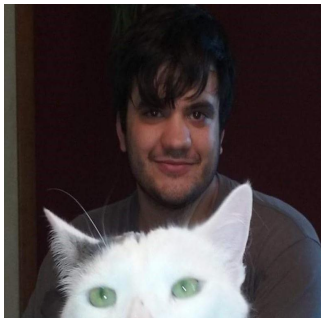
Cumulative Design Review

Team RoMo
March 8th, 2018

Team Romo



Kevin Moriarty
CSE ‘18
Hampden, MA

Collin Timmerman
EE ‘18
Westwood, MA

Aaron Stam
EE ‘18
Holden, MA

Leonardo Luchetti
EE ‘18
East Bridgewater, MA

Project Overview

ROMO -

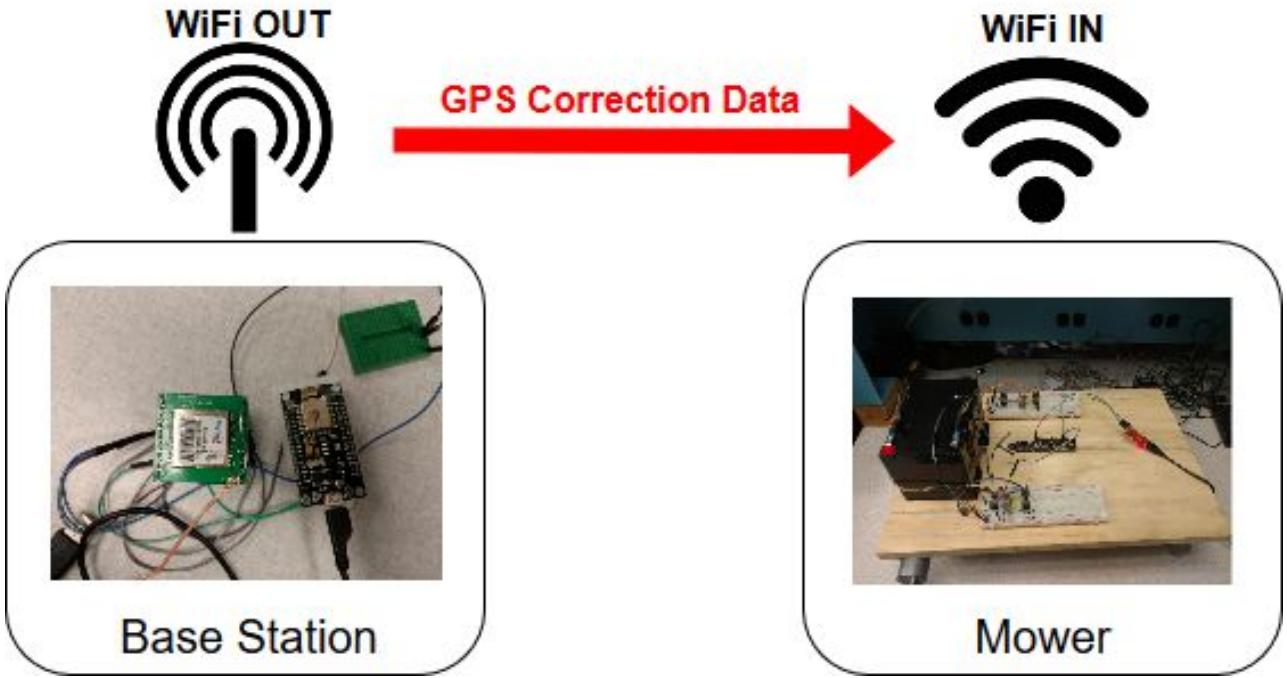
RObotic Autonomous Lawn MOwer

Romo offers the user free time and financial savings. It is cheaper than a hired worker, and easier than mowing by hand.

Overview - Requirements/Specifications

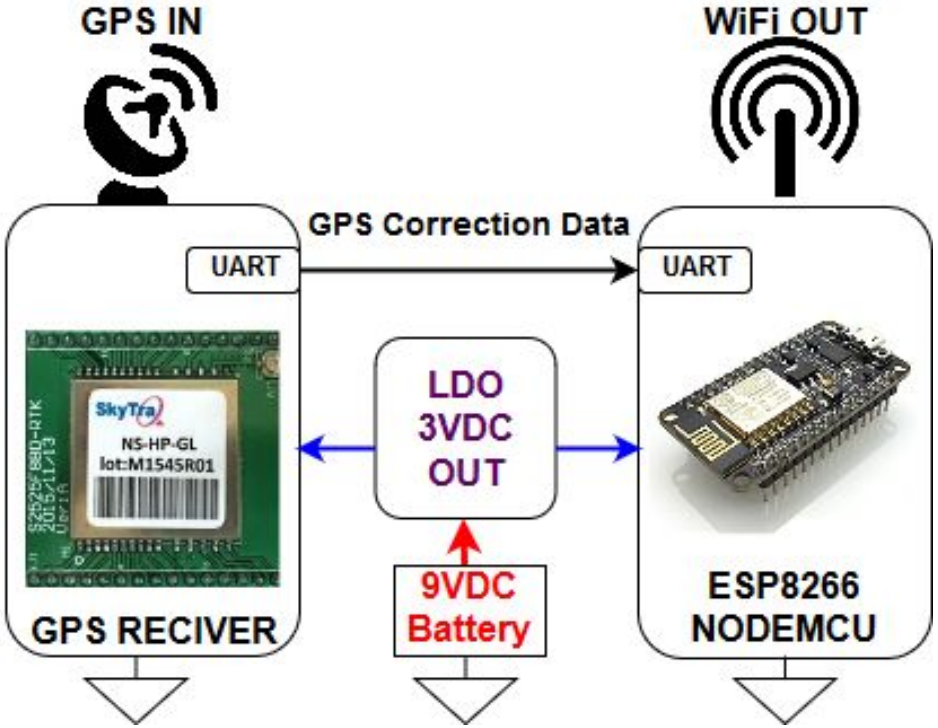
Requirement	Specification
Lawn Area	1500 sq. ft.
Mowing Speed	3.5 +/- 1.0 mph
Battery Life	1 charge = 1500 sq. ft.
Position Accuracy	Better than 5 cm

System Block Diagram



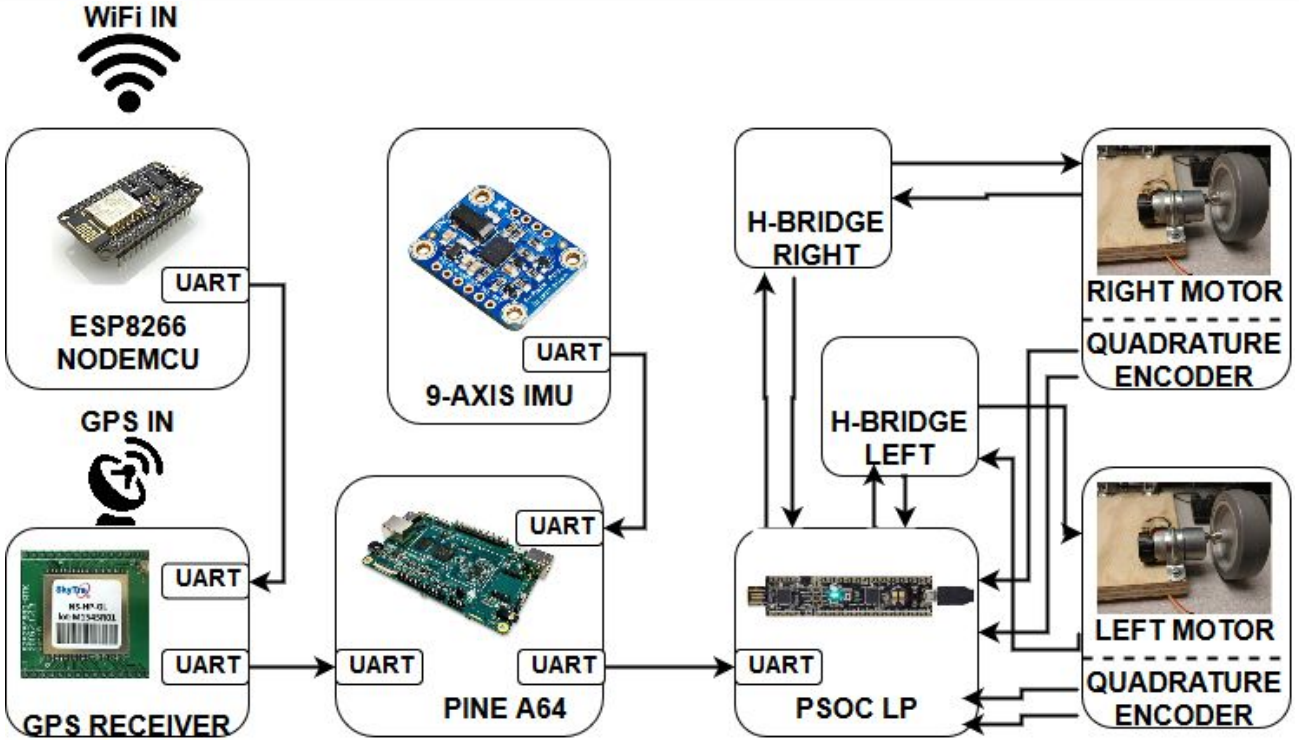
Updated Base Station System Block Diagram

- GPS Receiver gets position data and transmits to NodeMCU via UART
- NodeMCU uses Wifi functionality provided by the ESP8266 chip to transmit the GPS data to the Mower
- Data is transferred using a WebSocket Client and generated Wifi signal to a Websocket server on the Mower



Rover System Block Diagram

- GPS Correction Data inputs to GPS Receiver
- GPS Receiver outputs corrected GPS data
- Pine A64 computes current and desired position, outputs to PSOC
- PSOC outputs control signals to H-bridges and receives feedback from encoders



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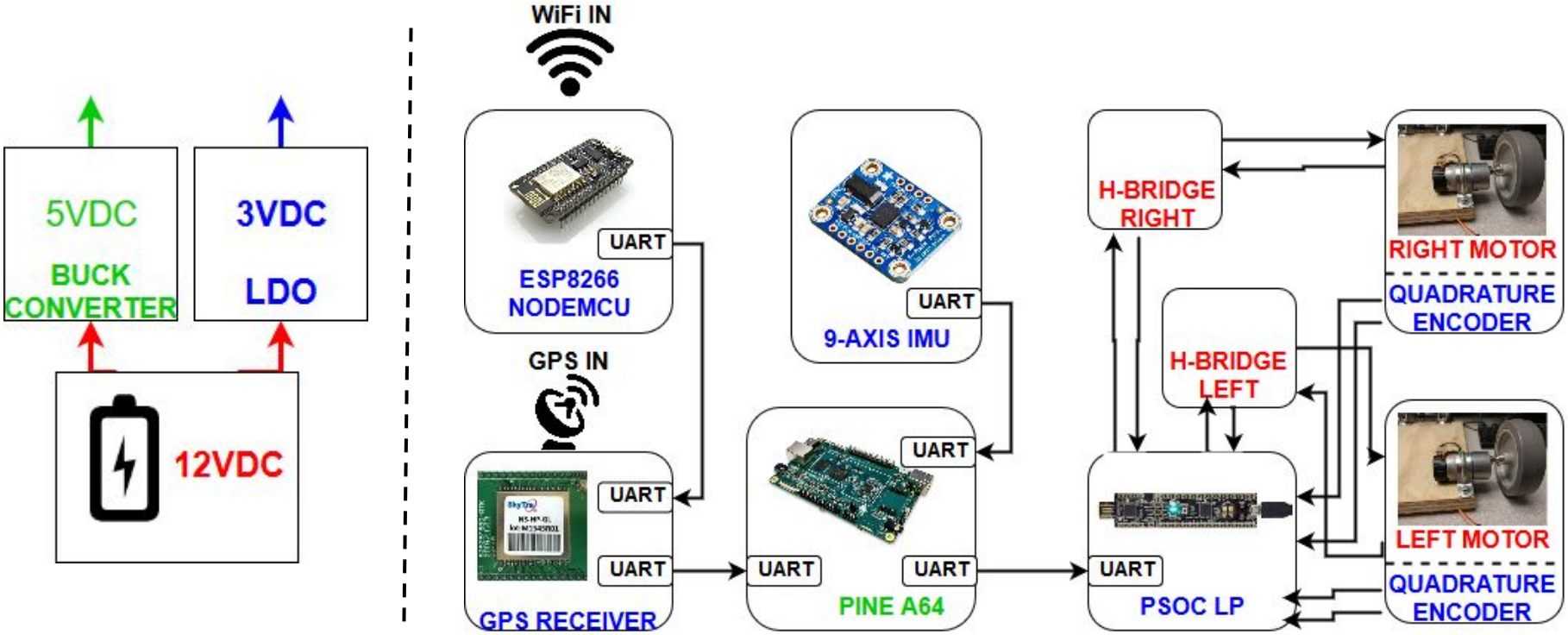

Proposed CDR Deliverables

- Rover Built and Functioning
- Kinematic GPS Position Functioning
  - If not, some other positioning system set-up
- Have Motor Control and Positioning system Integrated
- Power Components all wired, power requirement met

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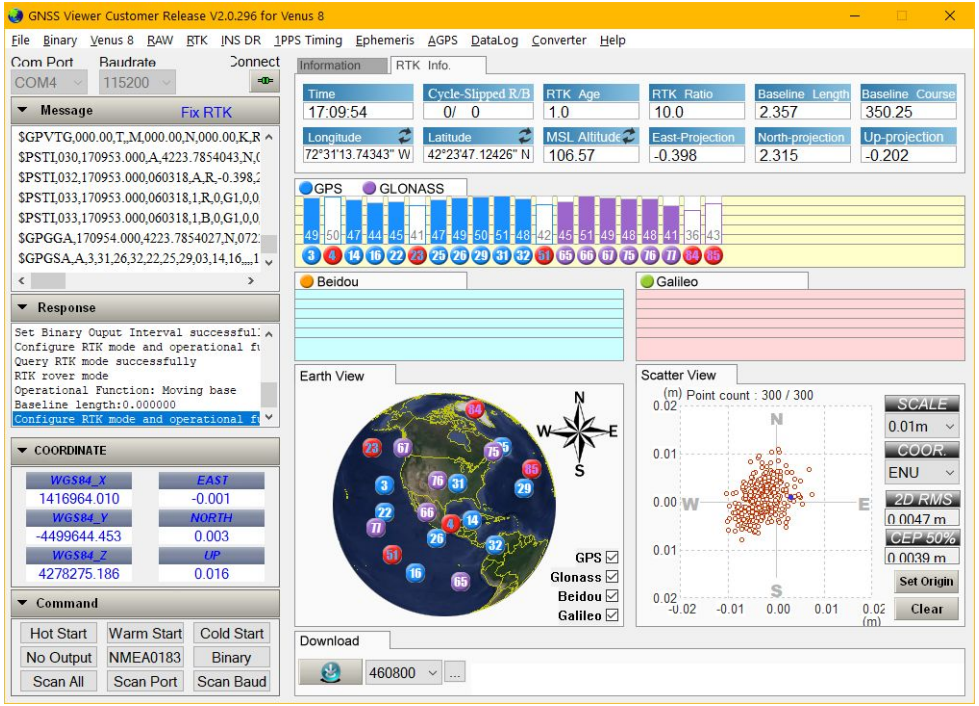
Still working on this

Outline of Demonstration

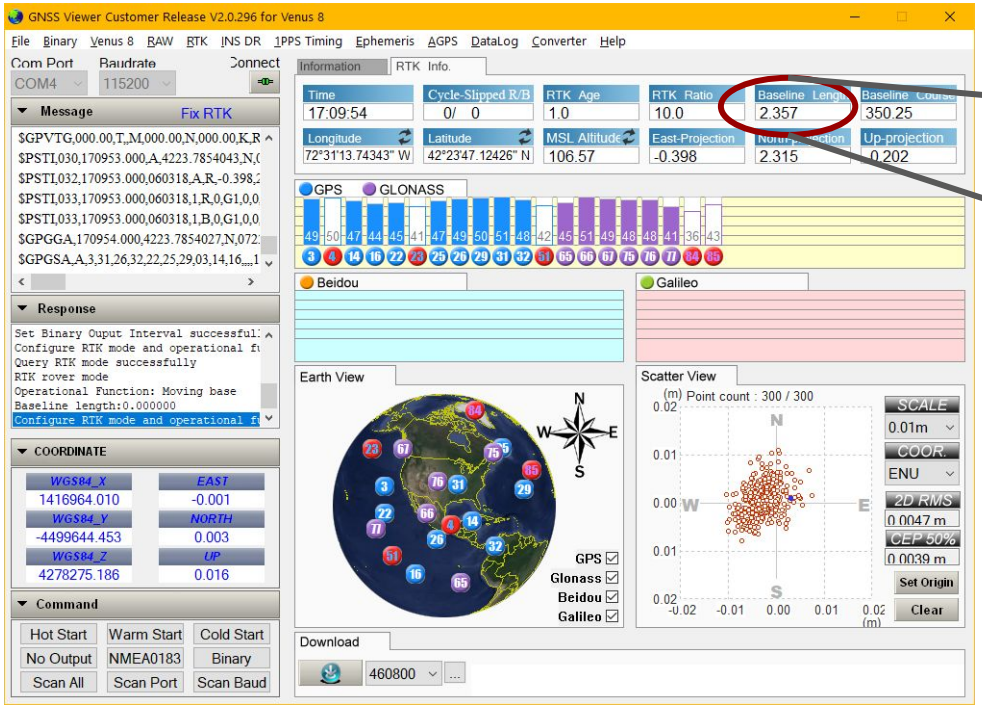
GPS Modules placed 93 inches (2.362m) apart, tested in static positions

Outline of Demonstration (cont.)



Screenshot of GPS output -

Outline of Demonstration (cont.)



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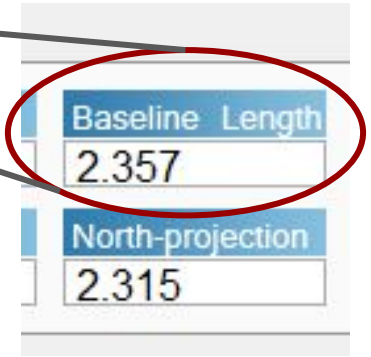
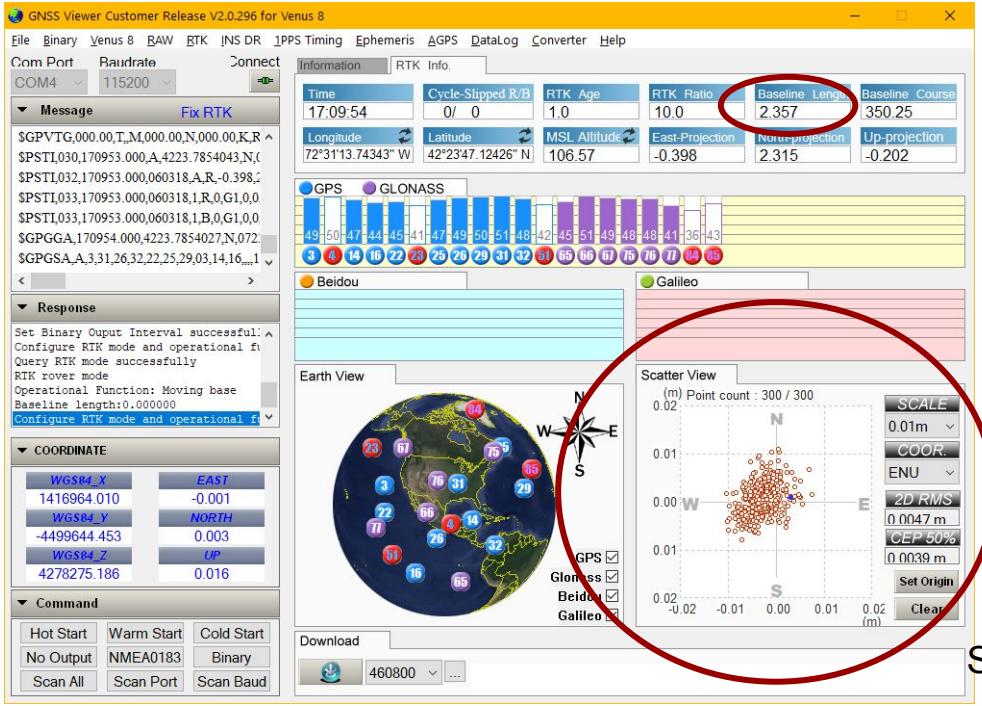


Baseline length recorded 2.357m
actual 2.362m
accuracy of 99.8%

Outline of Demonstration (cont.)



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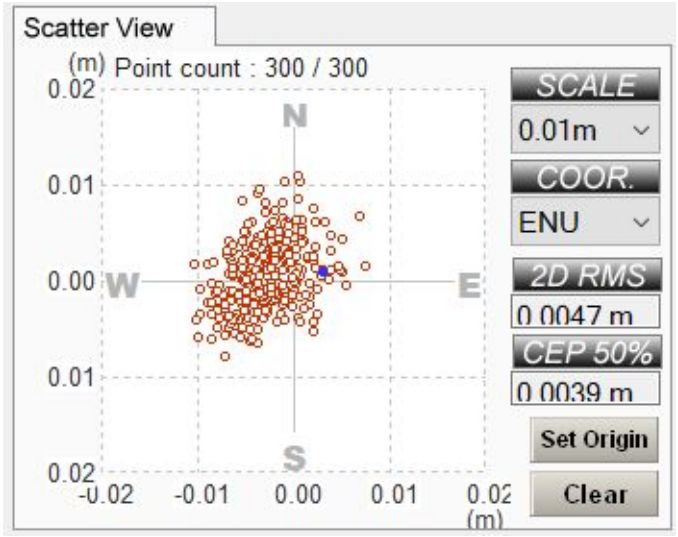


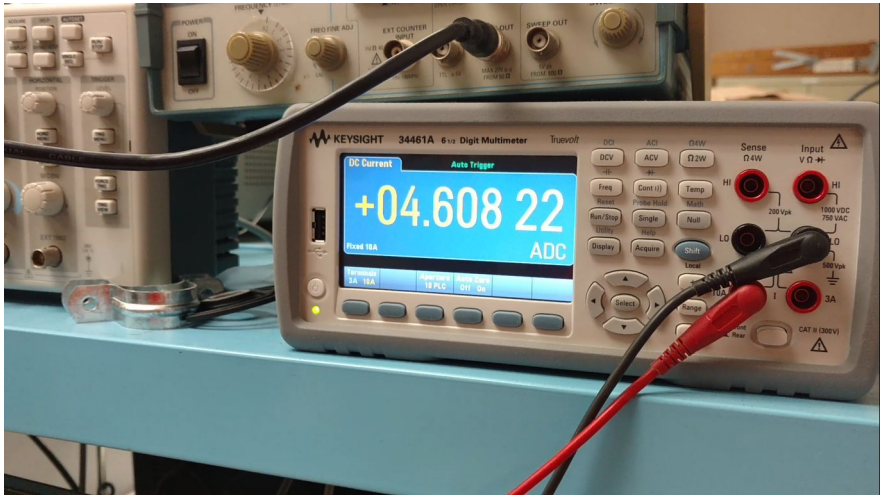
Scatter plot shows precision within 2cm (0.02m)

Power Capacity Test

Power testing performed by measuring motor stall current and extrapolating to battery capacity.

Stall current for single motor ~= 4.6A * 3 motors = 13.8A + 2A for mower electronics = 15.8A total draw

Battery capacity = 12Ah; 12Ah/15.8A = 45 minutes 30 seconds runtime



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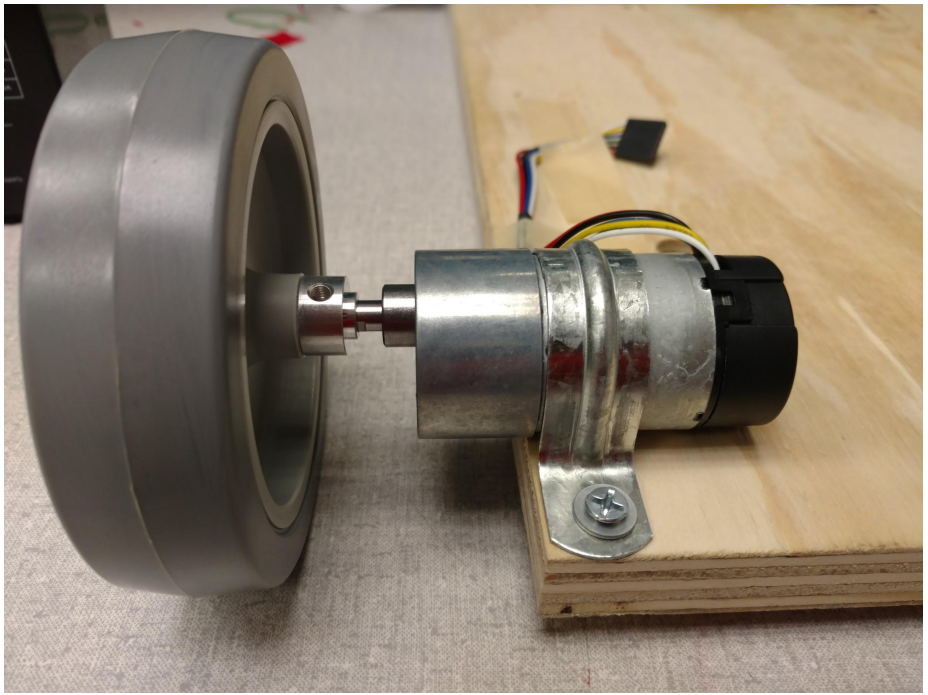

Mower blade is 12”, accounting for overlap effective width of 8”.

Giving us 1500ft *12/8 = 2250 ft to mow a 1500ft^2 lawn.

@3.5 mph = 7minutes 18 seconds

@2.5mph = 14 minutes 36 seconds

@1.0mph = 25 minutes 34 seconds

Planning Ahead: FPR Deliverables

- Mower can traverse the lawn
  - Can Drive straight
  - Path following algorithm
- Improve System: wireless link performance
- Simplify set up of Mower

Planning Ahead: Path to FPR

Task	Start Date	End Date	Duration
Finish testing/troubleshooting GPS (Aaron)	6-Dec-17	24-Dec-17	18
Setup and Test GPS with Two Receivers (Aaron & Kevin)	6-Dec-17	20-Dec-18	379
Port GPS Software to Raspberry Pi (Aaron & Kevin)	20-Dec-17	20-Jan-18	31
Complete chassis frame (Leo)	20-Dec-17	20-Jan-18	31
Mount Power Supply to Chassis (Collin)	28-Dec-17	2-Jan-18	5
Power Distribution (Collin)	2-Jan-18	5-Jan-18	3
Mount Motor Control Subsystem to chassis (Leo)	28-Dec-17	5-Jan-18	8
Test Motor Control and Chassis Functionality (Leo & Kevin)	5-Jan-18	12-Jan-18	7
Assembly of Dead Reckoning Subsystem (Collin and Leo)	12-Jan-18	19-Jan-18	7
Integrate Dead Reckoning into Software (Aaron & Kevin)	12-Jan-18	19-Jan-18	7
Testing of Dead Reckoning Subsystem (All)	19-Jan-18	26-Jan-18	7
Integrate GPS and motor control (Aaron & Kevin)	26-Jan-18	2-Feb-18	7
Testing to meet system requirements (All)	2-Feb-18	2-Mar-18	28
Final Integration and Testing (All)	2-Mar-18	11-April-18	40
Prepare for FPR (All)	11-Apr-18	20-April-18	9

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Test Motor Control and Chassis Functionality (Leo & Kevin)	5-Jan-18	12-Jan-18	7
Assembly of Dead Reckoning Subsystem (Collin and Leo)	12-Jan-18	19-Jan-18	7
Update Wireless Link Functionality (Kevin)	8-Mar-18	19-Mar-18	11
Integrate Dead Reckoning into Software (Aaron & Kevin)	12-Jan-18	19-Jan-18	7
Testing of Dead Reckoning Subsystem (All)	19-Jan-18	26-Jan-18	7
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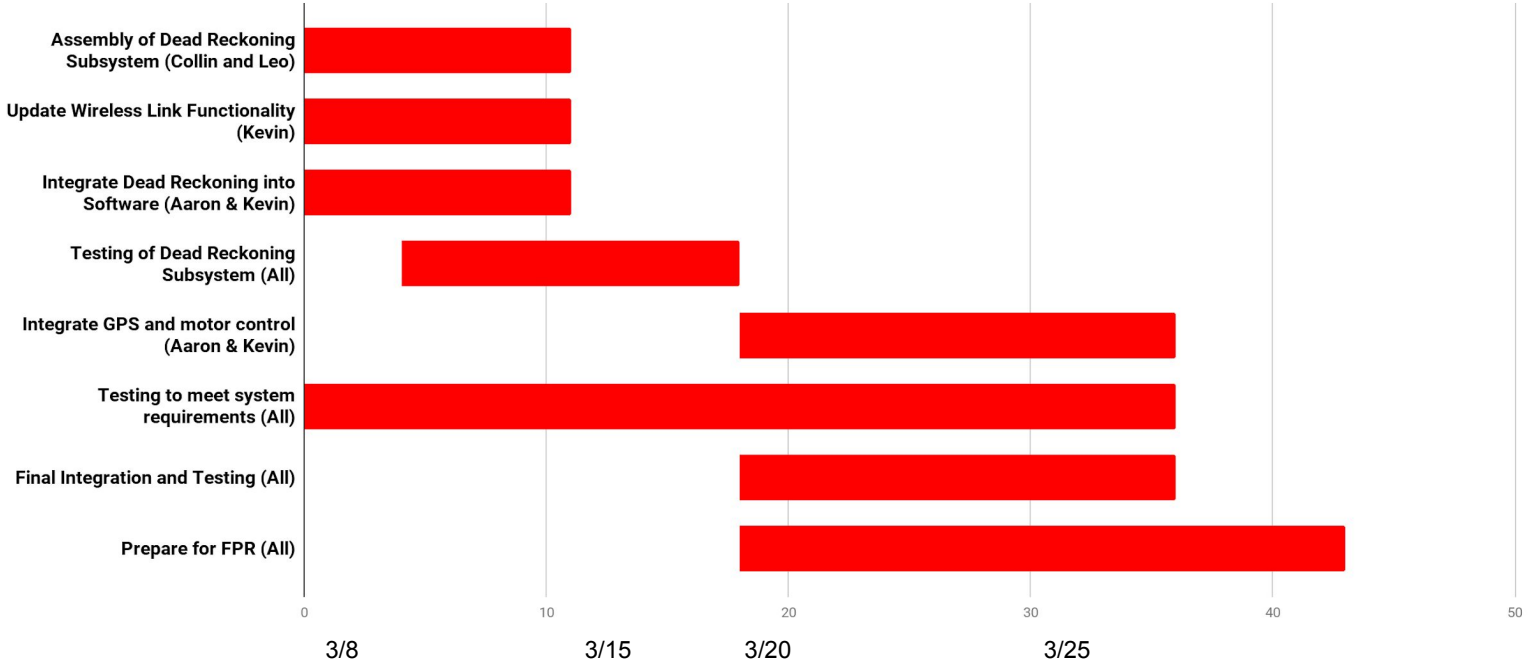
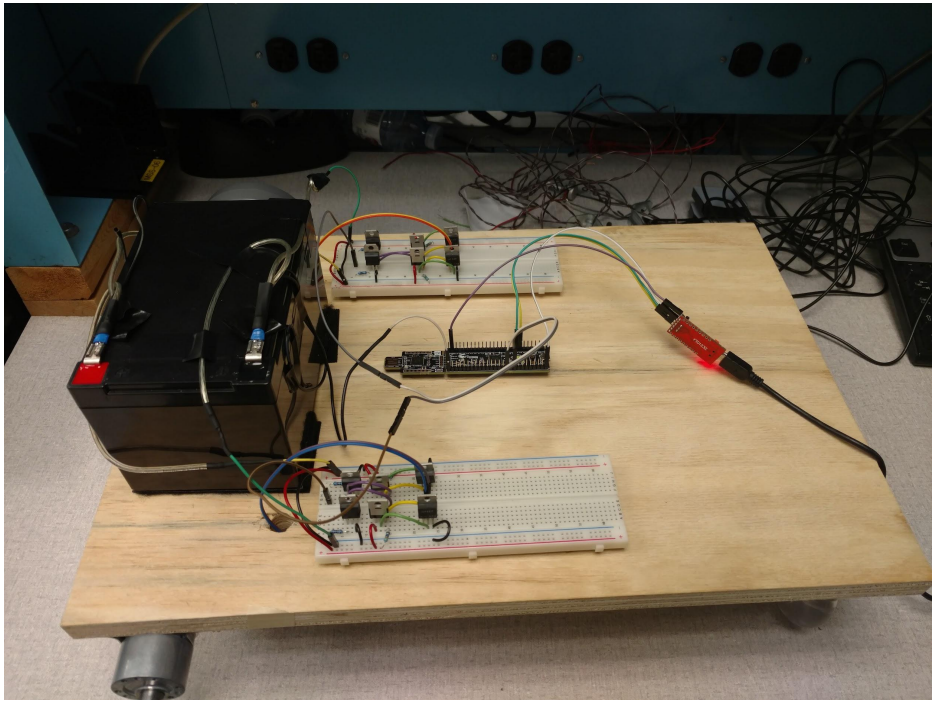


Power Demonstration

Mower Demonstration and Q&A



Mower Demonstration and Q&A

Questions?