

Robotic Trash Concierge

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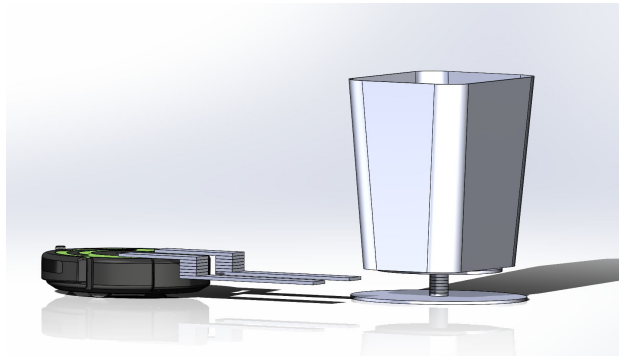
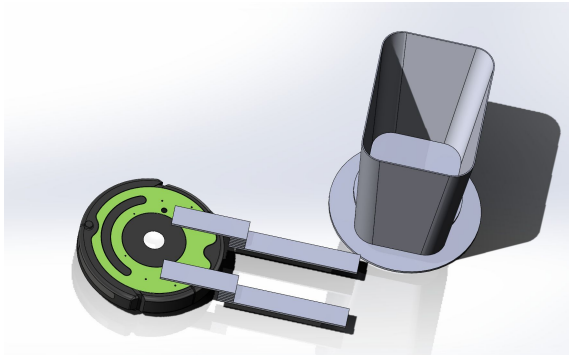
Use-Case / Application



Design Requirements

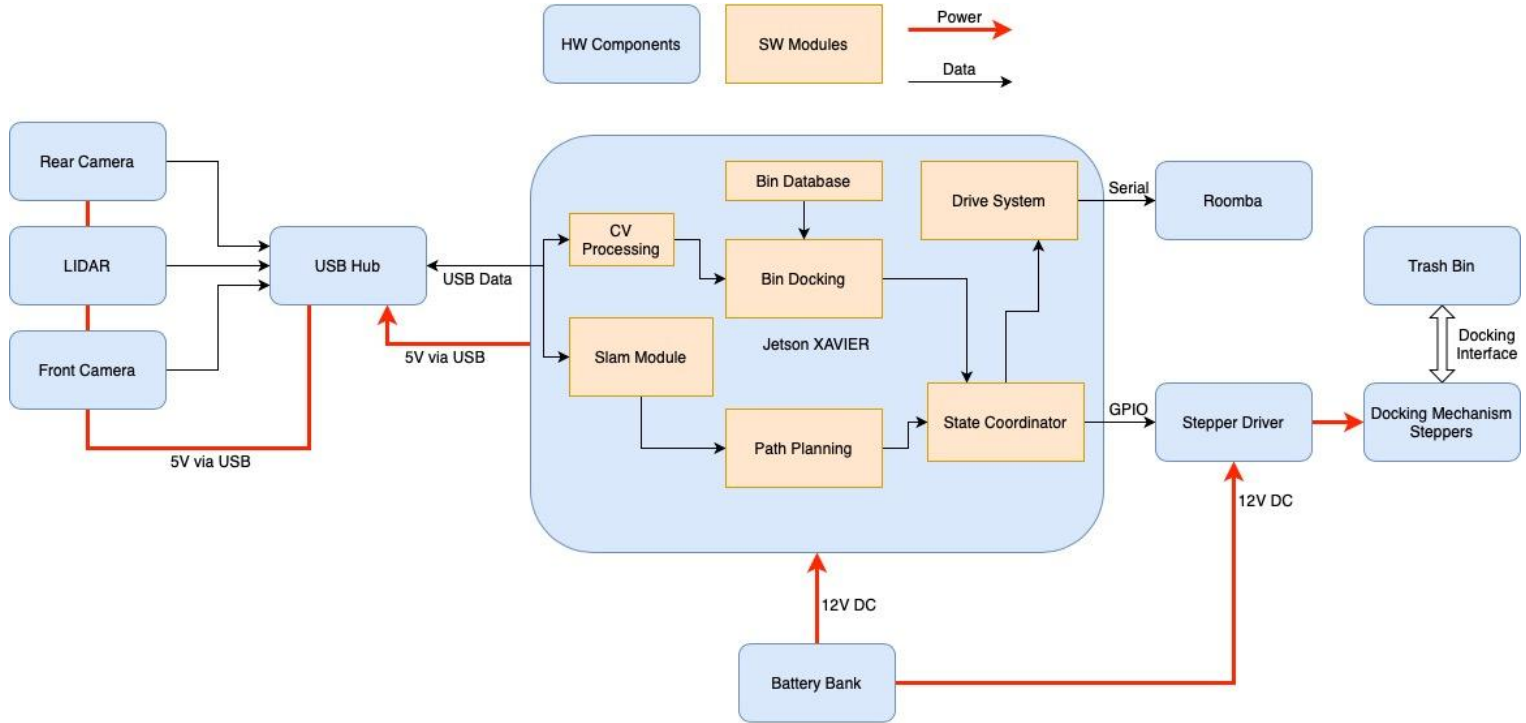
Requirement	Use-case Specification	Design Requirement
Work Area	META Open Office Work Section	Robot Height <30in, Robot Width: <3ft Flexible Mapping Technology
Health & Safety	Minimize human collisions and trash spills.	Obstacle Avoidance System, Easily Identified
Movement	Room Setup: 19m x 23m, 90 People, ~90 bins 5 Hour Work Period: 7 PM - 12 PM	Robot Battery >5 Hr, Movement Speed: >.21 m/s

Solution Approach

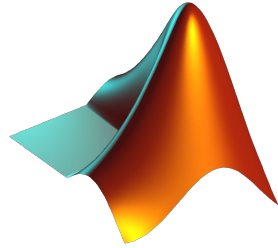


1. General Welfare: Maximize engineer happiness
2. Health and Safety: Eliminate leftover/overfilled trash bins
3. Economic Consideration: Reduce custodial workload

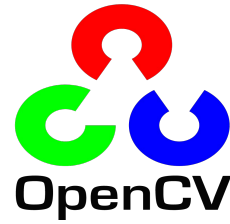
System Diagram



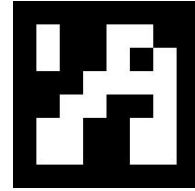
Implementation Plan Software



Lidar Slam / Path Planning



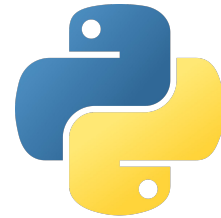
CV System



Drive System



Database



Bin Docking

Implementation Plan Hardware

Electronics Mount	Laser-cut wood / 3D printed
Drive System	Roomba motors
Power System	1 - 2 External battery banks Stepper motor driver
Bin Docking	Stepper motor lift system Worm gear for high torque
Bin Modification	Laser-cut wood base plate

Testing / Verification

Measurement	Input	Output / Goal	Risk Factors / Mitigation
Bin Identification	ARUCO Tag On Bin	Successful Identification	Misaligned Bin, Multiple ArUco tags
Bin Docking	ARUCO Tag On Bin	Successful Localization and docking	Misplaced Bins, Notify Custodian
Bin Tow	10 lb Trash Can	< 0.2 m of destination	Make Bins Smaller/Lighter
SLAM Bin Mapping	HH1307 + Randomized Bin Locations	Map Location of All Bins	Misaligned Bins, Manual Placement of Bins

Testing / Verification

Measurement	Input	Output / Goal	Risk Factors / Mitigation
SLAM Room Mapping	HH1307 Lab	General Accuracy	Overhead Camera
Path Finding	Multiple Bin Locations + Obstacles	.5 m Accuracy	Room Changes, Notify Custodian, Manual path planning
Obstacle Avoidance	Mason Walking around	< 90% collision rate	Move Around Objects, Stall, Notify
Integration Test	HH1307 two bin rotation	Runtime, 85% Overall Success	Aftermarket Battery/Add Charing Cycle

Project Management

