Carleton Mail Delivery Robot

Group 89
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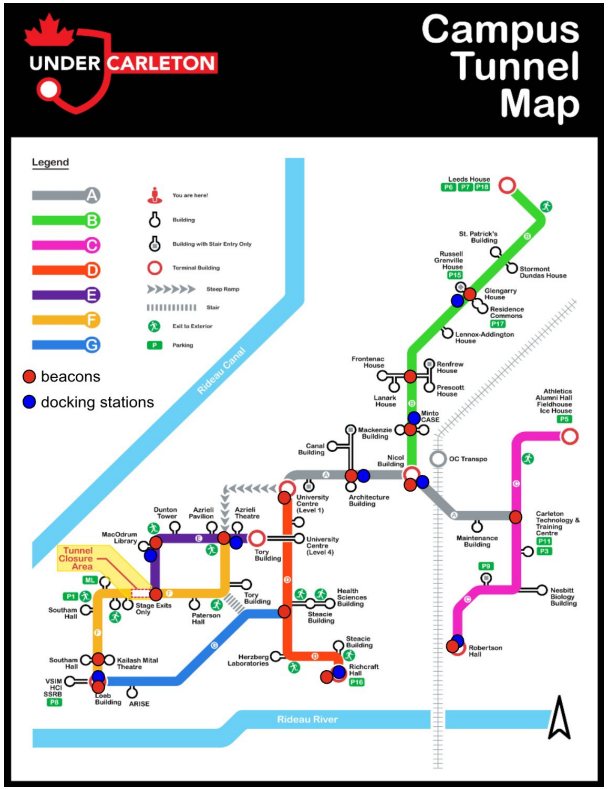
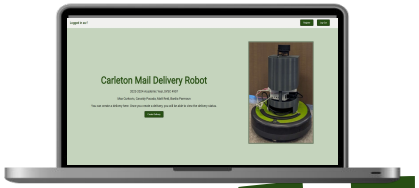
Introduction

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



Design

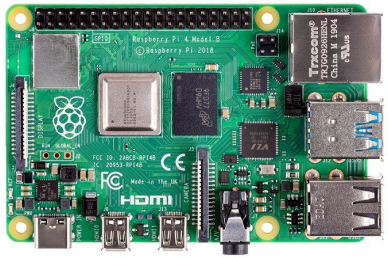


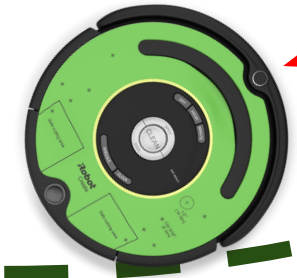
mail_delivery_robot

Azure

ROS

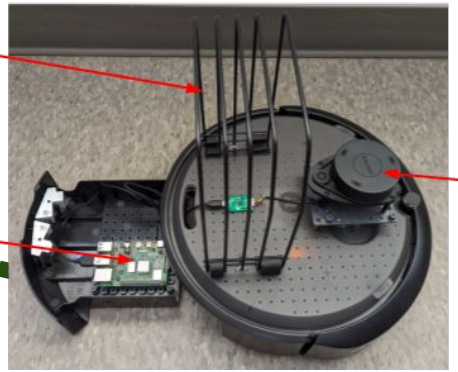
Web App





Hardware Implementation

iRobot CREATE 2

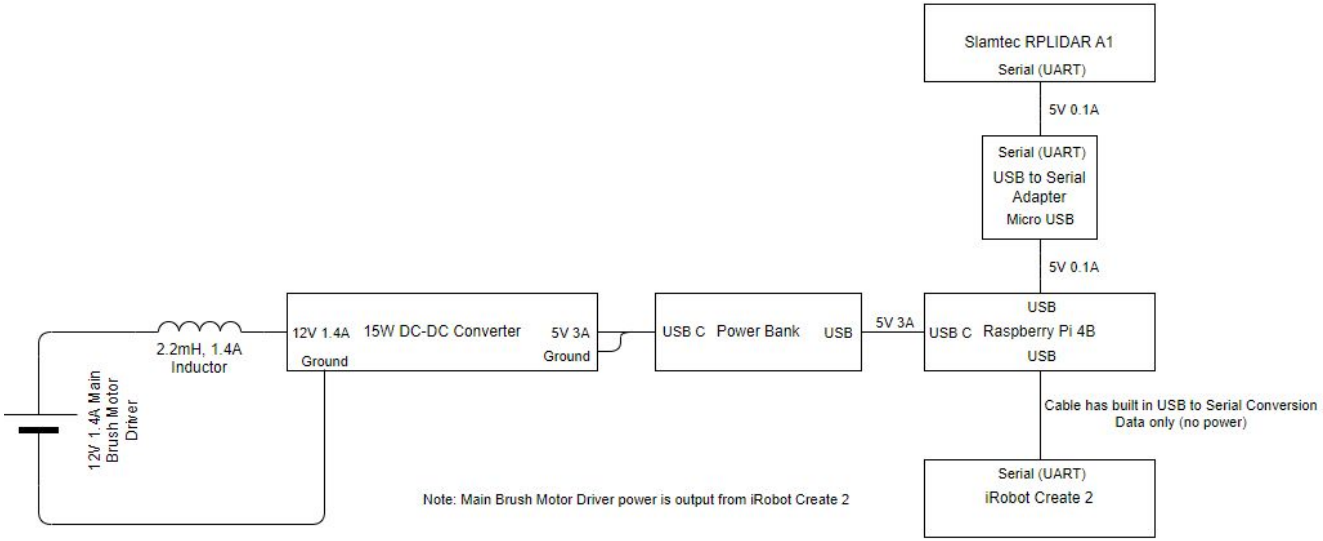


iRobot CREATE 3

Dock Station

Bluetooth Beacon

Hardware Design



CREATE 2

CREATE 3

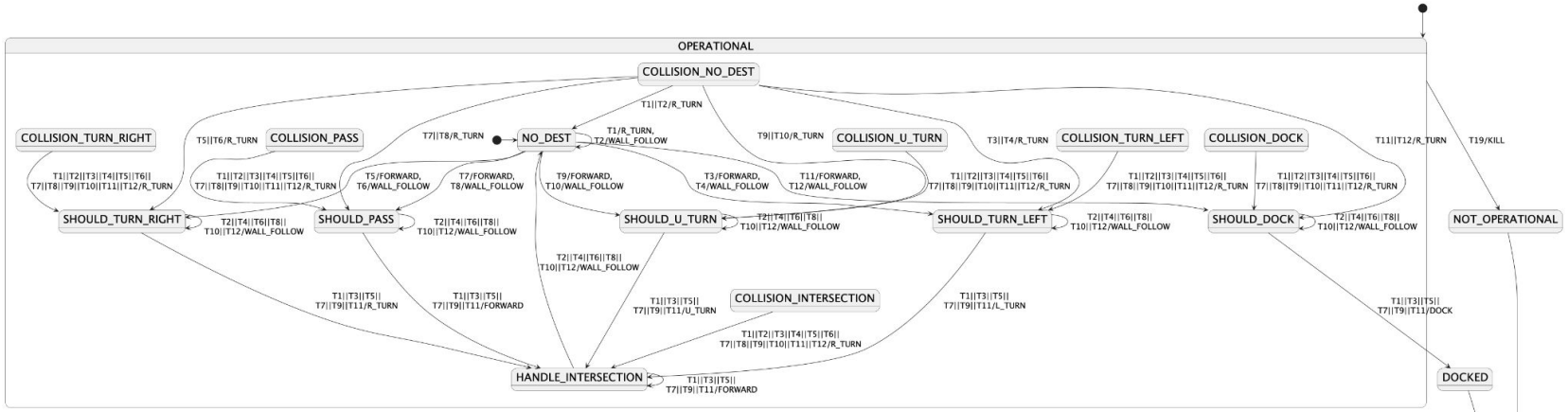
Software Implementation

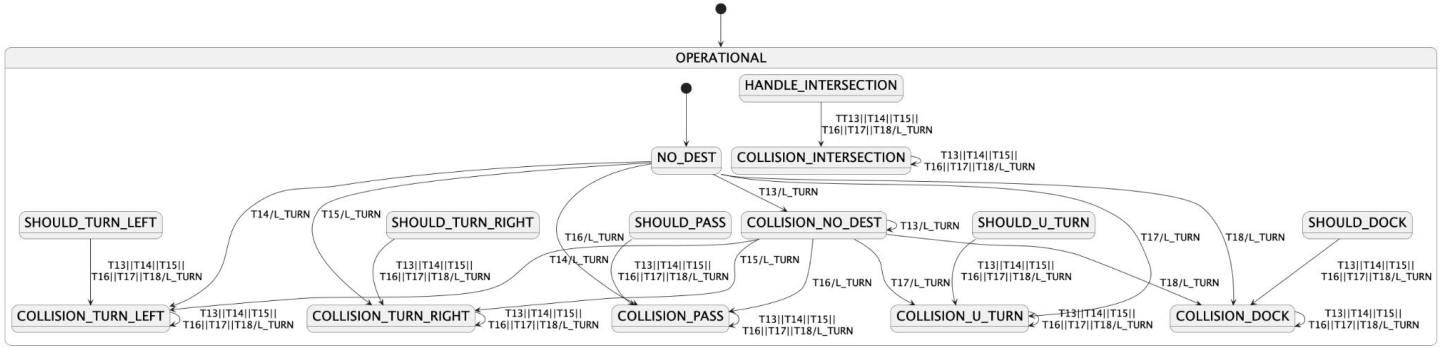
- Robot Backend
  - A complete real time system
  - A detailed state machine for resiliency
  - Uses ROS as the middleware
  - Mainly developed in Python
- Web Application
  - A simple Spring Boot application
  - Mainly developed in Java
- Simulator
  - Simulates all the sensor data
  - Reduces the need for hardware testing

State machine

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

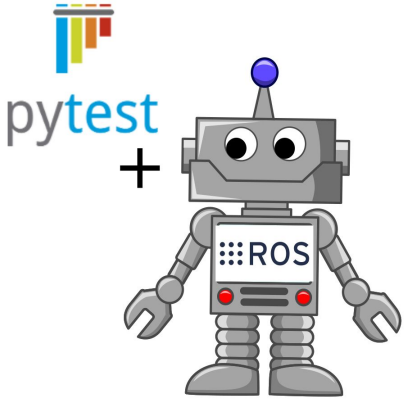
State machine





Testing

- Robot Testing:
  - Unit testing: Each individual unit
  - Integration testing: How units interact
- Web Application Testing:
  - Models and controllers
- Github Workflows:
  - ROS, Maven, Azure Deployment

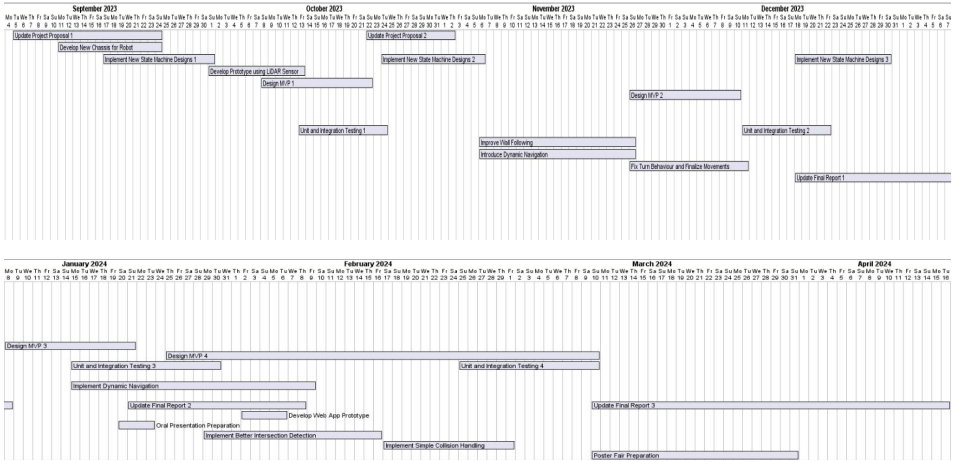


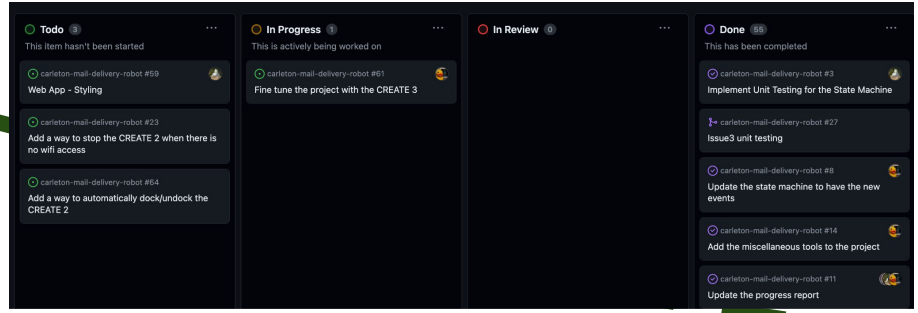
JUnit 5

GitHub

Project Management

- GitHub issue tracking
- Agile development
- Code reviews
- Weekly meetings





Achievements

- Codebase works with CREATE 2 and CREATE 3
- Dependable hardware
- Strong wall-following
- Reliable left and right turns, U-Turns
- Effective collision handling
- Resilient navigation using a map
- Simple but efficient web application
- Steady testing framework

Contributions

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