P1 - Brainstorming

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Overview

Each robot is required to reach a sequence of waypoints in a specified order while keeping a laser pointer oriented along the positive Y axis. Position of the robot, waypoints, and laser is given by a computer vision system provided by the instructor.

Pass/Fail Criteria

1. Robot stays in the arena, with robot tag within 1m vertically of the floor
2. Robot reaches the final waypoint within 15 minutes
3. Laser never illuminates in a direction with a negative Y component

* if a team feels they might not meet the pass/fail criteria they may manually drive their robot to the final waypoint and forfeit the competition

Design 1 - Mecanum Wheeled

This design utilizes omnidirectional mecanum wheels for the movement of the robot. It would have three rotational dynamixel modules mounted to the bottom surface of the chassis, and each module would rotate a mecanum wheel. The laser would be mounted in a constant orientation.

The robot and laser would face the same direction during the task, and different rotations of the dynamixel modules would result in the sufficient x- and y-motion without needing to rotate the robot.

Another variation of this design would be to use four mecanum wheels (two sets of mirrored pairs) with a similar design structure.

Design 1 - Mecanum Wheeled

PROS:

- Body points in same direction
- 2019 Red Team made 3 mecanum wheeled robot that we can use as a basis

CONS:

- Mecanum wheel is difficult to build
- Slightly complex wheel movement

Design 2

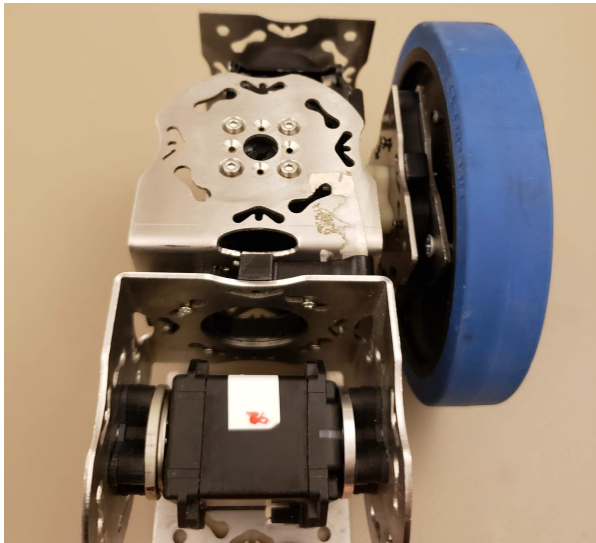
Rectangular base that slides on 4 castor balls

To move in Y:

A u-bar module mounted on the back of the base lowers two wheels driven by a continuous module

To move in X:

An identical mechanism is mounted on the left or right of the base



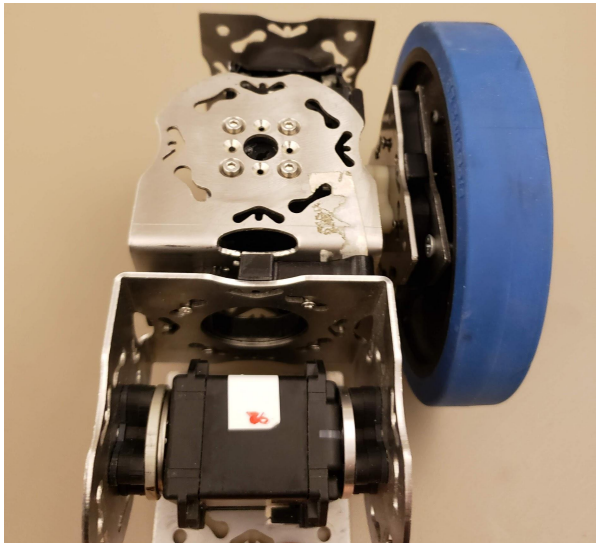
Design 2:Pros and Cons

Pros:

- Separate systems for x and y motion help with holonomic motion

Cons:

- Asymmetrical weight distribution



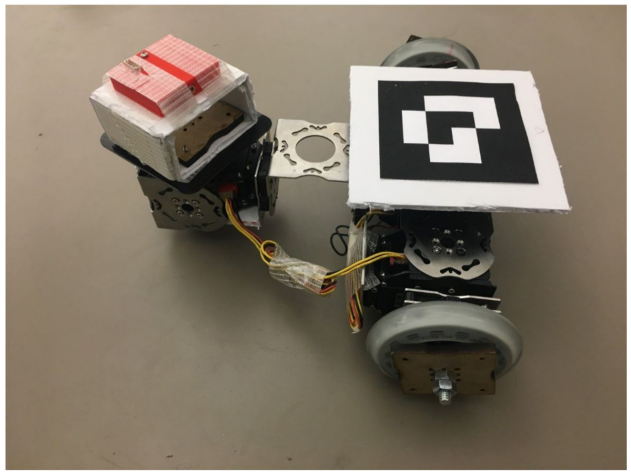
Design 3: Moving Turret

Two wheel based tower

Consists of laser on servo placed at top of tower

Laser will maintain aiming at the +y - direction and will adjust when turning using a PID controller

Inspired by 2018 Green team except laser mounted on top



Design 3: Pros and Cons

Pros:

- Simple Mechanical Design
- Easy Mechanical Construction

Cons:

- May be challenging to work with PID controller
- Servo displacement error compounds

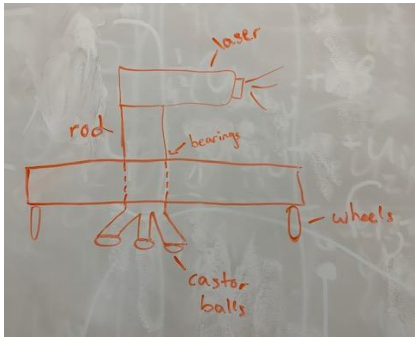
Design 3.1: Moving Turret + standalone laser

Iteration of Moving Turret

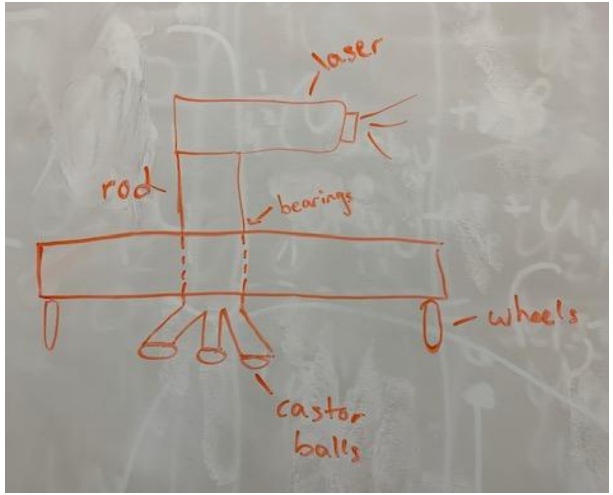
Replace mounted servo with the laser on a rod that extends through chassis and stands on 3 legs with caster balls

-Minimum Friction bearings used to prevent rotation of servo mount

Lubricant may be used to ensure little to no friction between laser stand and chassis



Design 3.1: Pros and Cons



Pros:

- Simple Mechanical Movement
- Easy Mechanical Construction

Cons:

- Difficult to get rod to remain in place and “frictionless” bearing
- No control scheme

Team Skills and Projected Roles

Madi: Mechanical design and testing

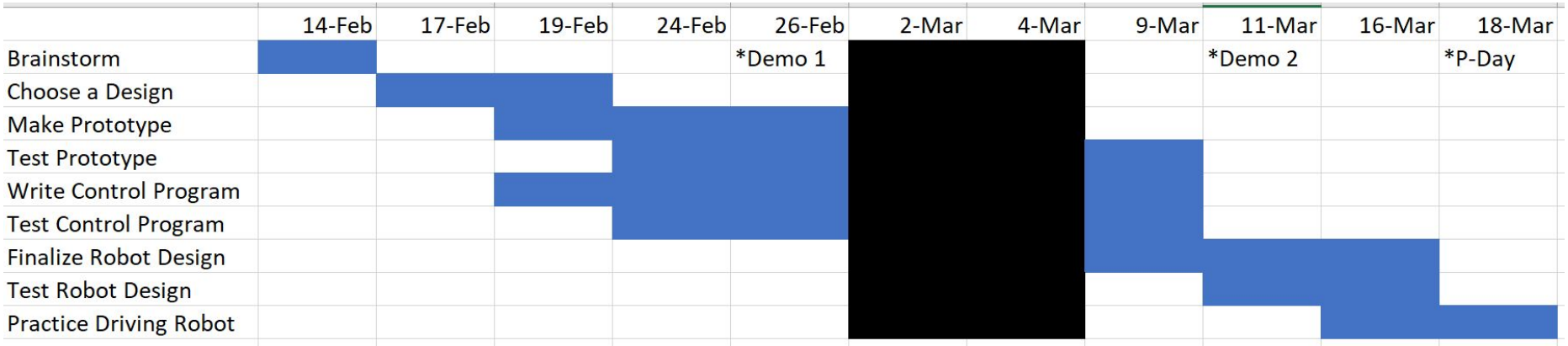
David: Mechanical design and construction

Matt: Prototyping and construction

Christian: Programming, Simulated Robotics

Ragav: Programming and Mechanical construction

Workplan


14-Feb
17-Feb
19-Feb
24-Feb
26-Feb
2-Mar
4-Mar
9-Mar
11-Mar
16-Mar
18-Mar
Brainstorm
*Demo 1
*Demo 2
*P-Day
Choose a Design
Make Prototype
Test Prototype
Write Control Program
Test Control Program
Finalize Robot Design
Test Robot Design
Practice Driving Robot

Risks and Mitigation

- Navigation
  - If we use the mecanum wheels we need to be able to guarantee that they will work consistently and not have problems with friction due to the carpet
- Complexity
  - The more complex our design the higher the chance that small variances in performance can appear causing errors in positioning
- Time Management
  - Since we have to factor spring break into our project cycle we need to be on top of our time management in order to complete Demo #1 and #2 before and after the break
- Parts
  - Since we may need parts to be ordered, it is crucial we have enough parts and spares to complete the design

Resources

2019 P1 Red Team Final Report

2017 Green Team P1

2018 Green Team P1

Frictionless bearings