracy	Within Typ. $\pm 2.5^{\circ}\text{C}$	Within Typ. $\pm 3.0^{\circ}\text{C}$		
Rated detection distance *1	5m (Max.)			
Field of View	Typ. 60° (Horizontal, Vertical)			

Solution Approach

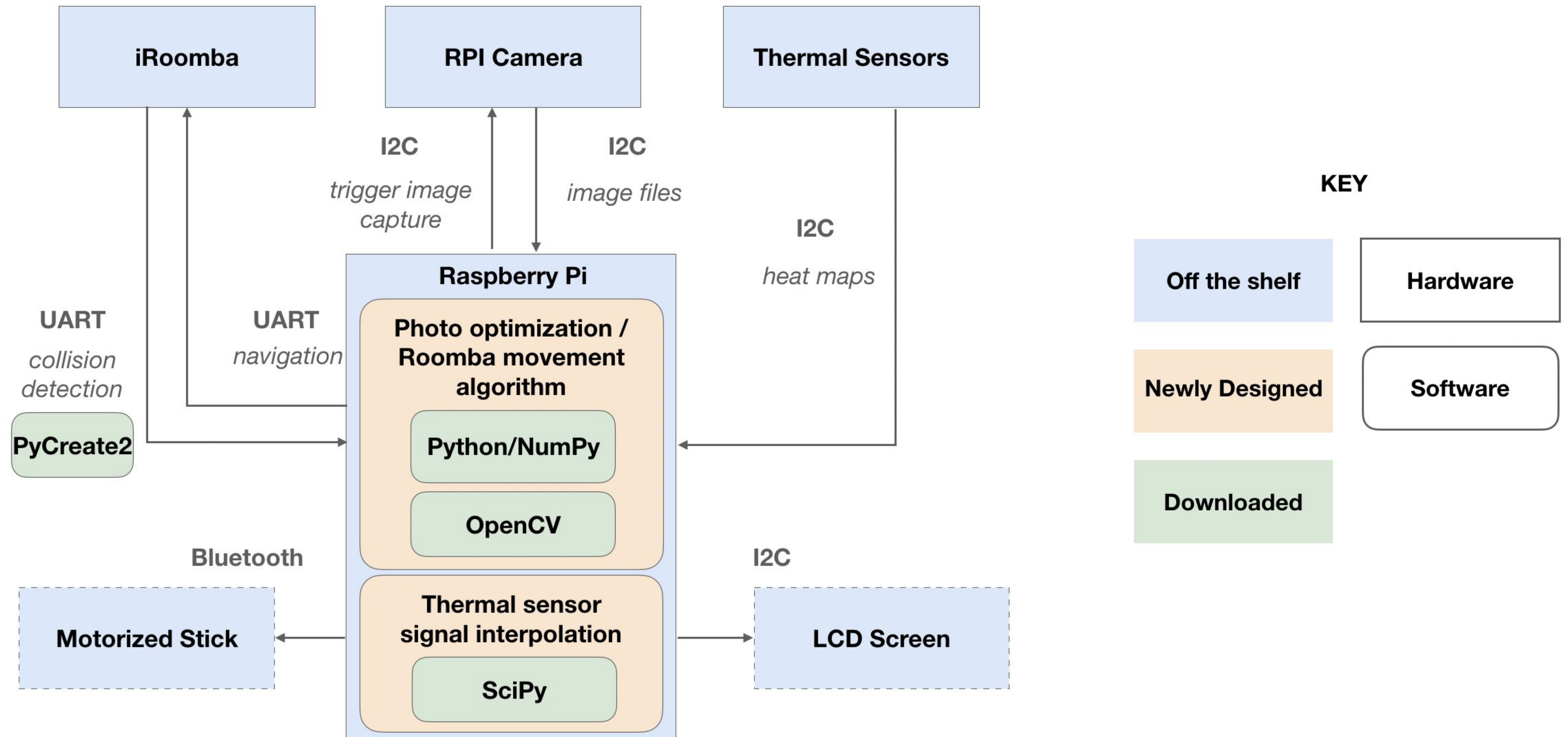
Software:

- Python/NumPy/OpenCV for face detection
- Raspbian OS
- Python for thermal camera sensors and Roomba movement

How it will work:



System Specification and Implementation Plan

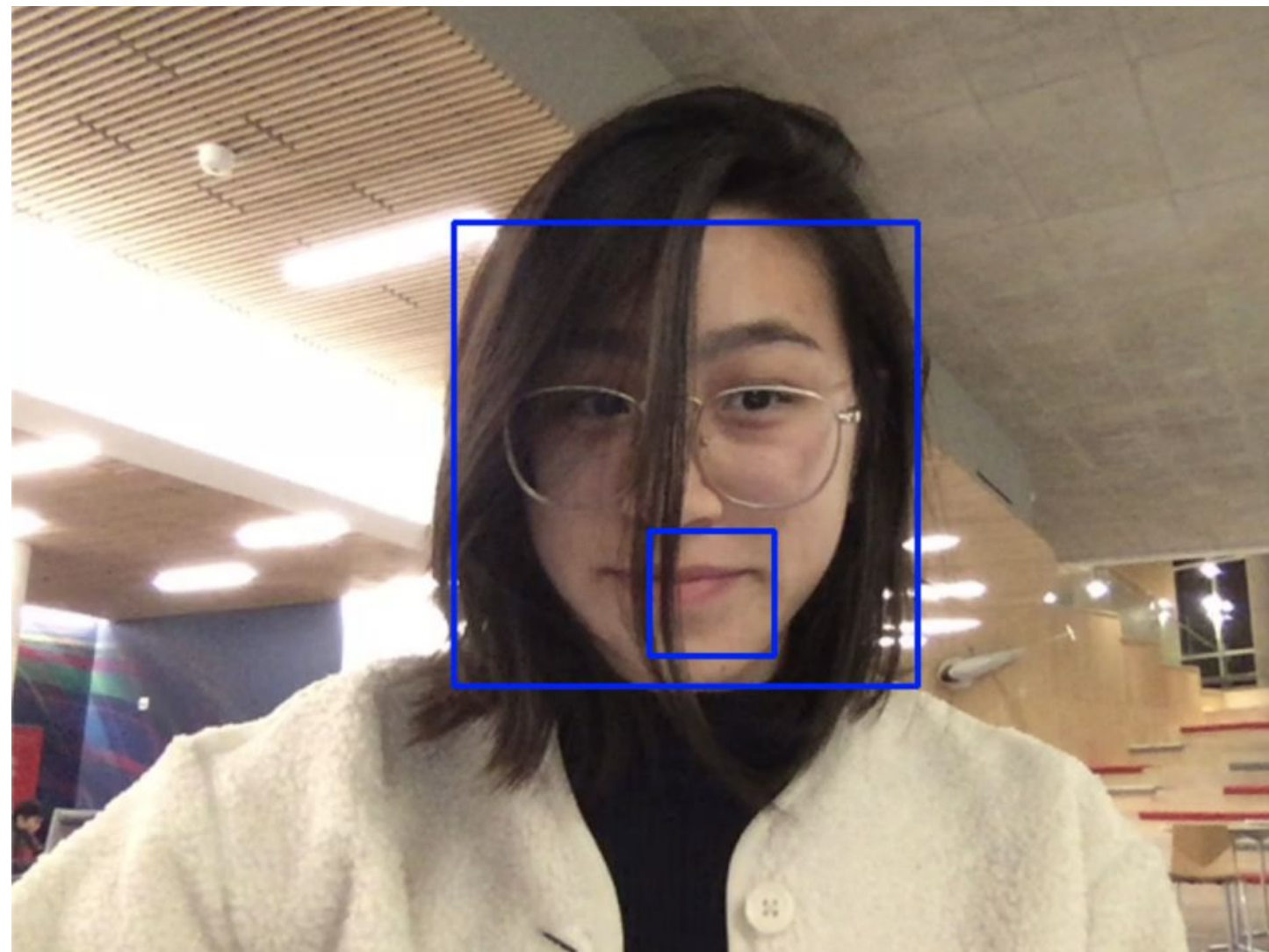


Metrics and Validation

Tested feature	Metric	Success Value
Face detection	Percentage of faces detected correctly in real time	90%+
Photo capture	Percentage of photos with faces	100%
Image margins	Moves to optimal position to ensure image margins	5%+ margin all the way around
Collision detection	Distance from human when it's detected	At least 3 ft away
Roomba stopping latency	Time between human detection and Roomba halting	< 1 sec
Image transfer	Images wirelessly transferred to designated folders	100%

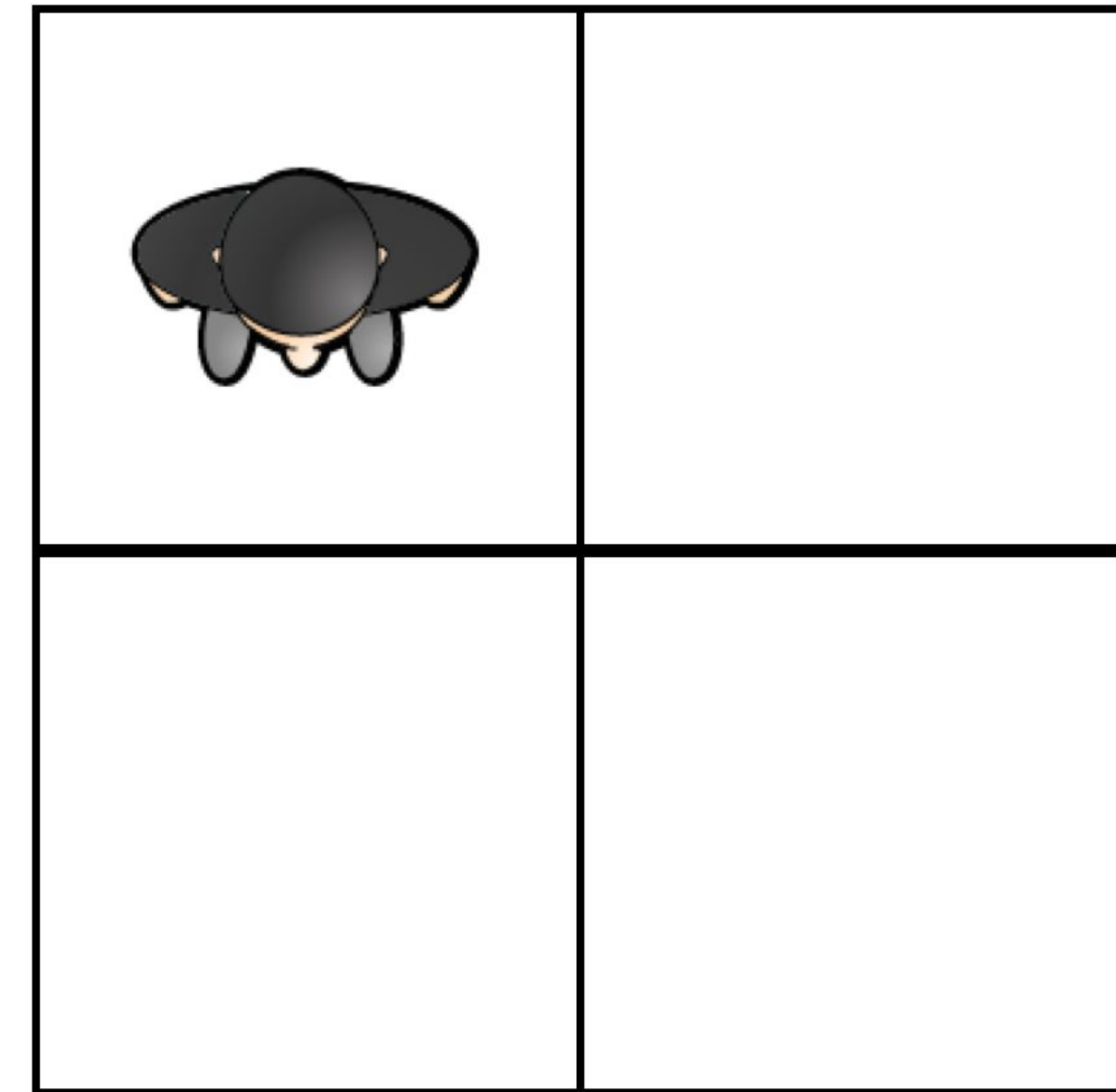
Metrics and Validation - High Risk Factors

- Collision Detection
 - Increase # of thermal sensors to widen range of view
 - Test ultrasonic sensors or object classification
- Face Detection
 - Use additional OpenCV datasets for higher accuracy (may reduce speed)



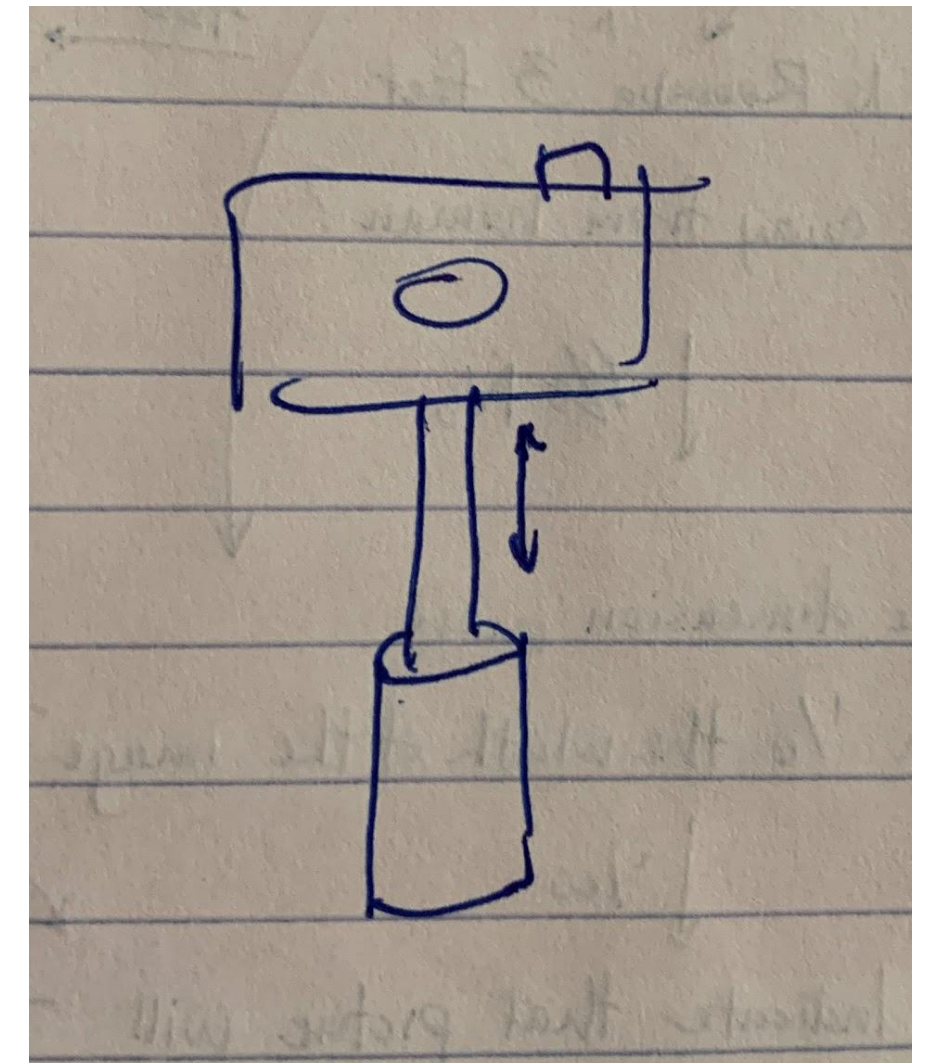
Demo Constraints

- Room size
 - Ideal dimensions: 20 x 20 ft
- Room shape
 - Ideal: square, enclosed
 - Actual: rectangle, one wall slightly open
- Density of people
 - 1 person per 4 square meter
 - 20x20ft room => 9 people



Challenges & Mitigation Plans

- Back up against wall
- Durable robot structure
- Collisions above Roomba height/sensors
- Up and down moving mechanism for camera



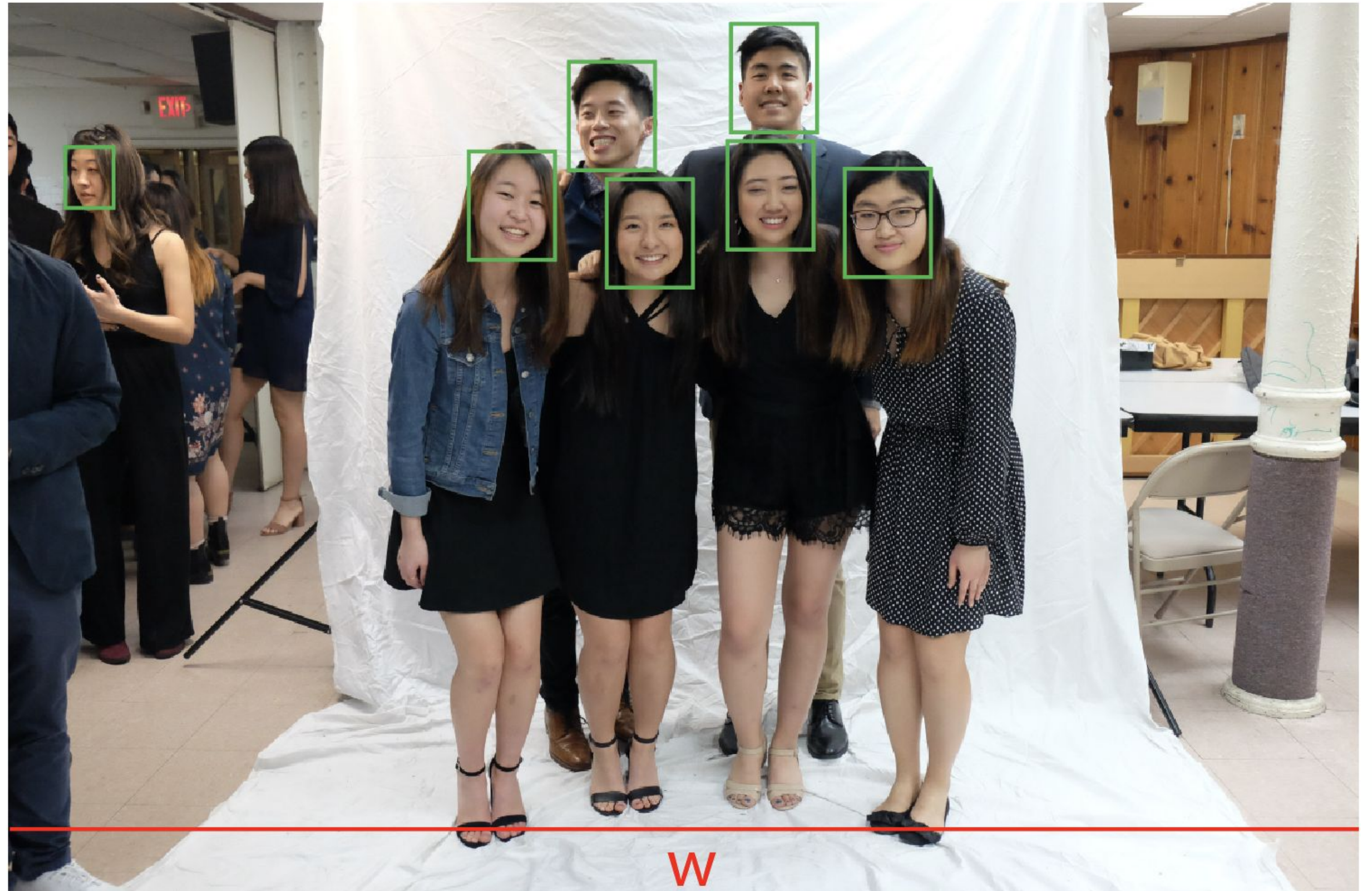
Challenges - Photo Optimization

- Deciding what faces will be used in calculations to move Roomba to fix margins

x: face width

w: photo width

$x \geq (1/10) * w$



Work Distribution

Mimi

Software

- Raspberry Pi
 - Face detection
 - Thermal detection
 - Image capture

Cornelia

Software/Embedded

- Raspberry Pi
 - Roomba movement
 - Processing thermal data and face detection

Adriel

Hardware/Embedded

- Set up RPi OS
 - Connecting and powering components
 - Robot assembly
 - Camera mechanics

Schedule

- Simplified Gantt Chart

