Carleton Mail Delivery Robot

Group 89
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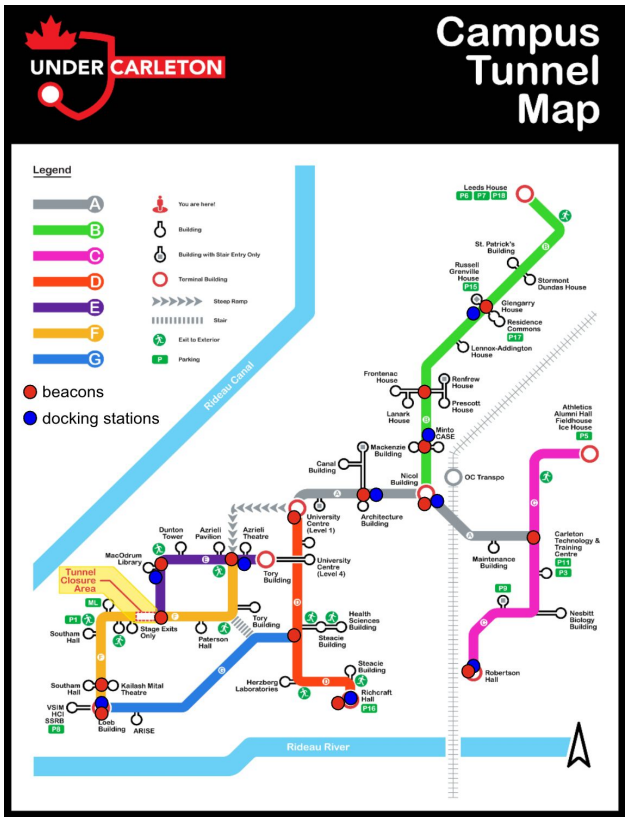
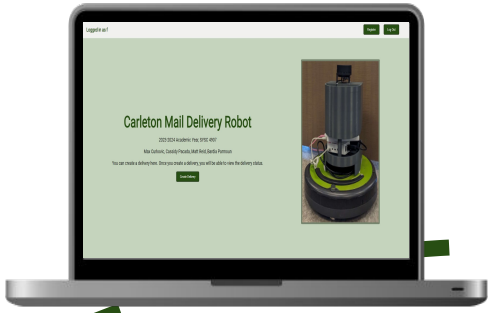
Cassidy Pacada
Bardia Parmoun
Matt Reid

Introduction

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



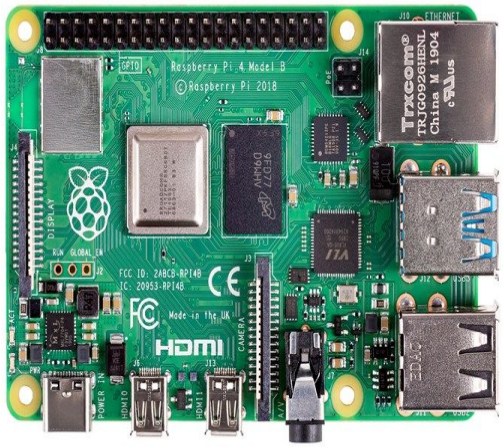
Project Overview



mail_delivery_robot

Azure

ROS



Web App

Equipment

RPLiDAR A1

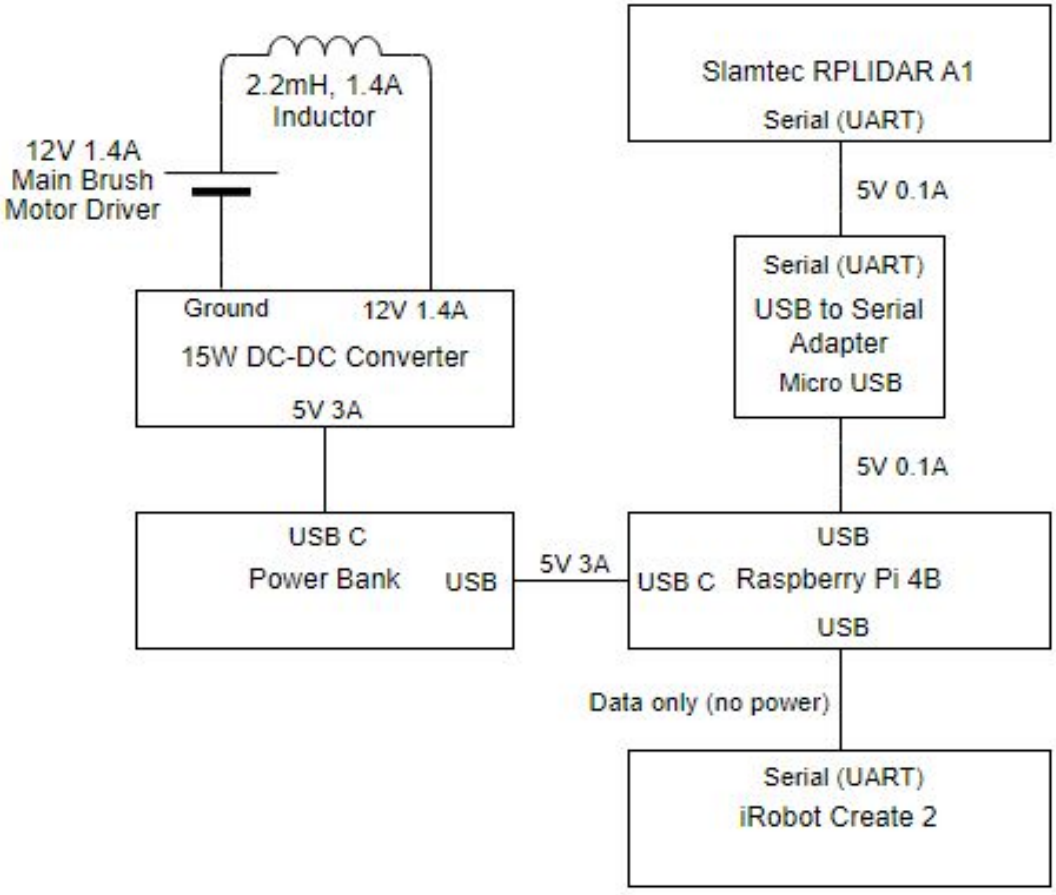
iRobot CREATE 2 & 3

Bluetooth Beacon

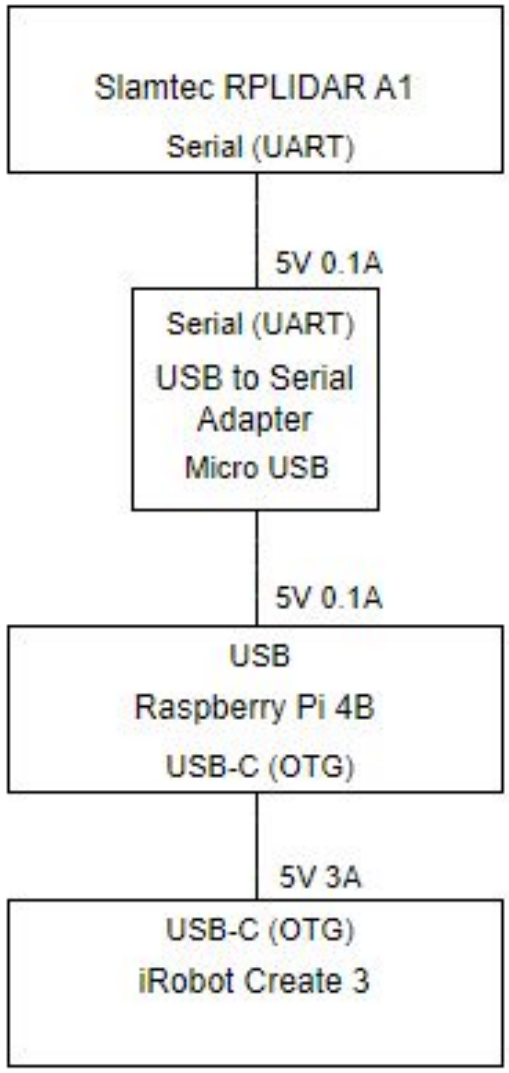
Dock Station

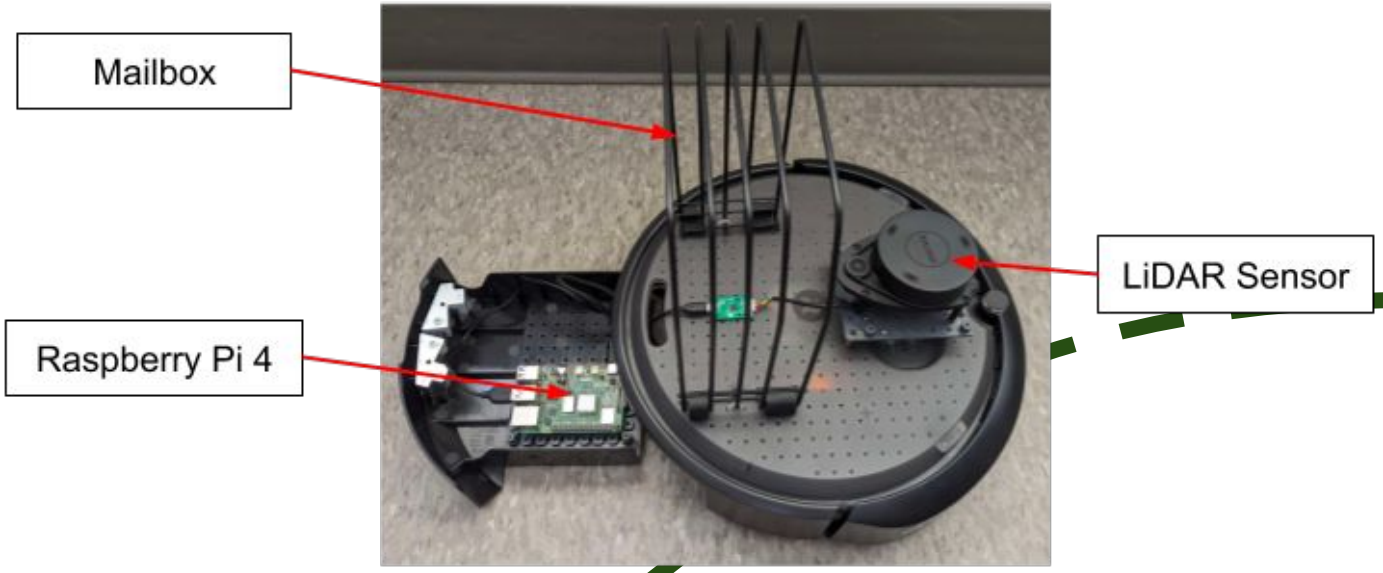
Raspberry Pi 4B

Hardware: CREATE 2



Hardware: CREATE 3





Software Implementation

ROS

python

Java

```
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
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[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:-0.2902114239102815 4:0.1:4:3
```

Robot Backend

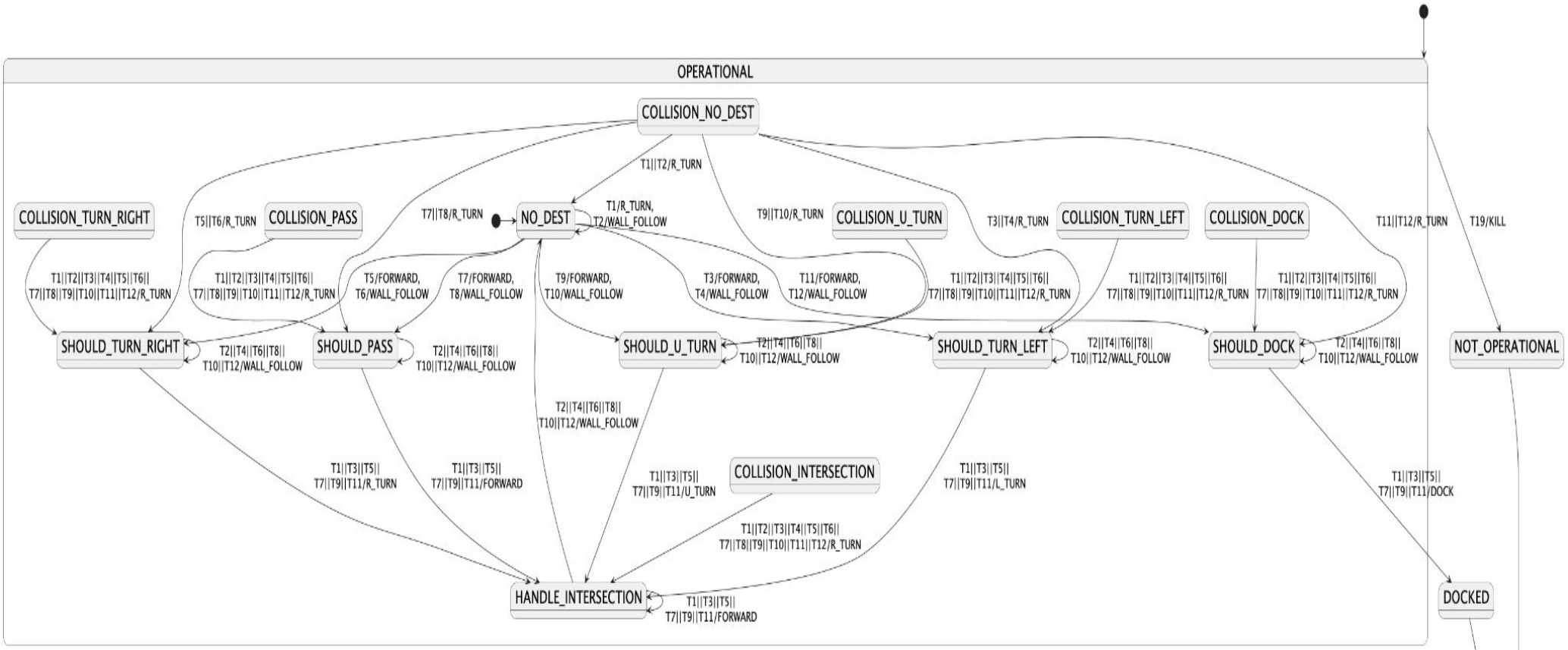
Web Application

Simulator

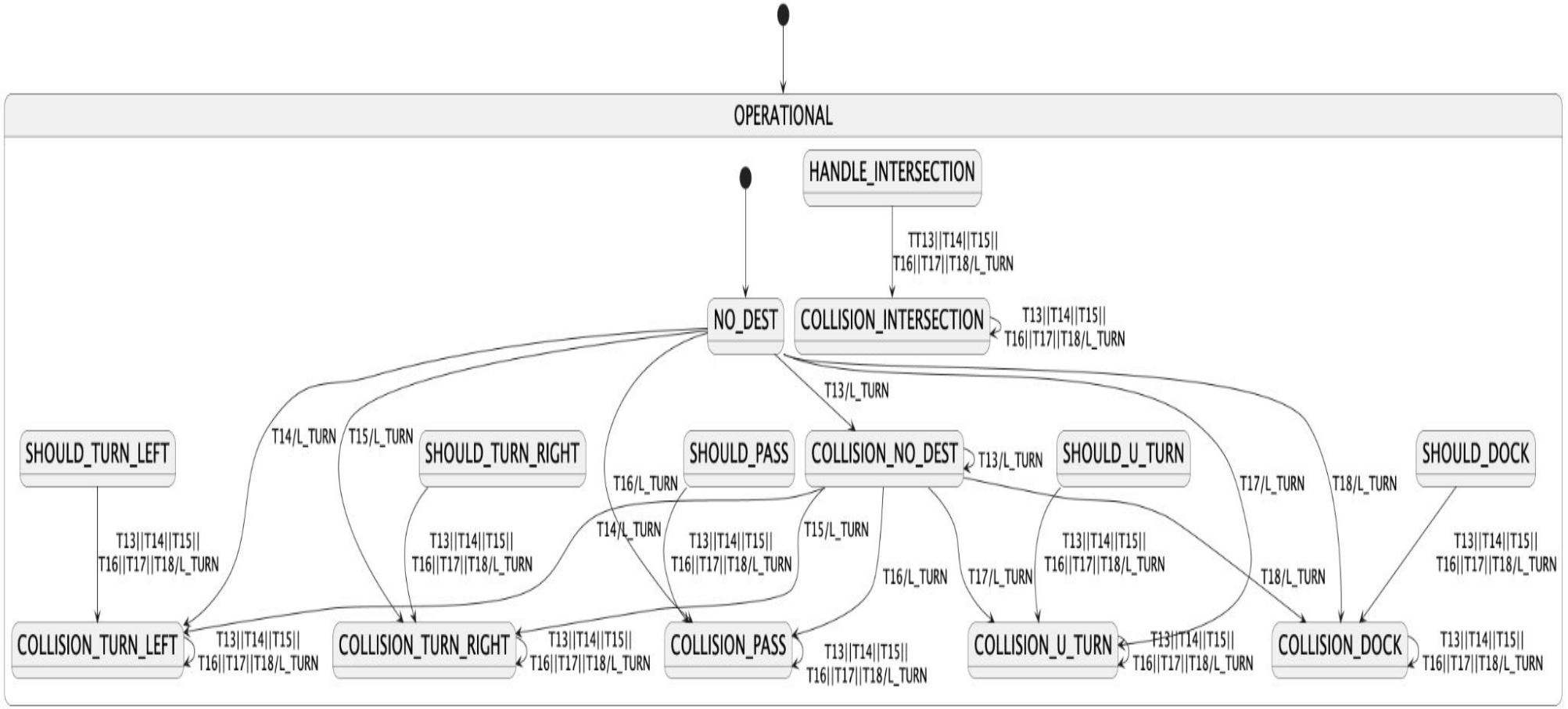
State Machine: Inputs & Transitions

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

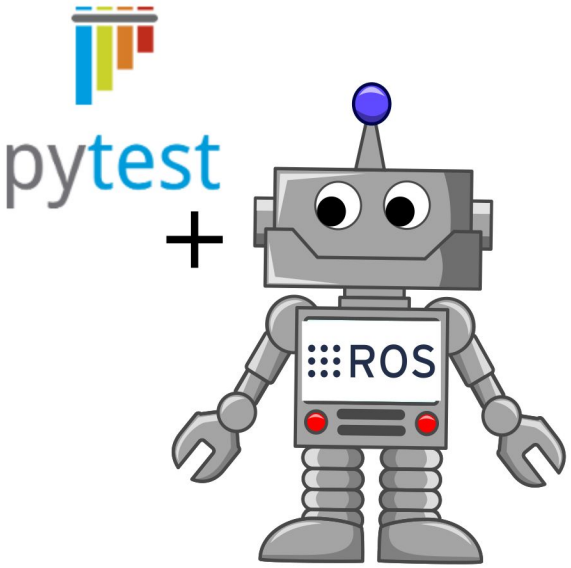
State Machine: Without Collision Events



State Machine: With Collision Events



Testing



JUnit 5

GitHub

Robot Testing

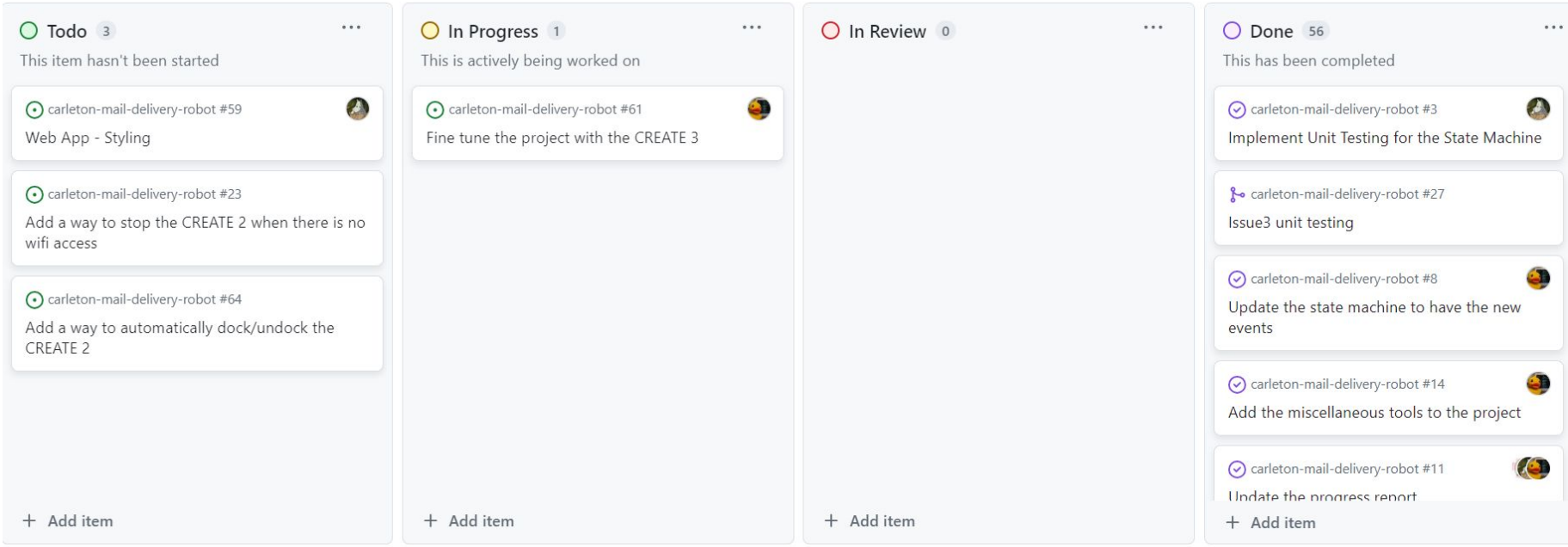
(Unit and Integration Tests)

Web Application

(Model and Controller Tests)

Github Workflows

Project Management: Github Issue Tracking



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

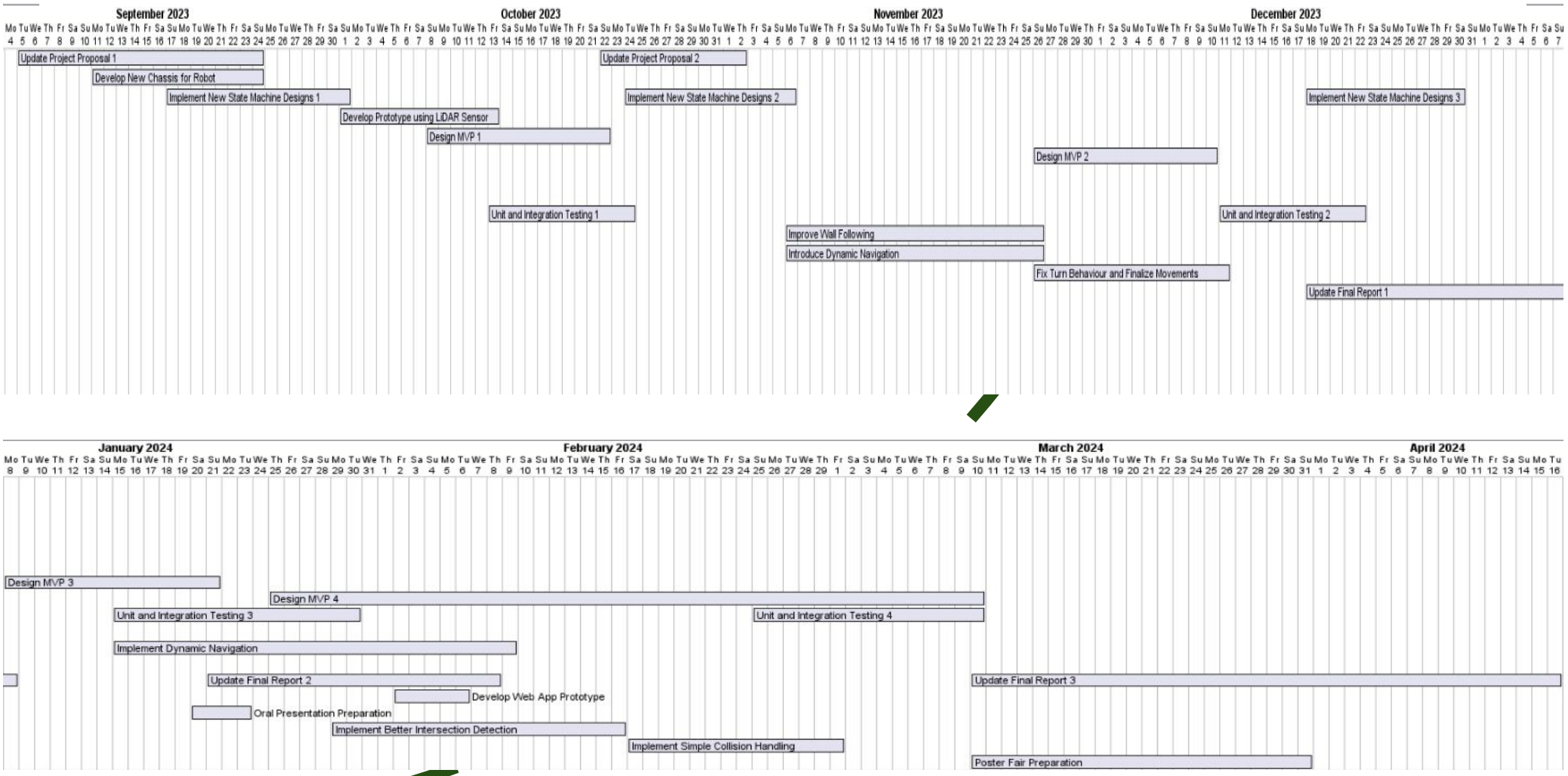
I believe the web application is ready to go to serve with the robot and ROS!

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