

Carleton Mail Delivery Robot



Group 89

Supervisor: Dr. Babak Esfandiar

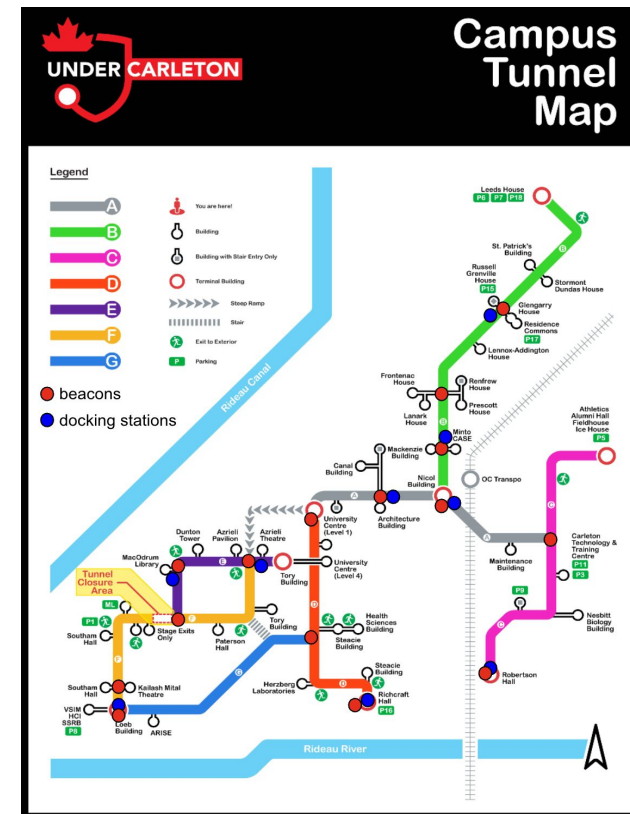
Max Curkovic
Cassidy Pacada

Bardia Parmoun
Matt Reid

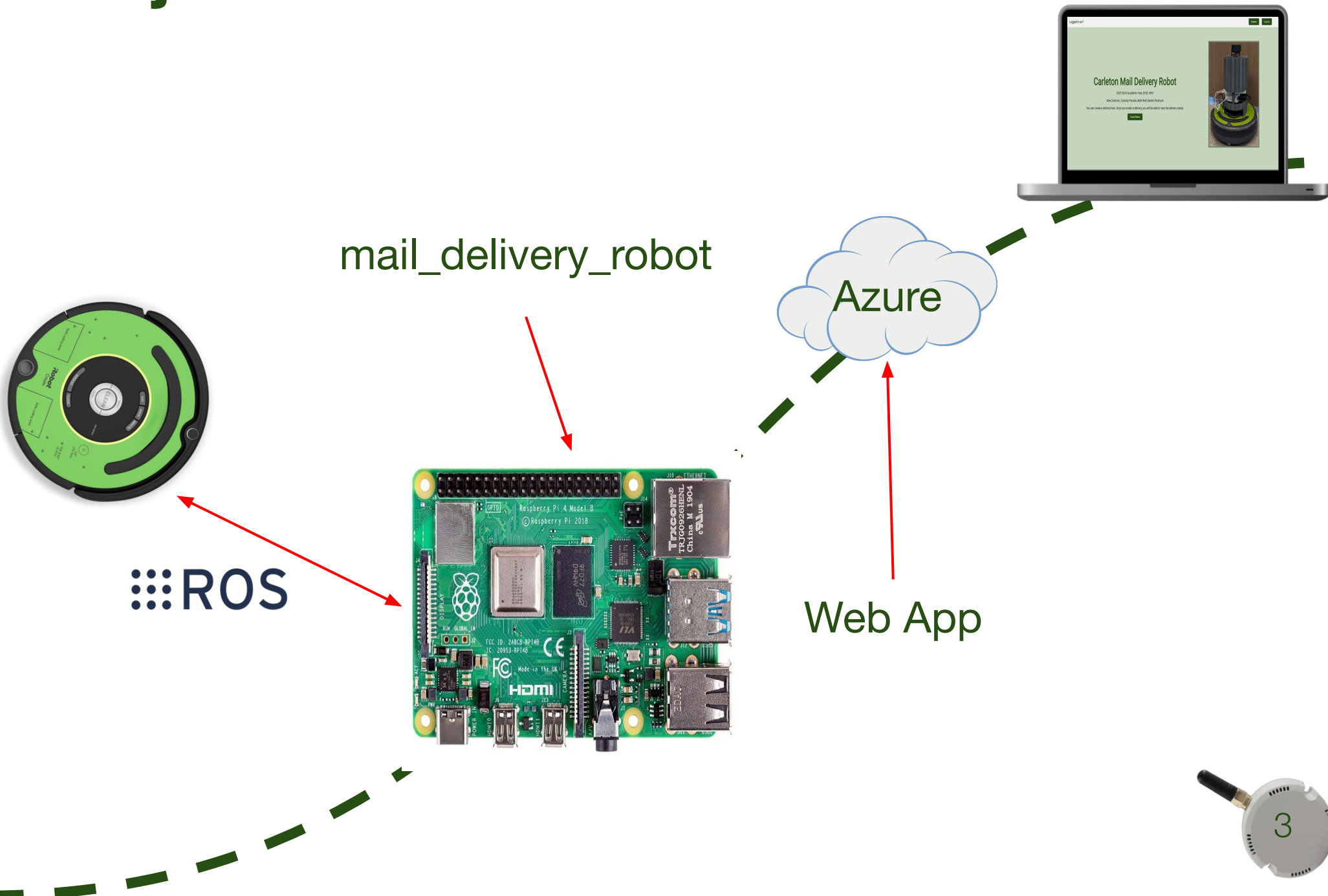


Introduction

- What?
 - Improve the mail delivery in the tunnels
- Why?
 - Faculty gets mail delivered everyday
- How?
 - Using programmable roombas
- Goals?
 - Cost-effective and resilient



Project Overview



Equipment



RPLiDAR A1



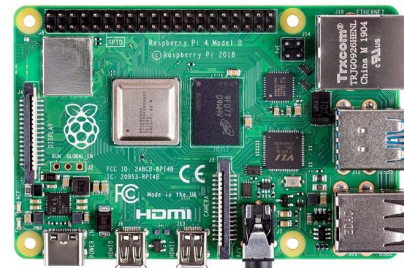
iRobot CREATE
2 & 3



Bluetooth
Beacon



Dock Station

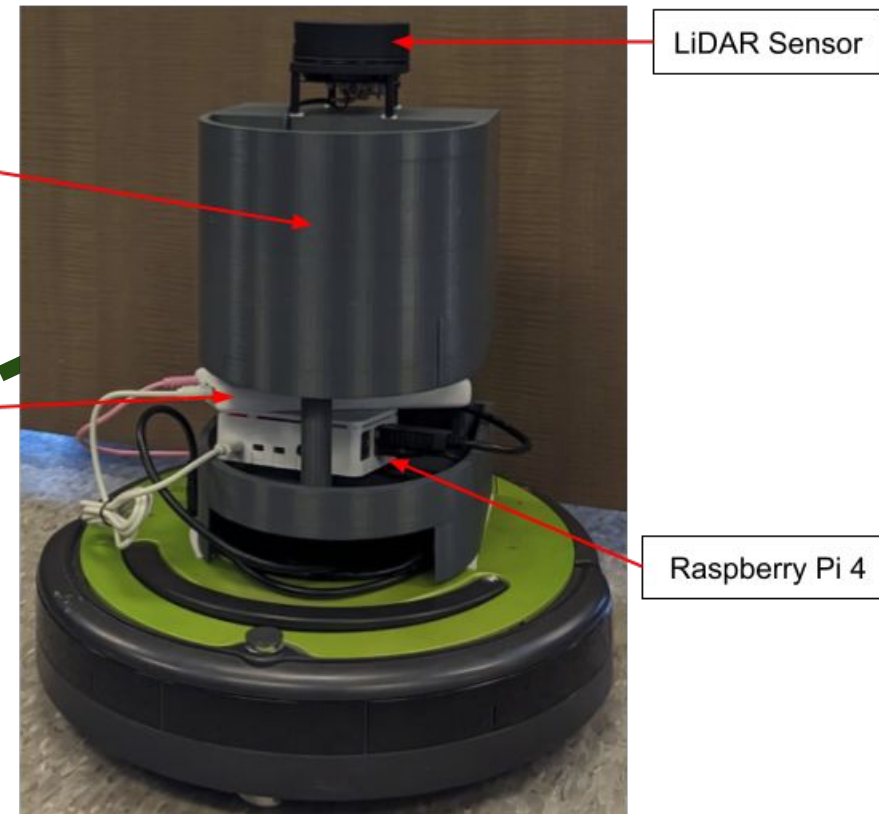
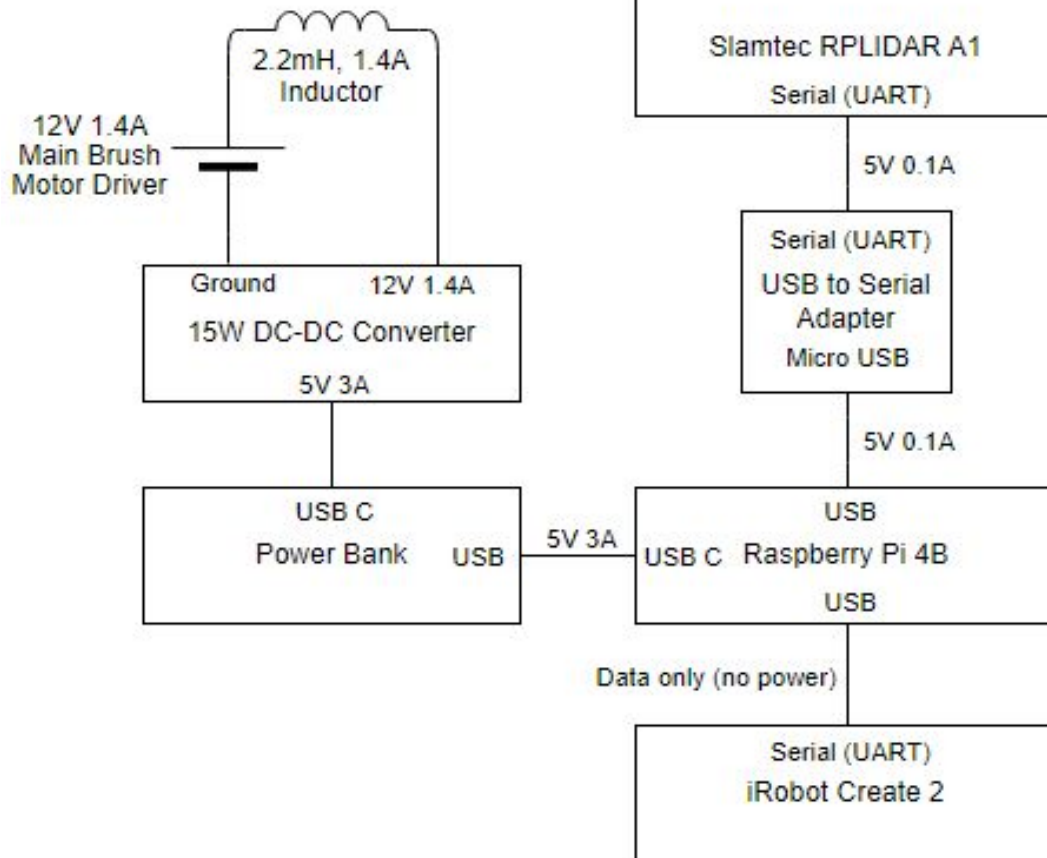


Raspberry Pi
4B

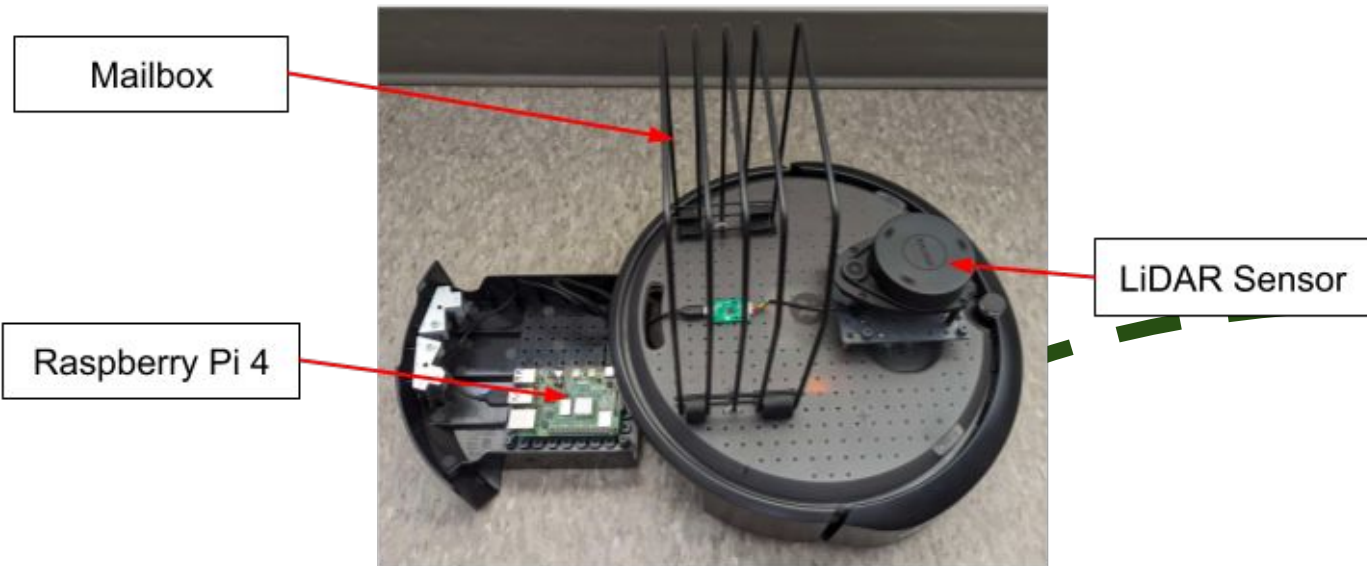
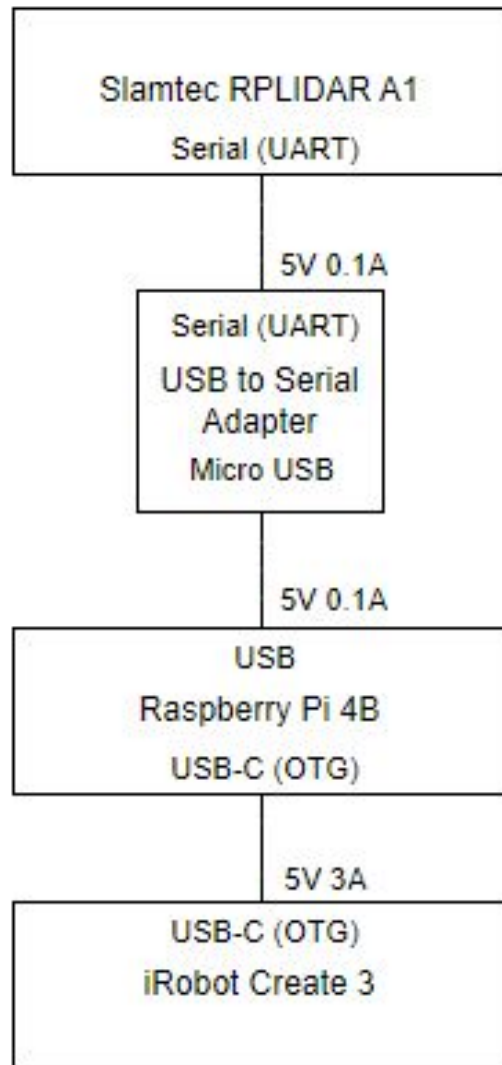


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Hardware: CREATE 2



Hardware: CREATE 3



Software Implementation

ROS



Robot Backend



Web
Application

```
ubuntu@cmds:~/cmds_ws$ ros2 launch mail_delivery_robot test.launch.py "path:=Canal:Nicol" "duration:=60"
"wall_diff:=0.6"
[INFO] [launch]: All log files can be found below /home/ubuntu/.ros/log/2024-03-21-01-26-09-872734-cmds-
4227
[INFO] [launch]: Default logging verbosity is set to INFO
[INFO] [action_translator-1]: process started with pid [4229]
[INFO] [robot_driver-2]: process started with pid [4231]
[INFO] [captain-3]: process started with pid [4233]
[INFO] [client-4]: process started with pid [4235]
[INFO] [stub_sensor-5]: process started with pid [4237]
[robot_driver-2] [INFO] [1710984370.256346474] [control.robot_driver]: Robot Starting STATE IS: NO_DEST
[stub_sensor-5] [INFO] [1710984370.357478228] [stubs.stub_sensor]: Init Pos (distance, angle): (0.2,0.1)
Collision Freq: 0.0, Path: ['Canal', 'Nicol'], Wall Difficulty: 0.6, Delivery(src, dest): (), Duration
: 60.0
[robot_driver-2] [INFO] [1710984370.560846331] [control.robot_driver]: 0.2:0.1:0.2:4:3
[action_translator-1] [INFO] [1710984370.579366118] [control.action_translator]: WALL_FOLLOW
[action_translator-1] [INFO] [1710984370.579891167] [control.action_translator]: WALL_FOLLOW
[action_translator-1] [INFO] [1710984370.584264798] [control.action_translator]: WALL_FOLLOW
[action_translator-1] [INFO] [1710984370.604460684] [control.action_translator]: WALL_FOLLOW
[action_translator-1] [INFO] [1710984370.614407324] [control.action_translator]: WALL_FOLLOW
[action_translator-1] [INFO] [1710984370.625376023] [control.action_translator]: WALL_FOLLOW
[action_translator-1] [INFO] [1710984370.644275619] [control.action_translator]: WALL_FOLLOW
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[action_translator-1] [INFO] [1710984370.684135176] [control.action_translator]: WALL_FOLLOW
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[action_translator-1] [INFO] [1710984370.703982627] [control.action_translator]: WALL_FOLLOW
[action_translator-1] [INFO] [1710984370.724455245] [control.action_translator]: WALL_FOLLOW
[action_translator-1] [INFO] [1710984370.734188941] [control.action_translator]: WALL_FOLLOW
[action_translator-1] [INFO] [1710984370.743965301] [control.action_translator]: WALL_FOLLOW
[robot_driver-2] [INFO] [1710984370.760196197] [control.robot_driver]: 0.1:-0.29021142391028154:0.1:4:3
```

Simulator



State Machine: Inputs & Transitions

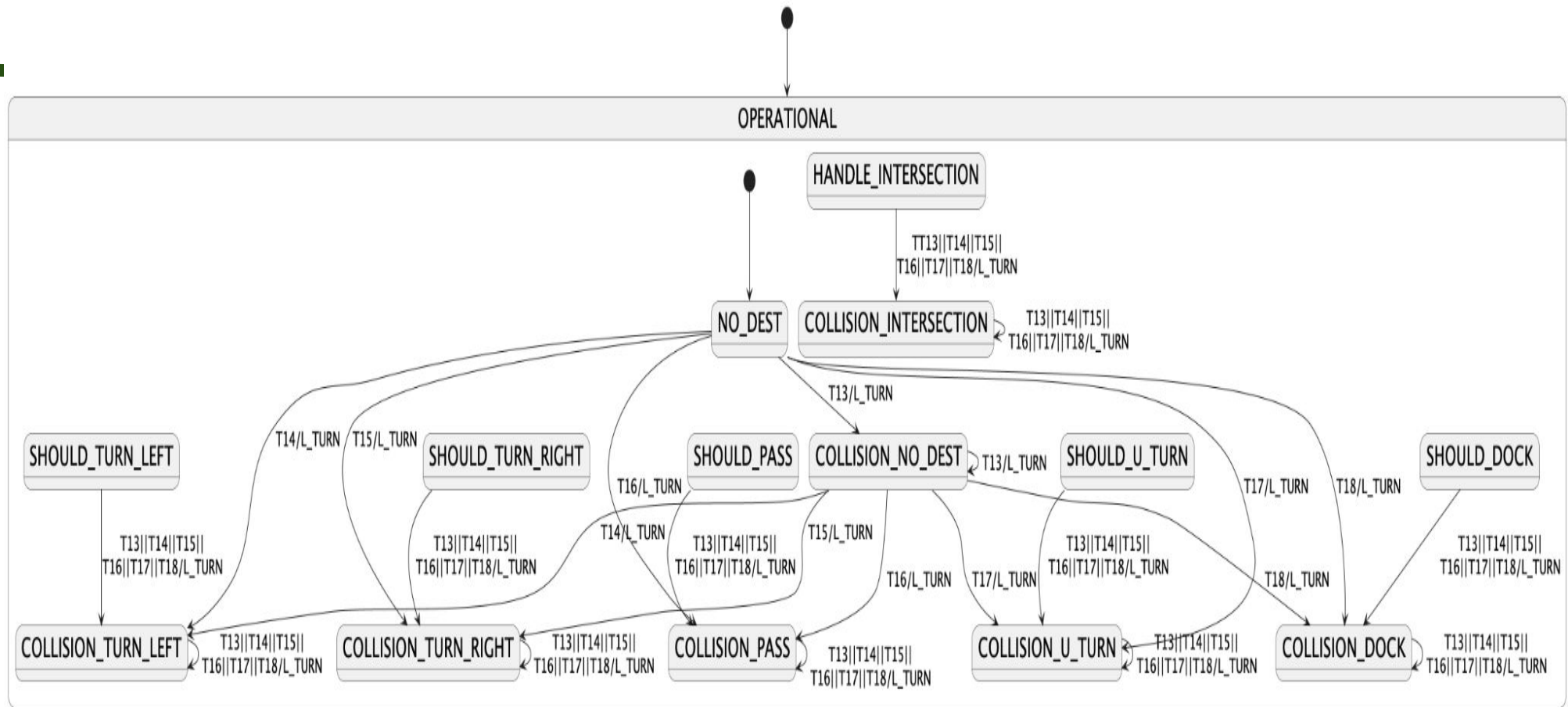


TRANSITION	ERROR	BUMPER	BEACON	LiDAR
1	FALSE	FALSE	NONE	FALSE
2	FALSE	FALSE	NONE	TRUE
3	FALSE	FALSE	LEFT	FALSE
4	FALSE	FALSE	LEFT	TRUE
5	FALSE	FALSE	RIGHT	FALSE
6	FALSE	FALSE	RIGHT	TRUE
7	FALSE	FALSE	PASS	FALSE
8	FALSE	FALSE	PASS	TRUE
9	FALSE	FALSE	U-TURN	FALSE
10	FALSE	FALSE	U-TURN	TRUE
11	FALSE	FALSE	DOCK	FALSE
12	FALSE	FALSE	DOCK	TRUE
13	FALSE	TRUE	NONE	x
14	FALSE	TRUE	LEFT	x
15	FALSE	TRUE	RIGHT	x
16	FALSE	TRUE	PASS	x
17	FALSE	TRUE	U-TURN	x
18	FALSE	TRUE	DOCK	x
19	TRUE	x	x	x

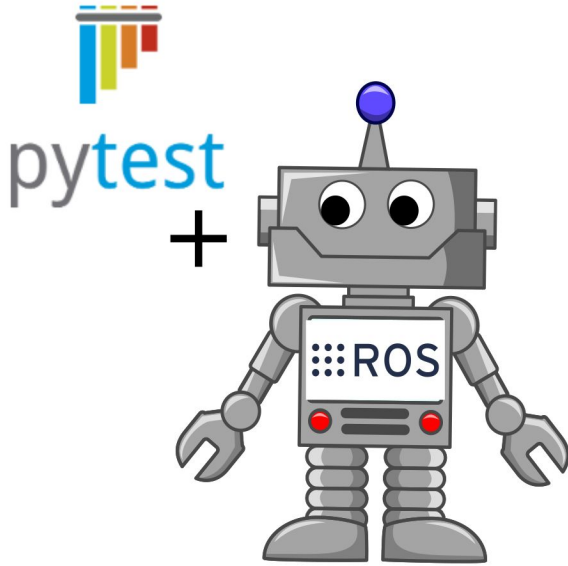




State Machine: With Collision Events



Testing



Robot Testing

(Unit and
Integration Tests)



Web Application

(Model and
Controller Tests)



Github Workflows

Project Management: Github Issue Tracking

Todo 3

This item hasn't been started

carleton-mail-delivery-robot #59

Web App - Styling

carleton-mail-delivery-robot #23

Add a way to stop the CREATE 2 when there is no wifi access

carleton-mail-delivery-robot #64

Add a way to automatically dock/undock the CREATE 2

+ Add item

In Progress 1

This is actively being worked on

carleton-mail-delivery-robot #61

Fine tune the project with the CREATE 3

+ Add item

In Review 0

This is actively being worked on

+ Add item

Done 56

This has been completed

carleton-mail-delivery-robot #3

Implement Unit Testing for the State Machine

carleton-mail-delivery-robot #27

Issue3 unit testing

carleton-mail-delivery-robot #8

Update the state machine to have the new events

carleton-mail-delivery-robot #14

Add the miscellaneous tools to the project

carleton-mail-delivery-robot #11

Update the progress report

+ Add item

Functional Implementation of Web App #54


 Merged maxcurkovic merged 12 commits into master from webapp_communication 2 weeks ago

Conversation 19

Commits 12

Checks 2

Files changed 21



maxcurkovic commented 2 weeks ago

Collaborator

I believe the web application is ready to go to serve with the robot and ROS!

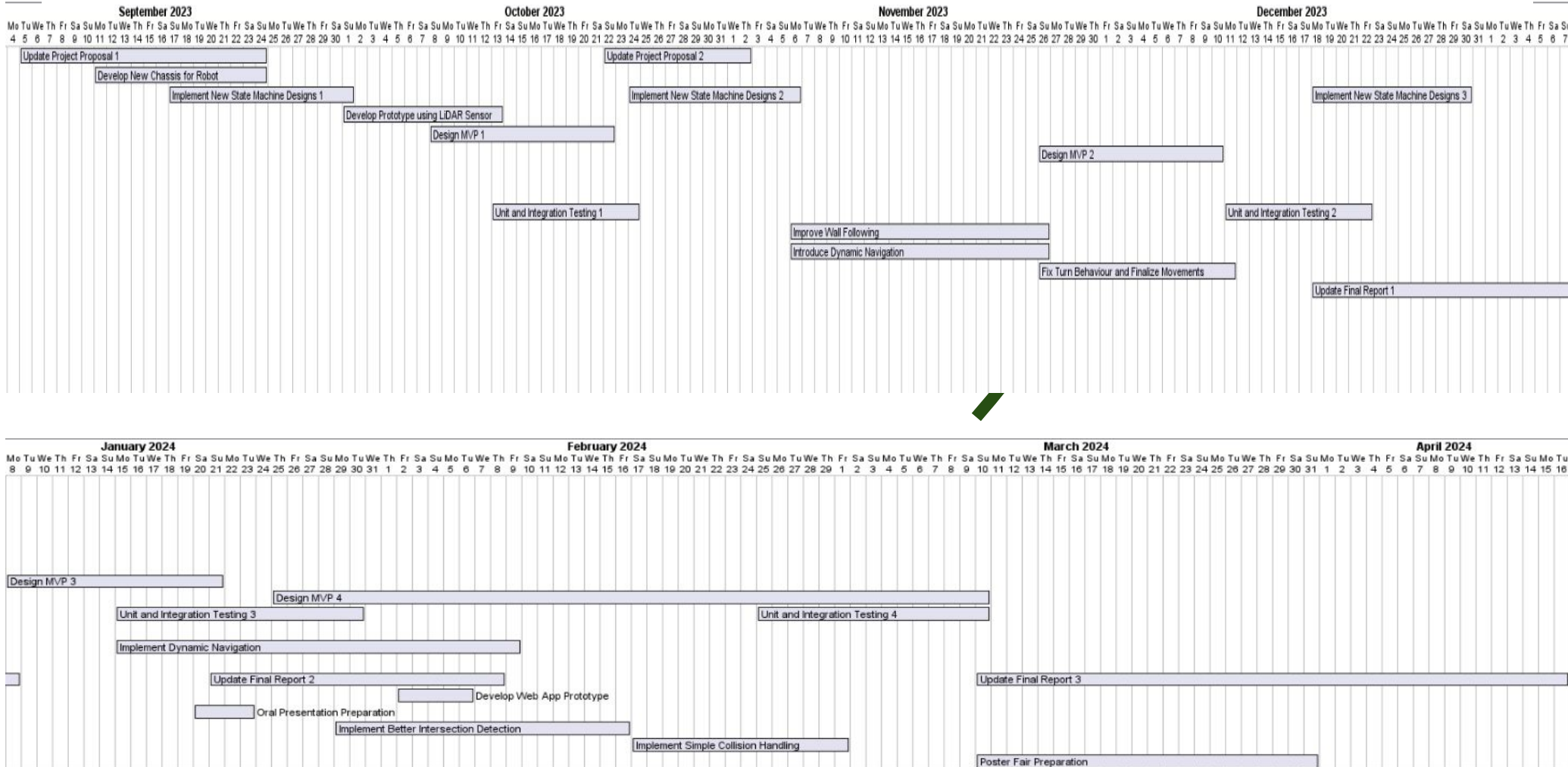
Please review and scrutinize all changes. There were a lot.

Work for weekend and next week:

- UML and database schema for report in PlantUML
- Adding the ability for robots to QUEUE deliveries, right now the functionality of finding an available robot is good but it doesn't add a "queue" of deliveries quite yet
- Kill delivery option
- Login aspect to prevent pages from being accessed in the address bar
- Separating User and Superuser functionality (Superuser only one that can register robots)



Project Management: Agile Development



Achievements: Fall 2023

- **September 2023 - October 2023:**
 - Created the MVP, including the new LiDAR sensor, state machine, and a new chassis.
- **November 2023:**
 - Improved the state machine and implemented strong wall-following capabilities.
- **December 2023:**
 - Implemented reliable intersection detection and collision handling.



Achievements: Winter 2024

- **January 2024:**
 - Fully implemented the state machine, improving upon currently implemented features.
- **February 2024:**
 - Fully implemented dynamic navigation. Began the process of transferring the codebase to the new CREATE 3.
- **March 2024:**
 - Developed a simple web application for the project, and completed the CREATE 3 transition.



Contributions

- **Max Curkovic:**
 - Robot's navigation, state machine, web application
- **Cassidy Pacada:**
 - Robot's testing framework, web application
- **Bardia Parmoun:**
 - Robot's logic, control, state machine
- **Matt Reid:**
 - Robot's hardware-related tasks

