Team 302

Development of a Prototype Mover Robot (PMR) for use in a Mobile Thermal Depolymerization Plant

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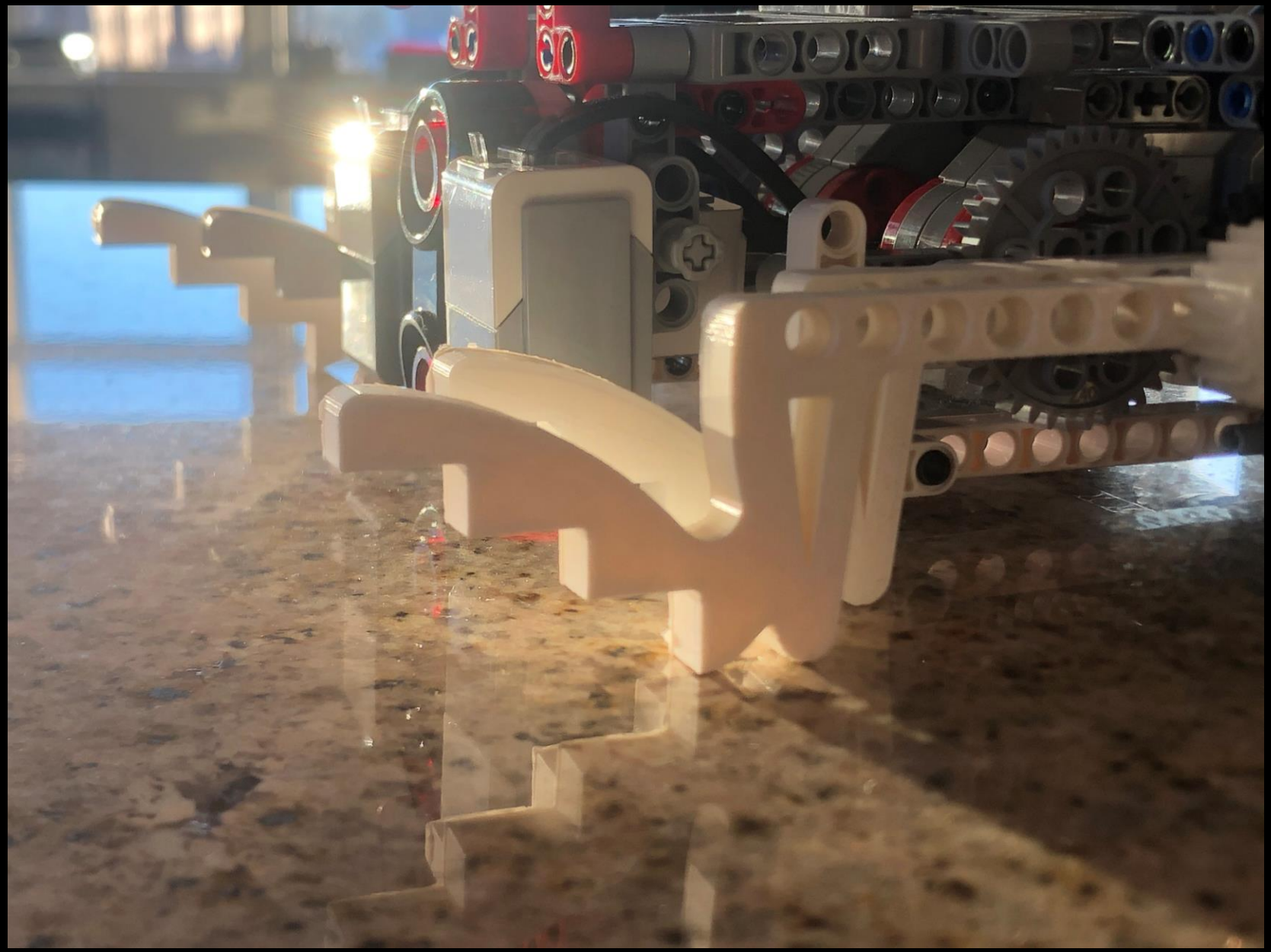
Robot Description

Chassis

- Inspired by the Nara Cricket
- 3D printed PLA legs
- 3 spur gear drivetrain
- Unique front-serrations allow the robot to go over obstacles
- Driven by two large motors
- Tightly packed sensor area allows for dual-sensor line following and ultra-sonic can detection

Body

- Compact design allows for high mobility
- Strategically placed brick and attachment point eliminate need for other balancing weights



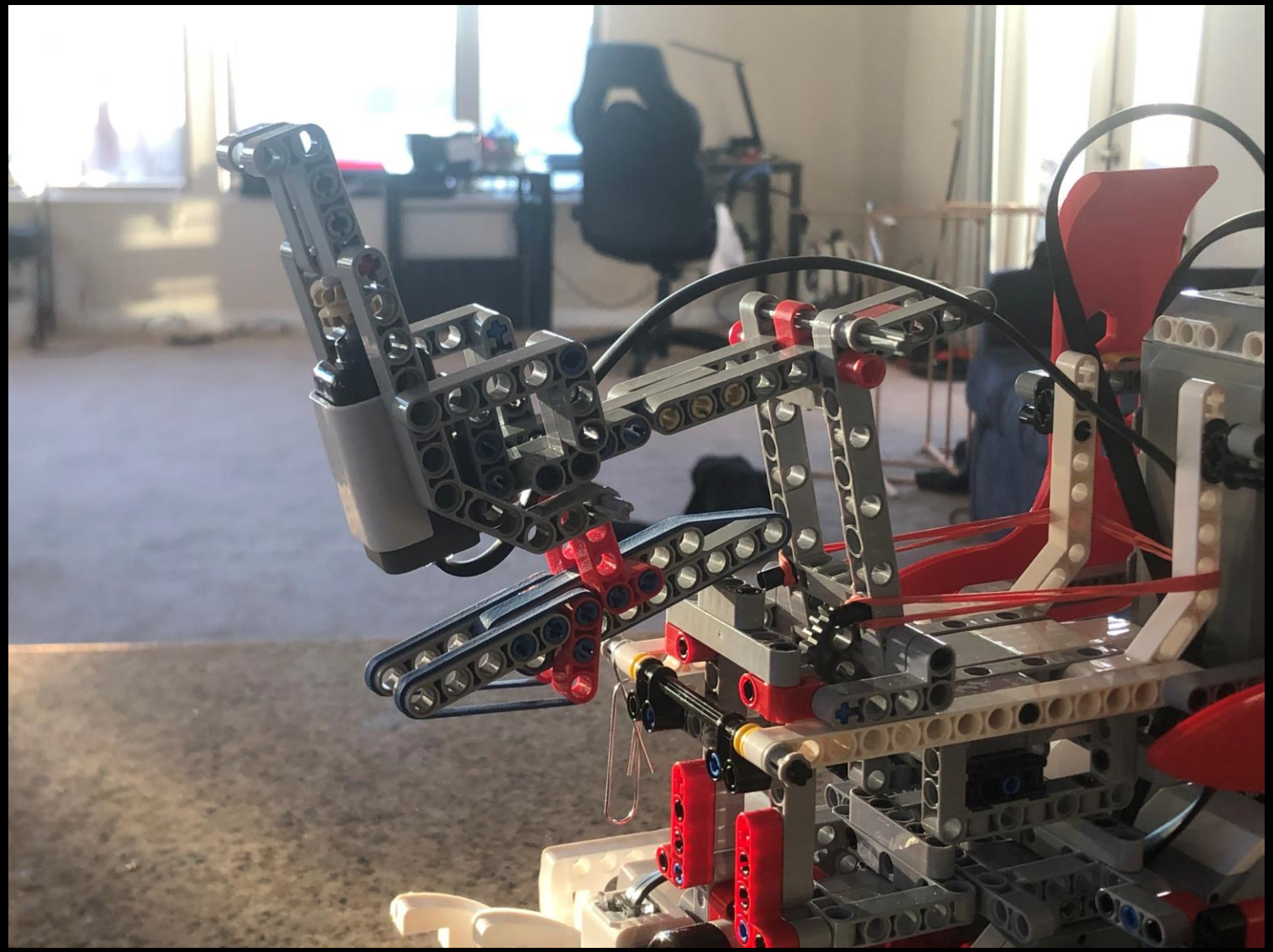
Robot Description

Arm

- 5:1 worm gear drive
- Driven by medium motor
- Rubber bands prevent shaking during movement

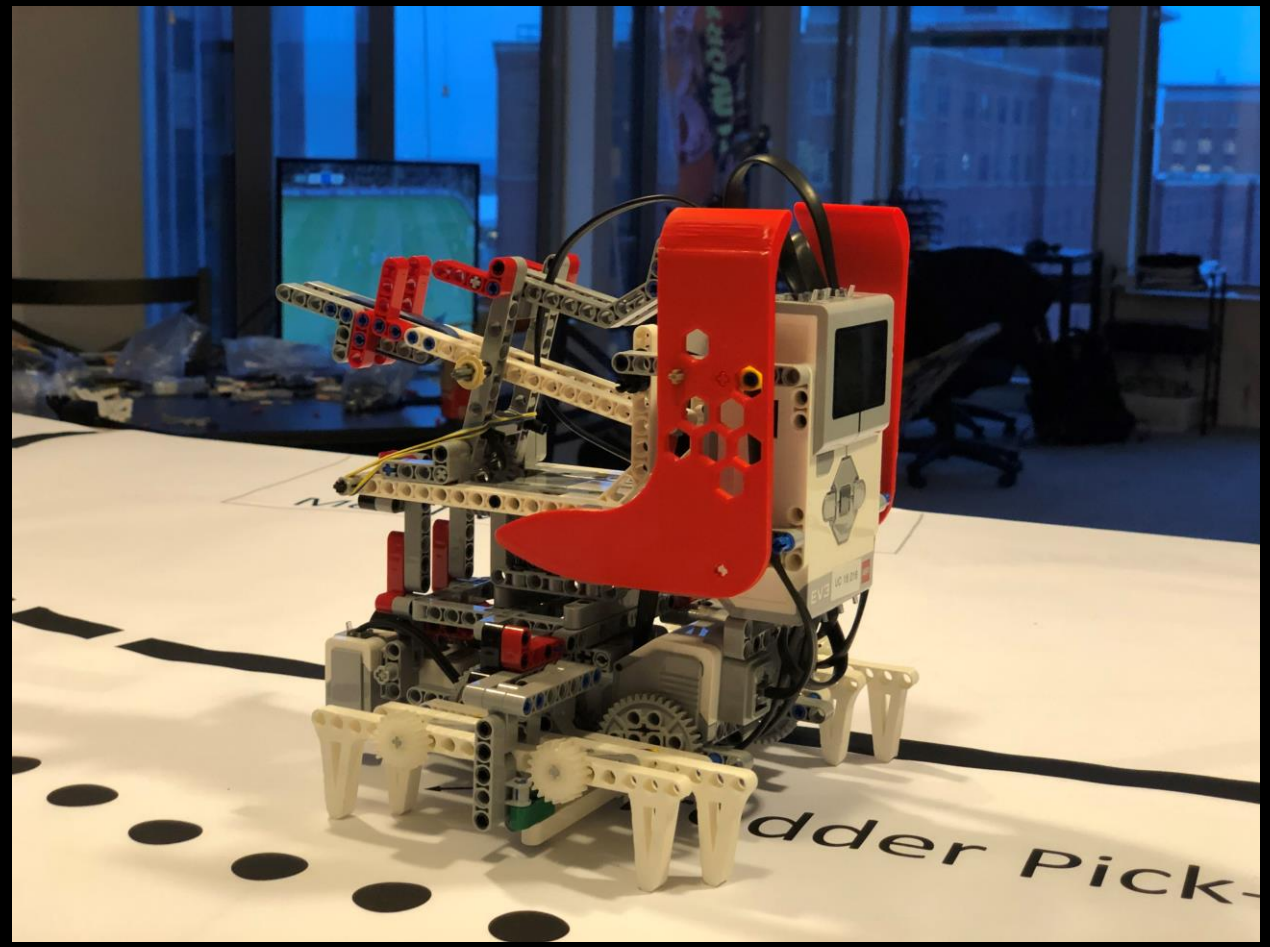
Attachment Point

- Compact design allows for high mobility
- Strategically placed brick and claw eliminate need for other balancing weights
- Utilizes a vertical force sensor to determine weight at all angles
- Rubber bands create a firm hold
- Back spur allows self-zeroing for the force sensor



Aesthetics

- Color choice of pieces used follows a visual theme
- Functional and aesthetic consideration was put into design of the 3D printed parts
- Added side elements printed in a red accent to make the robot look cooler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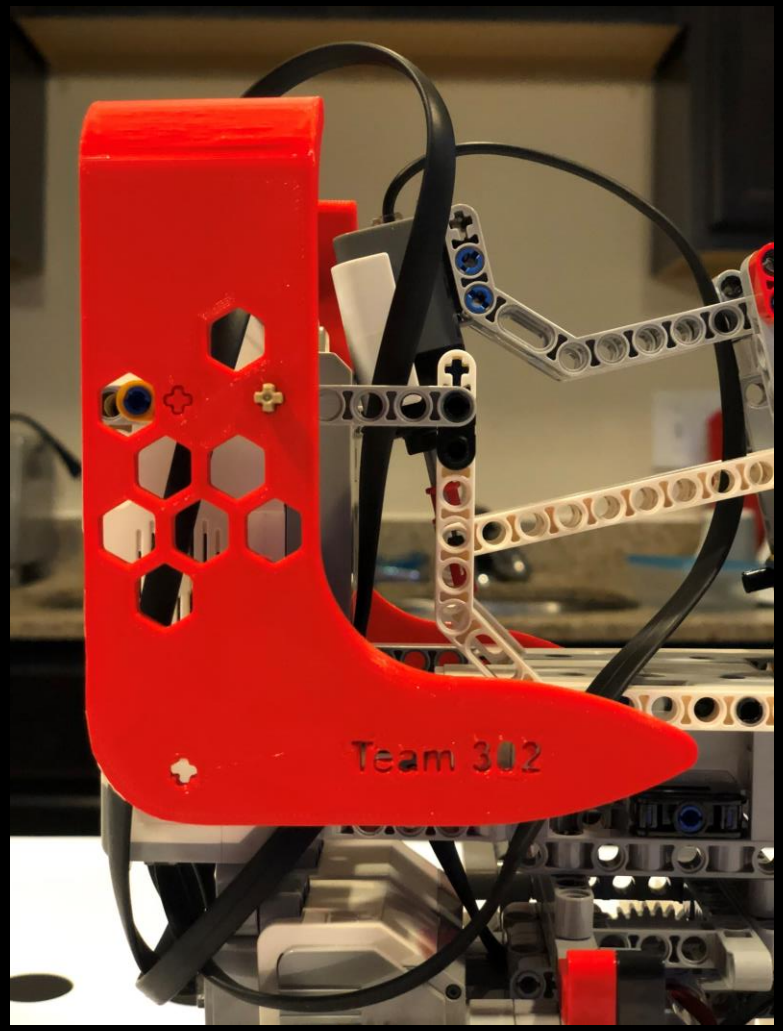
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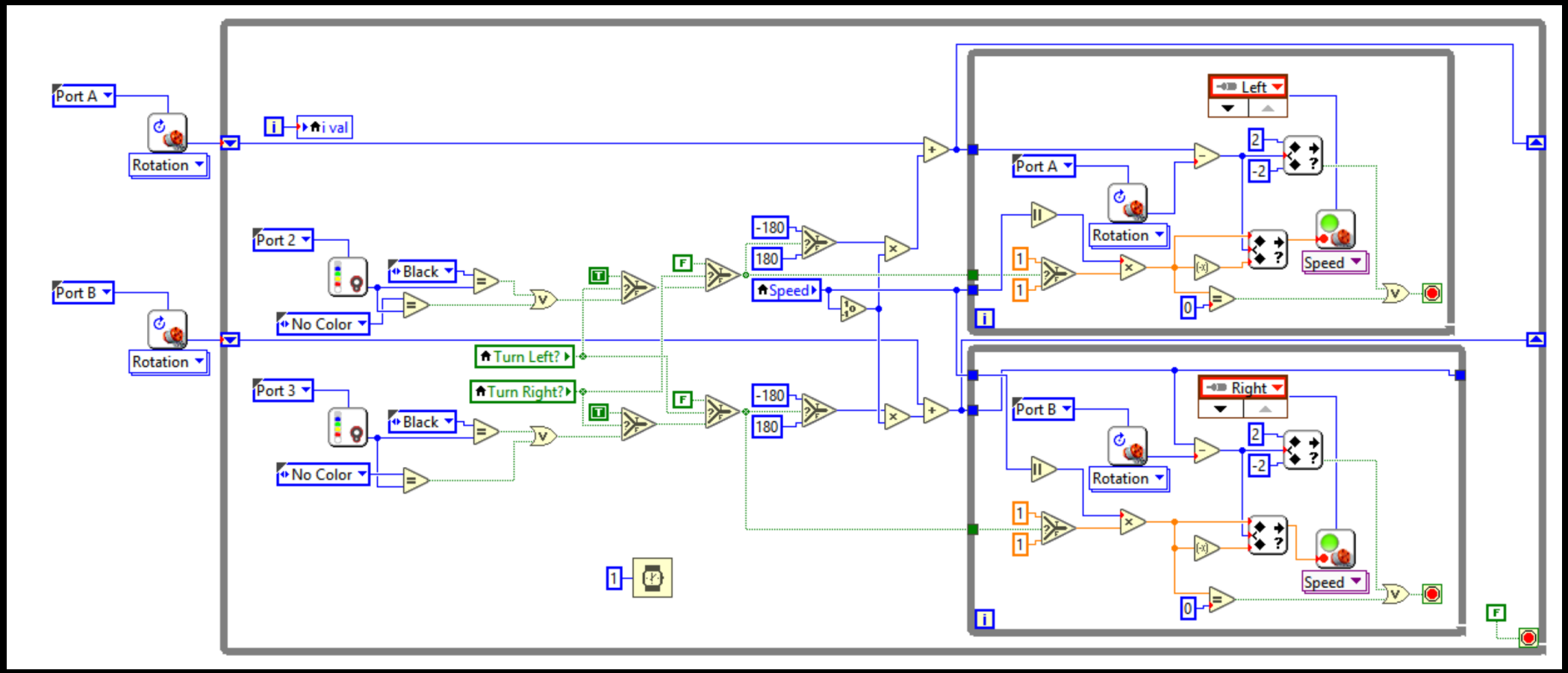
Software Description

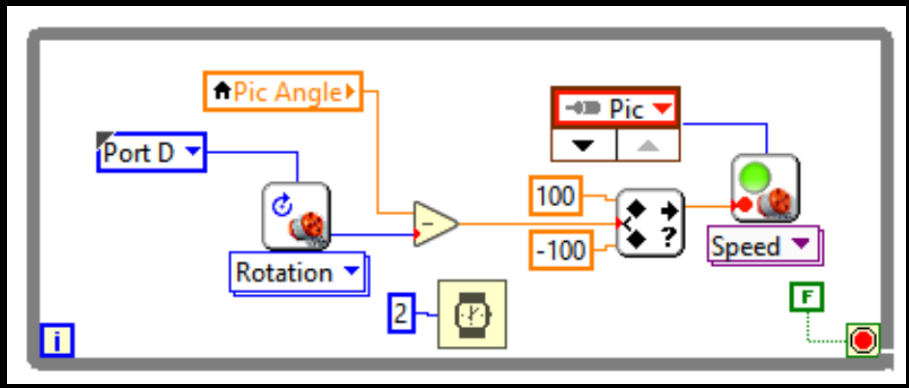
Arm Control

- Arm running on 2-millisecond proportional-closed-loop control using internal motor encoder
- Specific angles can be targeted and achieved

Walking Control

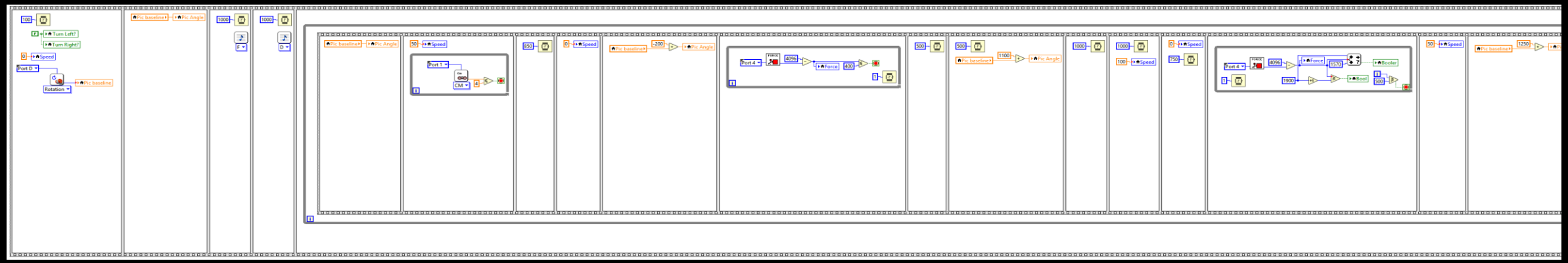
- Running on 1-millisecond PID closed-loop control using internal motor encoders
- Legs must be synchronized so we used a PID setpoint based on both of the sides rather than having a single side as the master
- Automatic turning based on light sensors


Port A
Rotation
i val
Port 2
Black
No Color
Port B
Rotation
Port 3
Black
No Color
Turn Left?
Turn Right?
-180
180
Speed
1
Left
Port A
Rotation
2
-2
Speed
1
1
0
Right
Port B
Rotation
2
-2
Speed
1
1
0


Pic Angle
Port D
Rotation
Pic
100
-100
Speed
2

Operational Modes

- Operational modes were run parallel to looped control
- Utilized flat sequence structures and while loops
- Local variables were used to communicate between parallel structures



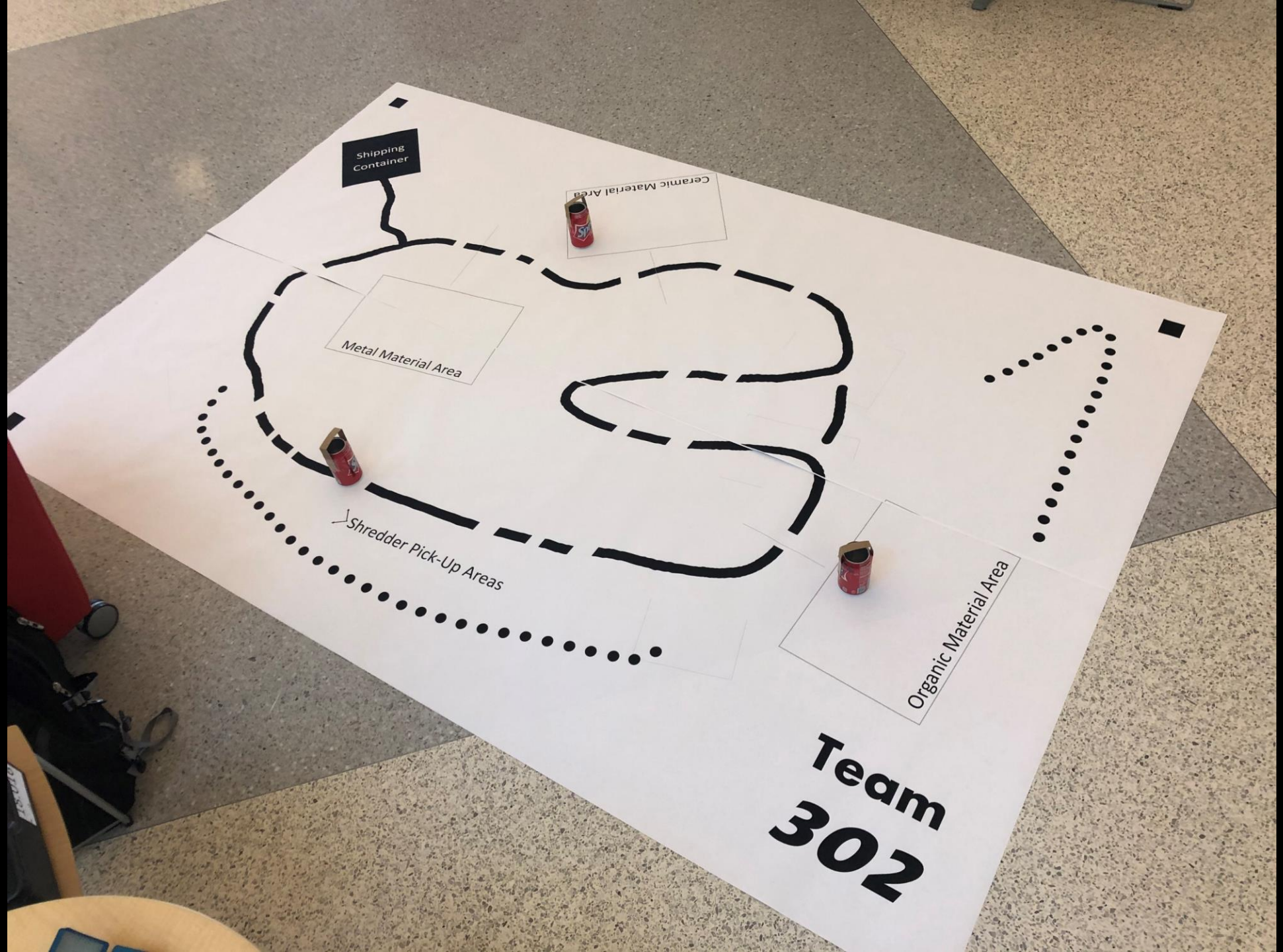
Meeting Requirements

Requirements Met

- Met all but one requirement last night; at the demo it could not follow the dotted line, but we met all other requirements including final demo

Verification

- Throughout the semester we measured the success of our systems using tests that we made based on information from the initial document and RFAIs
  - Printed a to-scale testing map
  - Created material bins
  - Used weights to imitate the real bins
  - For the aesthetics requirement, we sent out a survey


Shipping Container
Ceramic Material Area
Metal Material Area
Shredder Pick-Up Areas
Organic Material Area
Team
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Justifying Design

- We didn’t want to make our design decisions purely on conceptual decision matrices
- Instead, we created criteria and tested multiple designs on each one
- We recorded the merits and weaknesses of each, and used this to pick a design.

Future Enhancements

Aspects to Improve Upon

- Work to make dotted line following more accurate
- Add more 3D printed aesthetics

Our Total Cost

- We recorded the amount of time we spent on each major part of the project

Task	Hrs
Building	28
Testing	26
Software	33
Designing/Creating Parts	14
Meetings	5
Total	**106**
Total Amount	**$4240**

Questions