

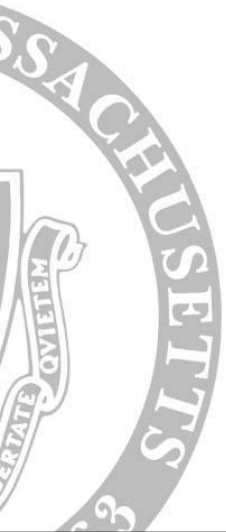
Mid-Year Design Review

I.G.O.R.

Intelligent General
Order-fulfillment Robot

Team 20 - LH 27

Adam, Alex, Johnathon, Josh, Victor



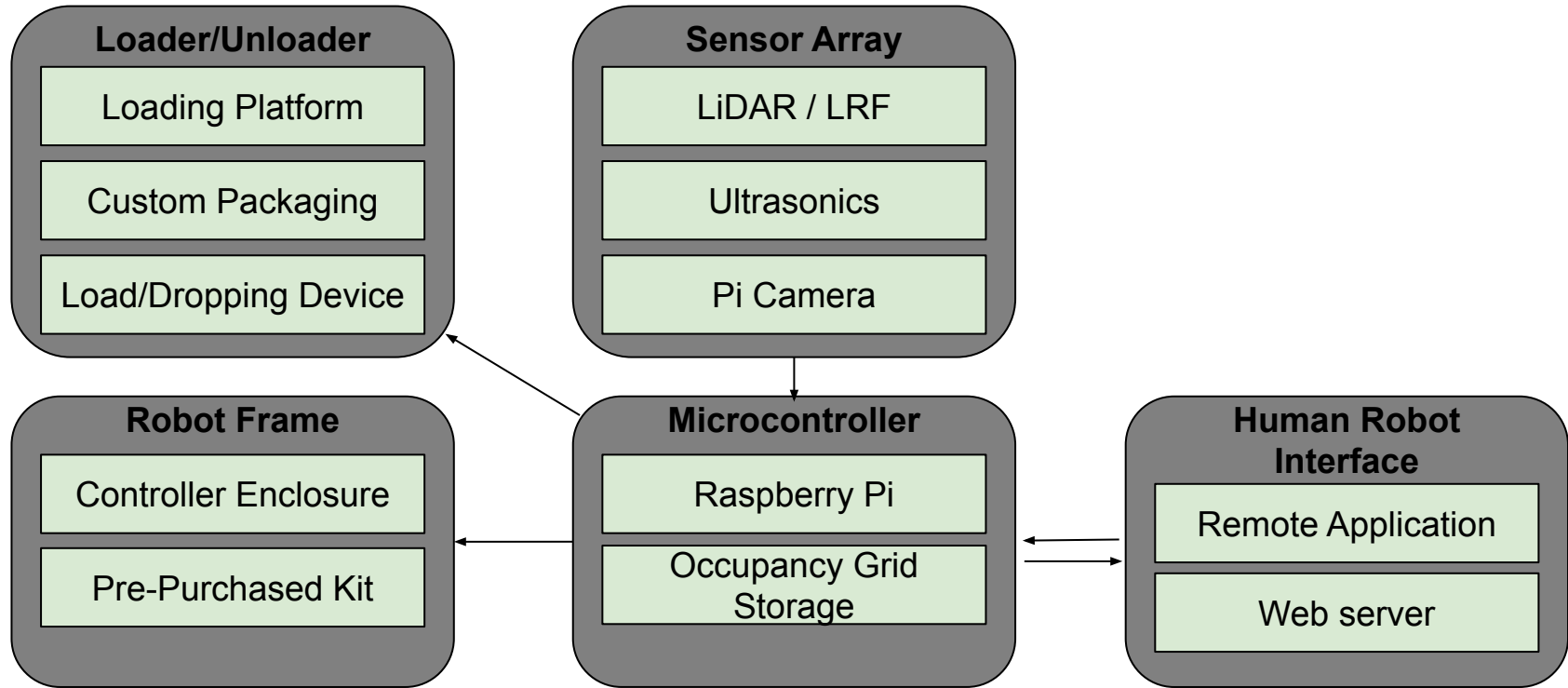
Problem Statement

- Delivering objects indoors takes time and resources
- Package sizes and shapes can vary, making them challenging for a robot to pick up
- Dynamic environments with moving humans can make operation of autonomous robots dangerous for both parties

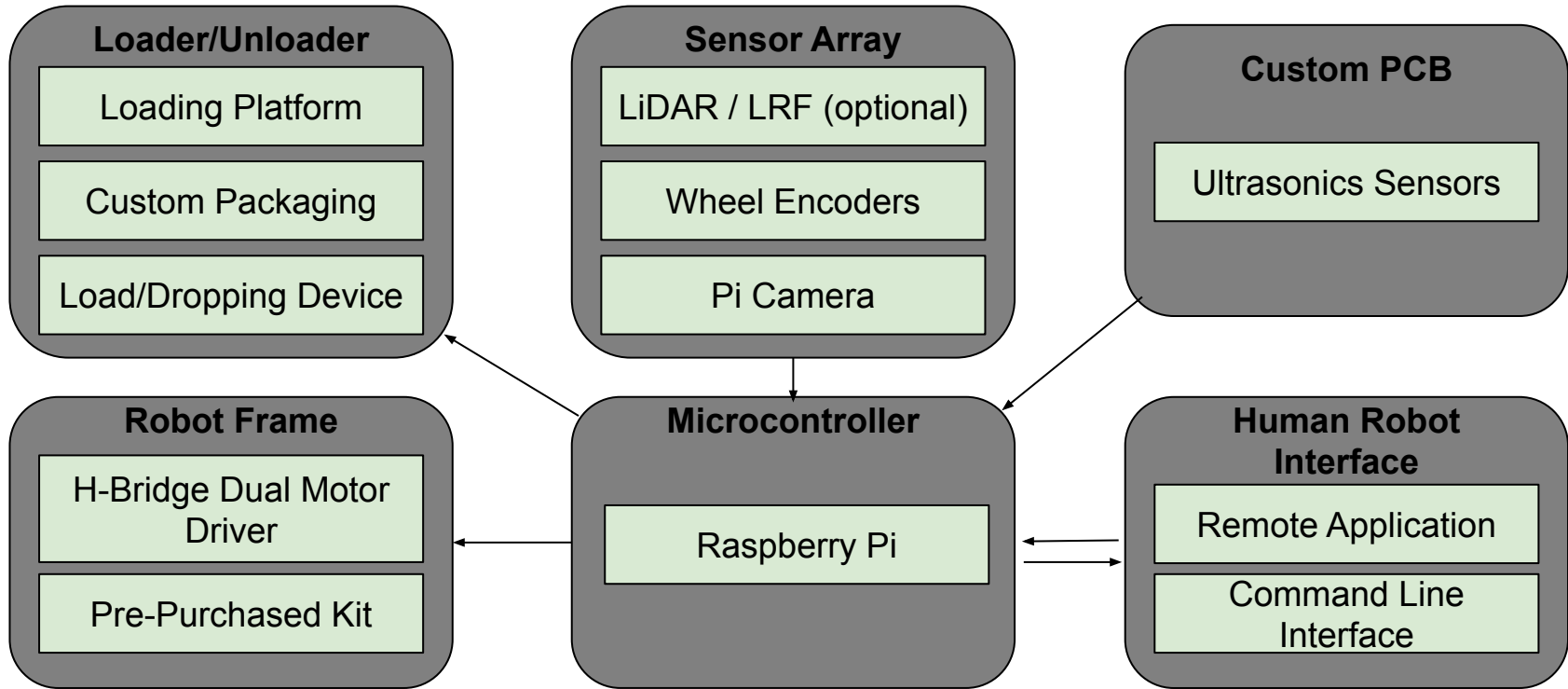
Requirements and Specifications

Requirement	Specification	Value
Receive source and destination	Graphical user interface	Display a map that the user can use to select a package source and destination
Path plan route to goal	Time	< 2 sec
Carry a package to destination	Speed	0.5 mph
Autonomous package unloading	Distance from selected destination	3 feet
Battery Life	Number of deliveries	3+ deliveries in Marcus
Collision avoidance	Response time	< 180ms
Portable	Size / weight	< 4cuft / < 20 lbs

Previous Block Diagram



Revised Block Diagram



Proposed MDR Deliverables

MDR Requirements:

- Autonomously load packages
 - The robot will be able to lift and acquire the package when pre-aligned

- Plan a path
 - The robot, when given a coordinate, floor plan, and a ground truth about its initial position can plan and follow a path from point A to point B

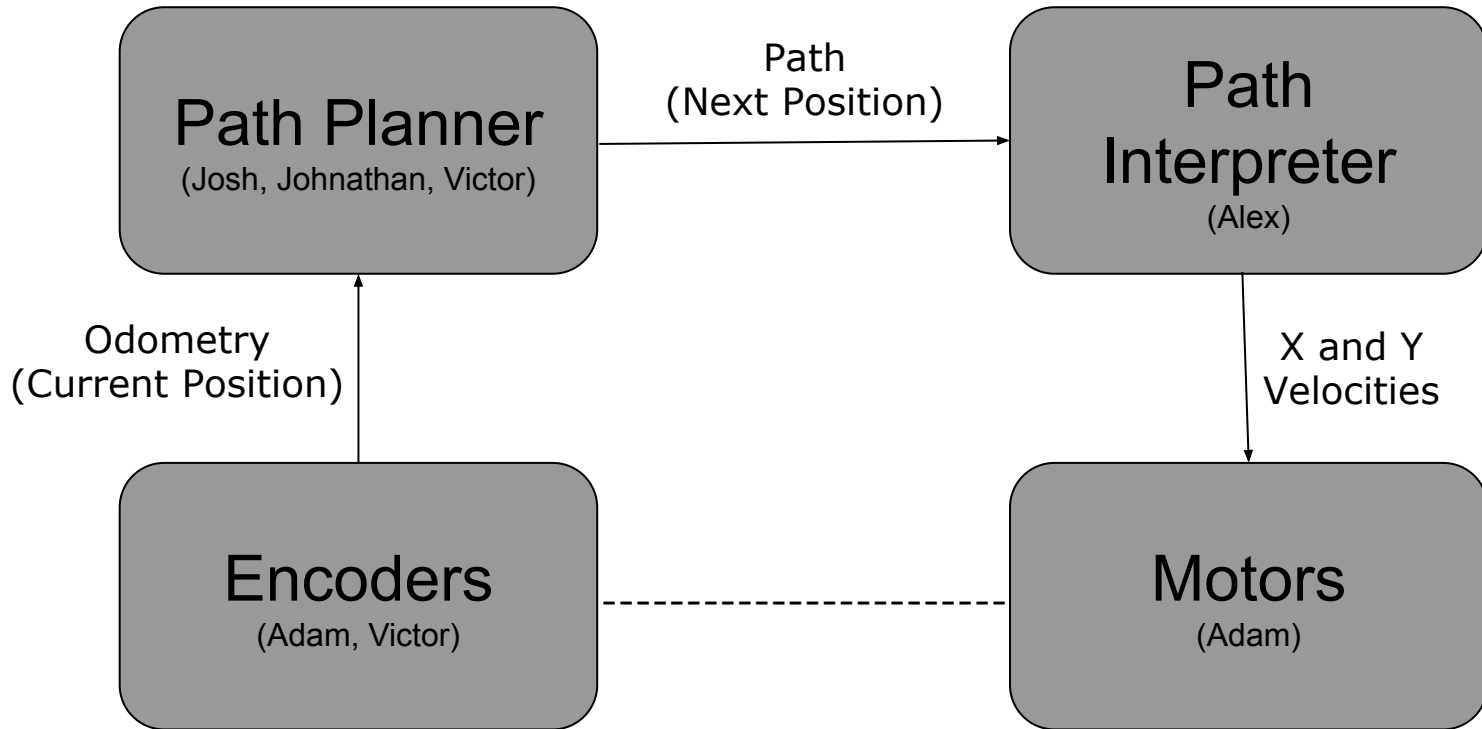
- Receive directives and plan a path
 - One-way communication will be implemented so the robot can receive a delivery goal

- Ultrasonic sensors to detect objects

Package Lifting Mechanism

- Continuous servo drives a pinion, which drives a vertical rack, raising the fork
- Package is able to lift an empty box

Navigation Integration w/ Robot Operating System



Ultrasonic Distance Sensors

- Individually detects objects
- Not integrated into robot system

GANTT Chart (Spring 2020)

TASK NAME	PLANNED DATE	Start Date	DURATION (Weeks)	Task Owner	PERCENT COMPLETE	January		Feb				Mar				Apr			
						3	4	1	2	3	4	1	2	3	4	1	2	3	4
General Tasks																			
Fix Git Repository	1/24		2	Everyone	0%														
Clean Robot Working Directory	1/31		2	Everyone	0%														
State Machine																			
Main logic	4/10		1	Johnathan	0%														
Testing	4/17		1	Johnathan	0%														
April Tags																			
Pi Camera Setup	1/24		1	Victor, Alex, Johnathan	0%														
Setup April Tags	1/31		2	Victor, Alex, Johnathan	0%														
Localization with April Tags	2/14		2	Victor, Alex, Johnathan	0%														
Testing	2/21		2	Victor, Alex, Johnathan	0%														
Ultrasonics + PCB																			
PCB Design	11/12		3	Josh	0%														
Integration	11/13		2	Victor & Josh	0%														
Testing	11/14		2	Victor & Josh	0%														
Human-Computer Interface																			
Create User Input GUI	11/8		4	Josh	0%														
Write Start Scripts	11/15		3	Victor	0%														
Operational Testing	11/22		2	Victor, Josh	0%														
Lifting and Alignment																			
Construct Weighted Lifter	11/8		4	Adam	0%														
Create Alignment Software(april tags)	11/15		2	Adam, Alex, Johnathan	0%														
Test Package Pickup and Delivery	11/22		3	Adam, Alex, Johnathan	0%														
SLAM (Stretch)																			
Research libraries	11/8		2		0%														
Integrate libraries	11/15		2		0%														
Testing	11/22		4		0%														

Proposed CDR Deliverables

- Update global position with April Tags
- Detect and plan around obstacles with Ultrasonic Distance Sensors
- Plan a path and navigate to a destination location within a specified range of error
 - For now, within a meter, but will need to run tests to get a better sense of what accuracy we can expect

Proposed FDR Deliverables

- Create a CLI or GUI interface to receive the pickup and destination points
- Drop off the package at the delivery point

FDR Stretch Goals

- Align itself and load the package
- If time permits:
 - Use SLAM to generate and map a floor as an alternative to being given an existing floor plan of a building
 - Receive the coordinates of a pickup point and delivery point via an application, where the user can select these two points on the map
 - Create a GUI (replaces the CLI)

Thank You
Questions?