Robot Assisted Tours

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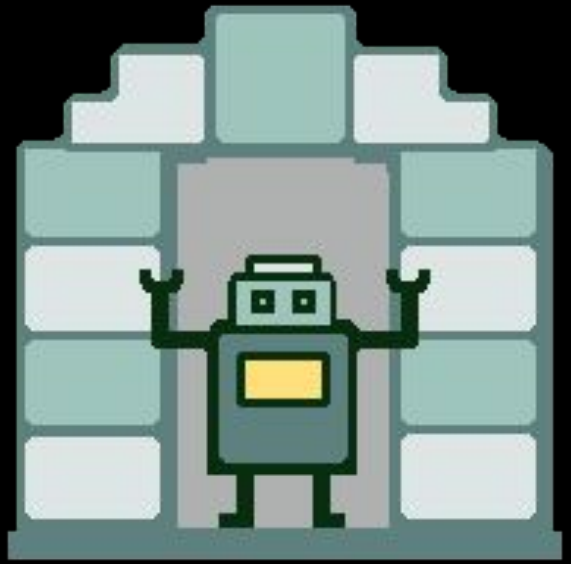
Design Review II
Keystone Robotics



Introduction

- Computer Science Team
  - **Hailey Ginther -**Team Lead, Customer Communicator
  - **Shannon Washburn -** Architect
- Electrical Engineering Team
  - **Gabrielle Halopka -** Recorder
  - **Falon Ortega -** Hardware Design Manager
- Mentor - **Austin Sanders**
- Client: **Dr. Michael Leverington**, Faculty member and Lecturer in NAU's School of Informatics, Computing, and Cyber Systems

Problem Statement

- Primary Problem: Building a robotics project foundation for future students
- Driving Idea: Build a robot that can give automated tours of the engineering building
- Typically ~$4,000-$80,000

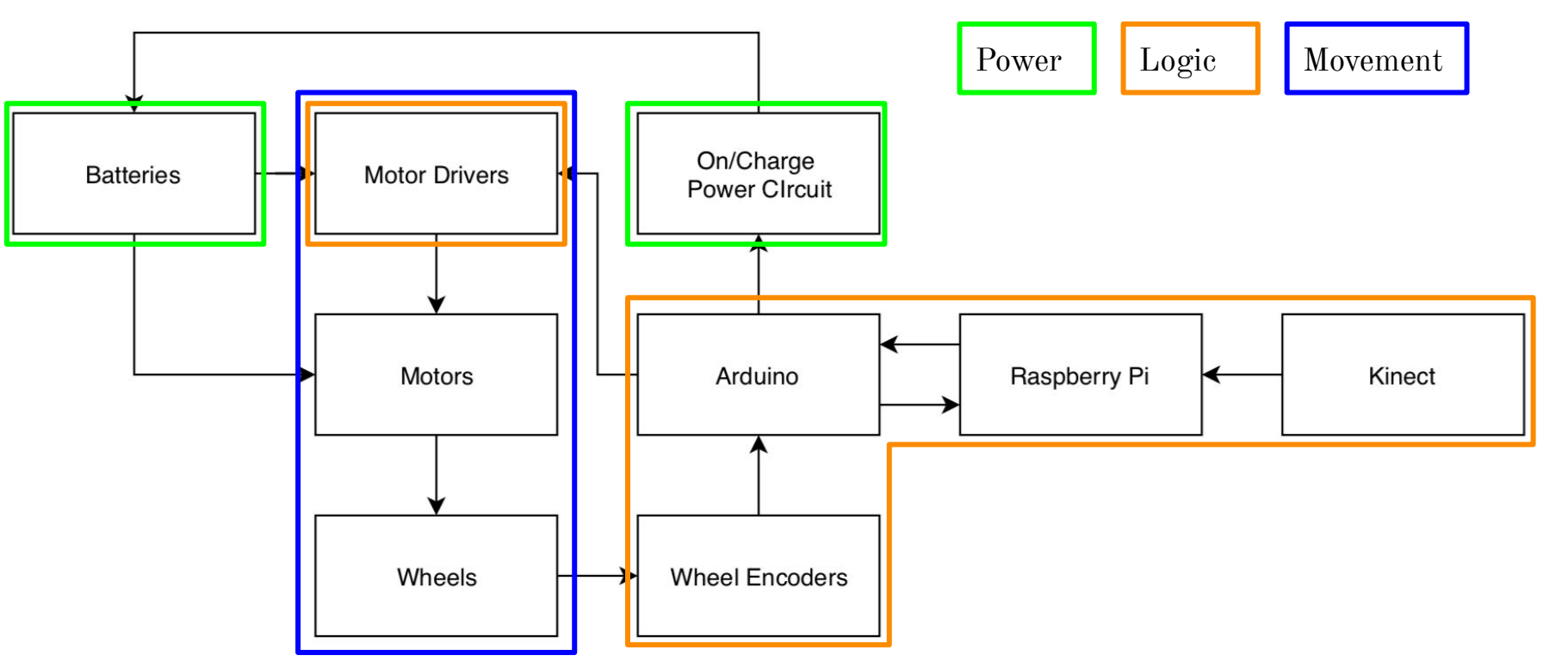
Solution Overview

- Construct a robot that can move around the building with user input
- Documentation of the process
    - Paper trail for other students to follow
- Integratable parts
    - Other projects can be derived from ours
- Cost effective parts

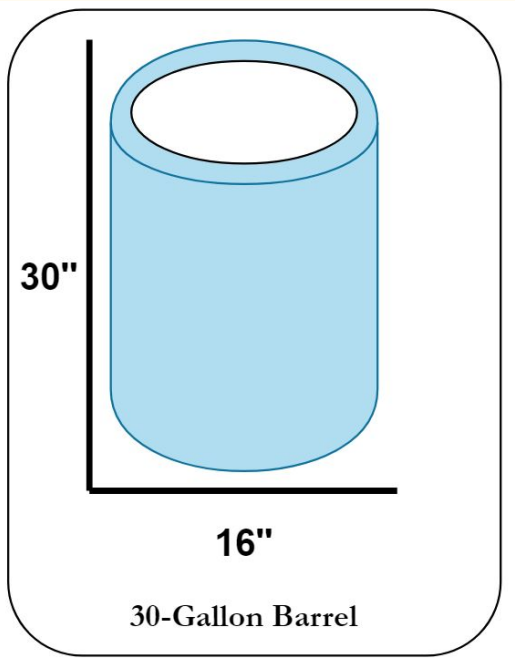
Key Requirements Summary

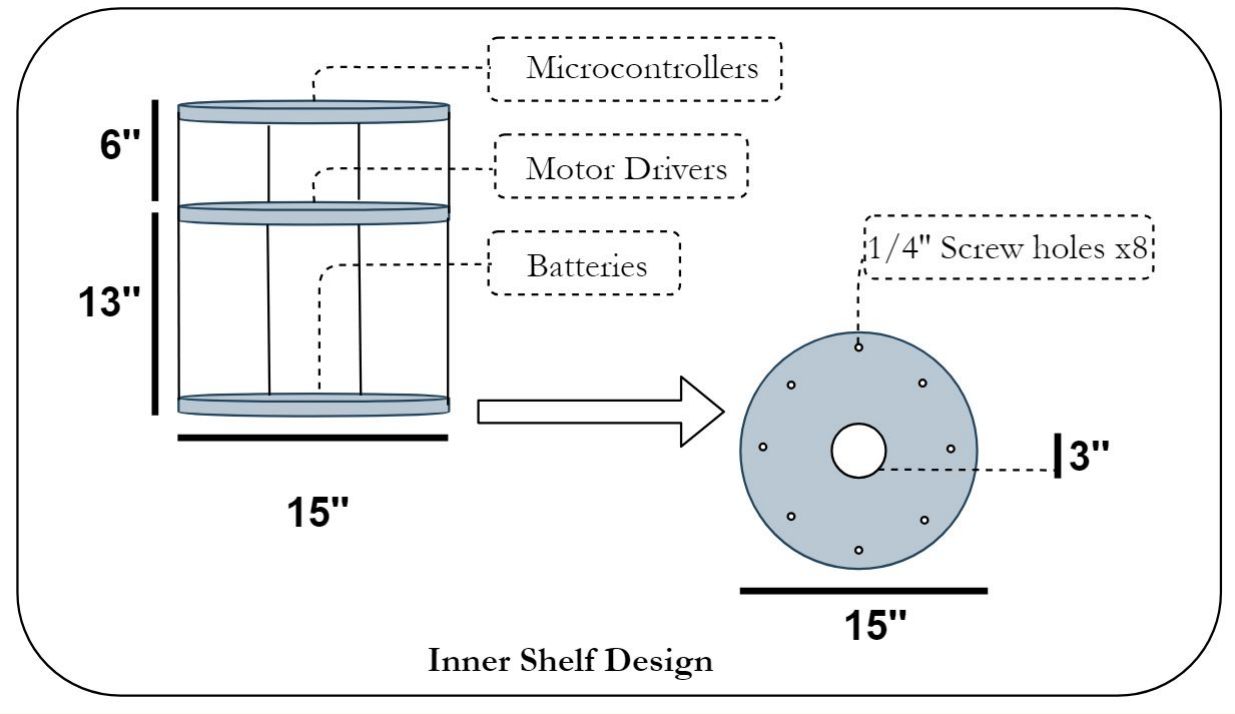
- Will be capable of basic mobility
- Will be expandable to future projects
- Will operate safely
- Will be modifiable for a technical end user

Architecture Overview



Implementation - Movement Module





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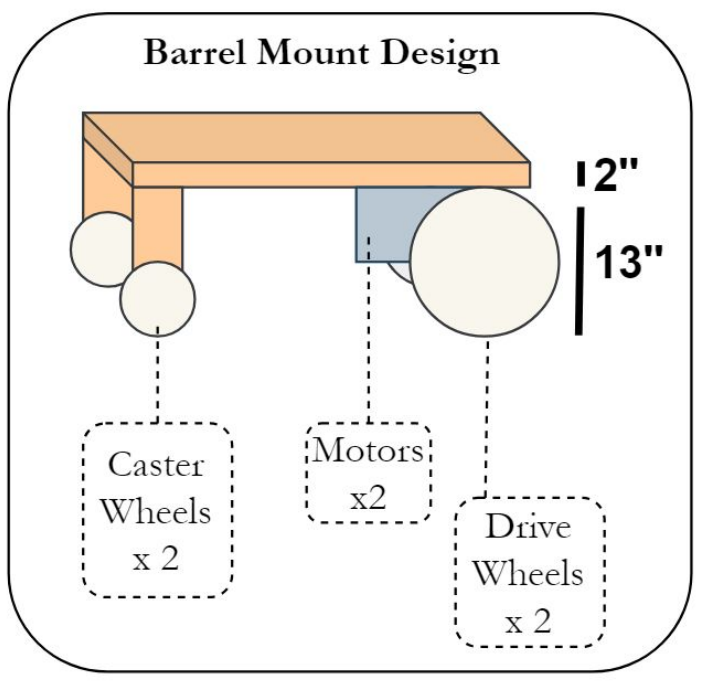
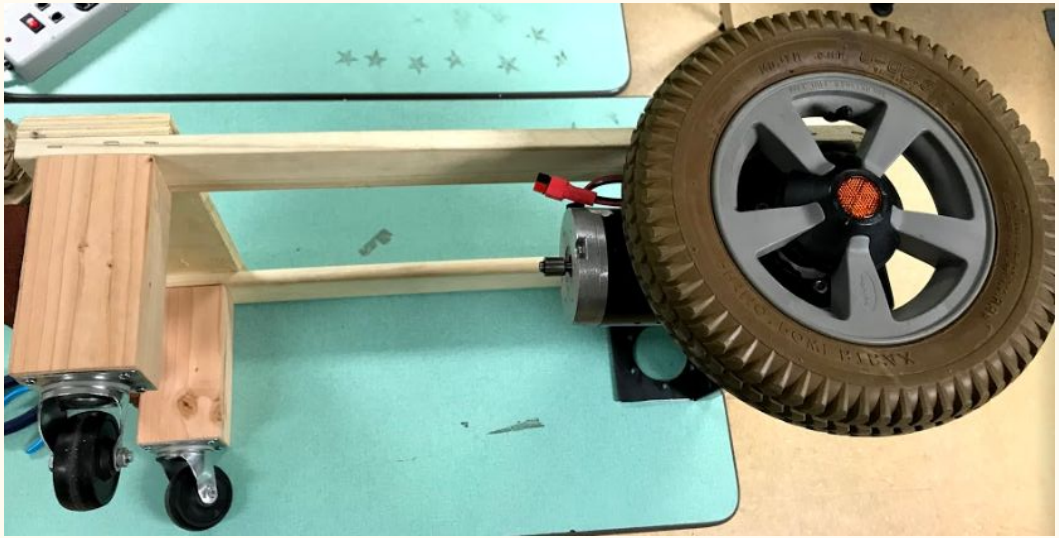
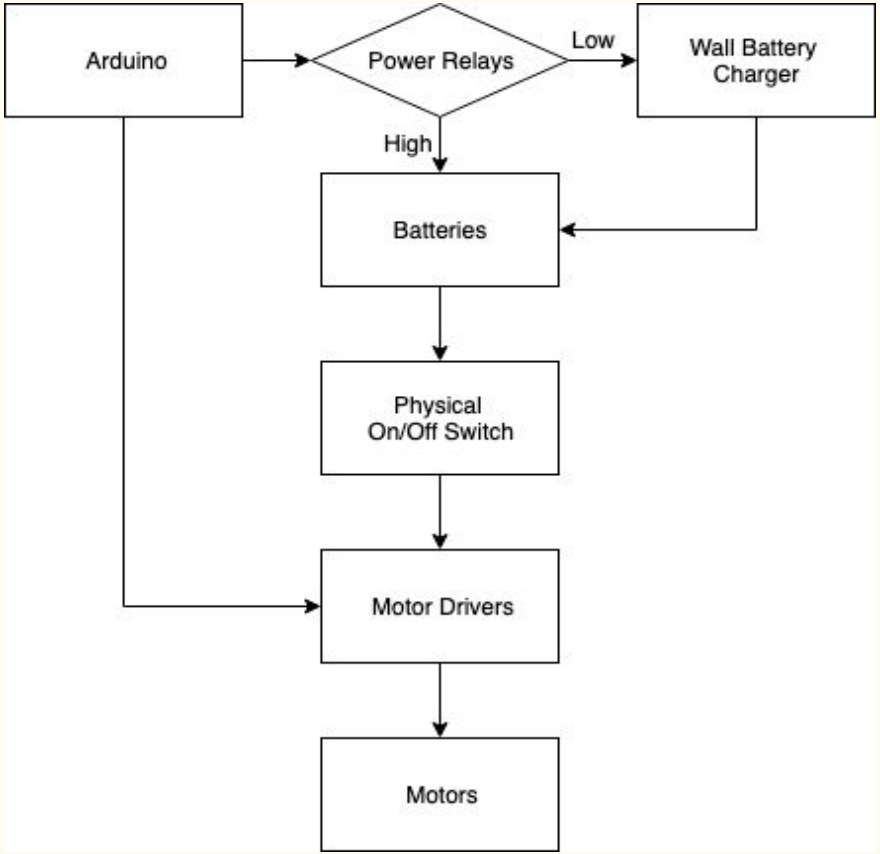




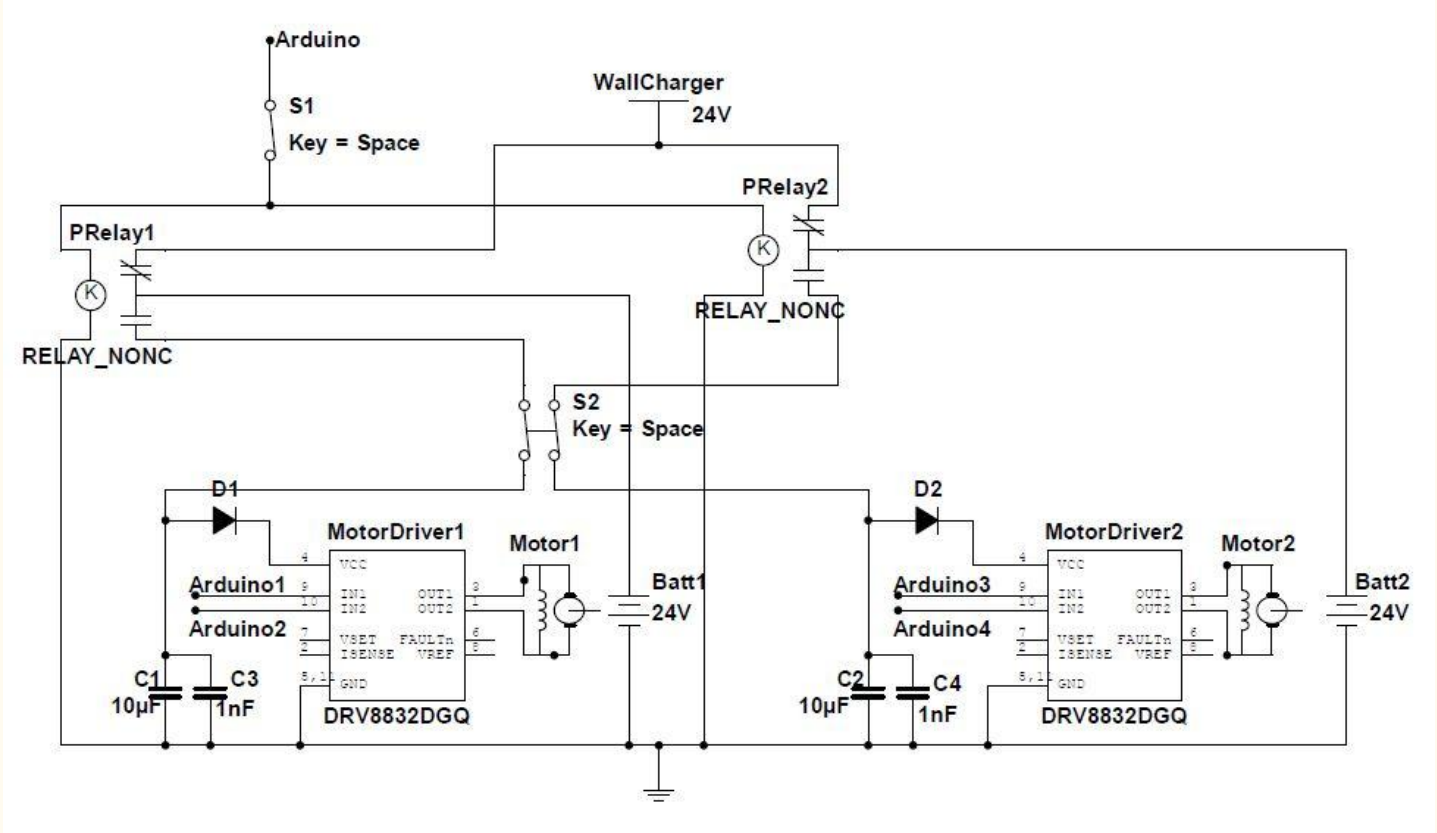
Implementation - Power Module (Circuit)

- Specific Client Requirements:
  - Off switch that cuts motors from batteries
  - Plug one wall plug in to charge batteries
  - Doesn’t melt the physical components
- On/Charge Circuit
  - Knife Switch, 3 in 1
  - SPDT Relays
  - Motor Drivers/H-bridges
  - Heat Sinks

Circuitry Flow



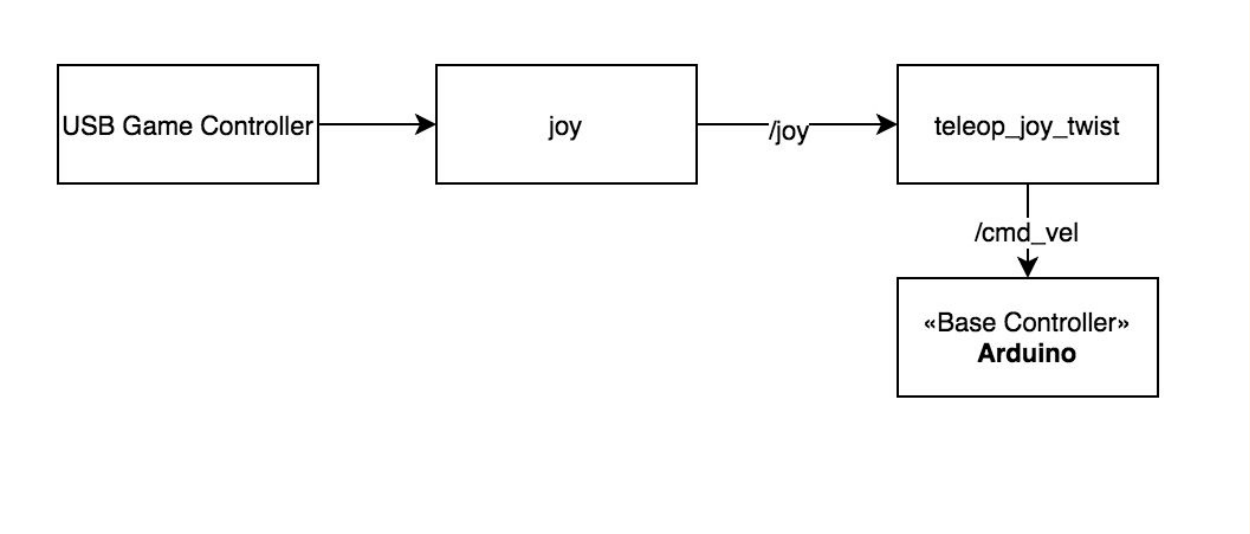
Circuit Schematic



Implementation - Logic Module

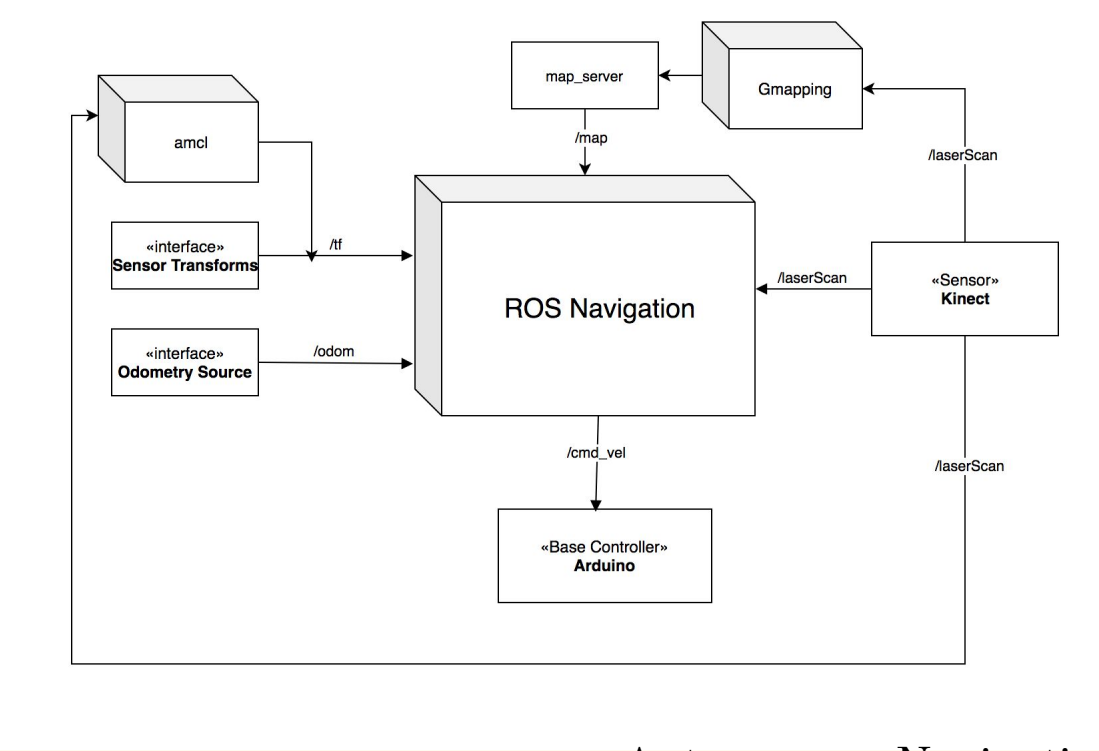
- ROS (Robot Operating System)
  - Framework for robotics applications
  - Provides tools to interface with sensor
- Arduino - Interfaces with motor drivers and wheel encoders
- Two Modes of Operation:
  - Manual Control via Joystick
  - Autonomous Navigation

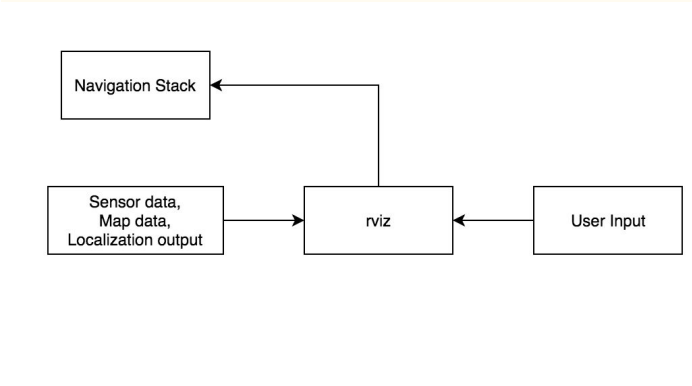
Implementation - Logic Module



Manual Control Flow

Implementation - Logic Module



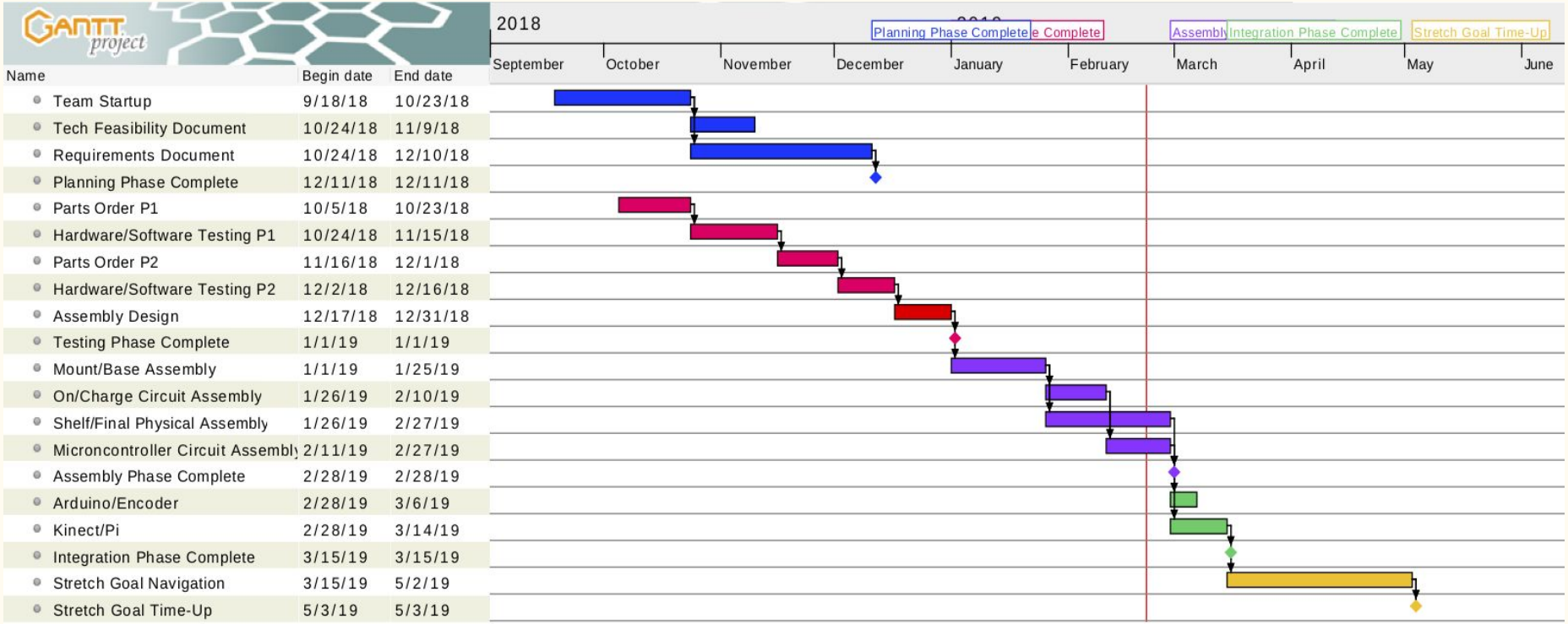


Autonomous Navigation Flow

Challenges and Resolutions

- Issue with possible corrosive liquid in barrel
- Precision needed in encoder installation underestimated
- Needed solution for battery charger to meet intelligent charger requirements
- Unexpected readings from sensor data in software

Schedule



Name	Begin date	End date
Team Startup	9/18/18	10/23/18
Tech Feasibility Document	10/24/18	11/9/18
Requirements Document	10/24/18	12/10/18
Planning Phase Complete	12/11/18	12/11/18
Parts Order P1	10/5/18	10/23/18
Hardware/Software Testing P1	10/24/18	11/15/18
Parts Order P2	11/16/18	12/1/18
Hardware/Software Testing P2	12/2/18	12/16/18
Assembly Design	12/17/18	12/31/18
Testing Phase Complete	1/1/19	1/1/19
Mount/Base Assembly	1/1/19	1/25/19
On/Charge Circuit Assembly	1/26/19	2/10/19
Shelf/Final Physical Assembly	1/26/19	2/27/19
Microncontroller Circuit Assembly	2/11/19	2/27/19
Assembly Phase Complete	2/28/19	2/28/19
Arduino/Encoder	2/28/19	3/6/19
Kinect/Pi	2/28/19	3/14/19
Integration Phase Complete	3/15/19	3/15/19
Stretch Goal Navigation	3/15/19	5/2/19
Stretch Goal Time-Up	5/3/19	5/3/19

Conclusions

- Problem
  - Need expandable, robotics platform
  - Idea stems from time-consuming tours at NAU Engineering Building
- Solution
  - Physical: dolly, motor mount, shelving
  - Electrical: on/charge circuit, heat sinks
  - Software: ROS, Microcontrollers
- End product is far cheaper than alternatives by thousands of dollars