Engineering Notebook

TEAM 14719R

Risa Chokhawala
Rohan Goyal
Orion Ghai
Ayden Grover
Krishna Muddu

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Team Bios

Ayden:I am 12 yrs old, and this is my 3rd year of VEX robotics. I started with other tournament platforms such as WRO, Tech Challenge, and FLL. I play soccer and the cello.

Orion: I am 13 years old, and this is my 2nd year of VEX robotics. Before VEX, I have participated in the Tech Challenge and The Junior Solar Sprint. Some of my hobbies include basketball and guitar.

Risa: I am 13 yrs old, and this is my second year of VEX robotics. Before VEX, I participated in FLL, first lego league, and Tech Challenge. Some of my hobbies are math, coding, and dance.

Krishna: Hi, I am Krishna and I am 12 years old. This is my third year at VEX Robotics and I have played in other programs like WRO and Tech Challenge. Some of my hobbies are playing guitar and playing basketball.

Rohan:
I am 13 yrs old and this is my second year of VRC Robotics. Prior to this, I did one year of Vex IQ and one year of The Tech Challenge. My hobbies include playing soccer, reading, and the violin.

Notebook Design Layout Guidelines

Heading layout for each meeting

MM/DD/YY Meeting # - Meeting Title

Attendees: Ayden, Rohan, Risa, Orion, Krishna

PHASE(S)

Depending on the phase during the meeting outline in the Design Build Test, which phase time was spent on that day.

> **DESIGN**
> **BUILD**
> **TEST**
> **(works for coding or building)**

Quick Summary: *(don't underline any semicolons at the end of an underline)*

Write a quick summary of what we did in the meeting

Depending on what is covered in the meeting journal outline should be as follows

If we do build in that meeting…

Team 1: name and name (project)

> Task 1
> Task 2
> (diagram/ picture)

How to label:

Parallel arrows on same side of same color with visibility to background

Example:

> Border Weight: 3px
> Font size: 14px
> Width of arrow size: 2px

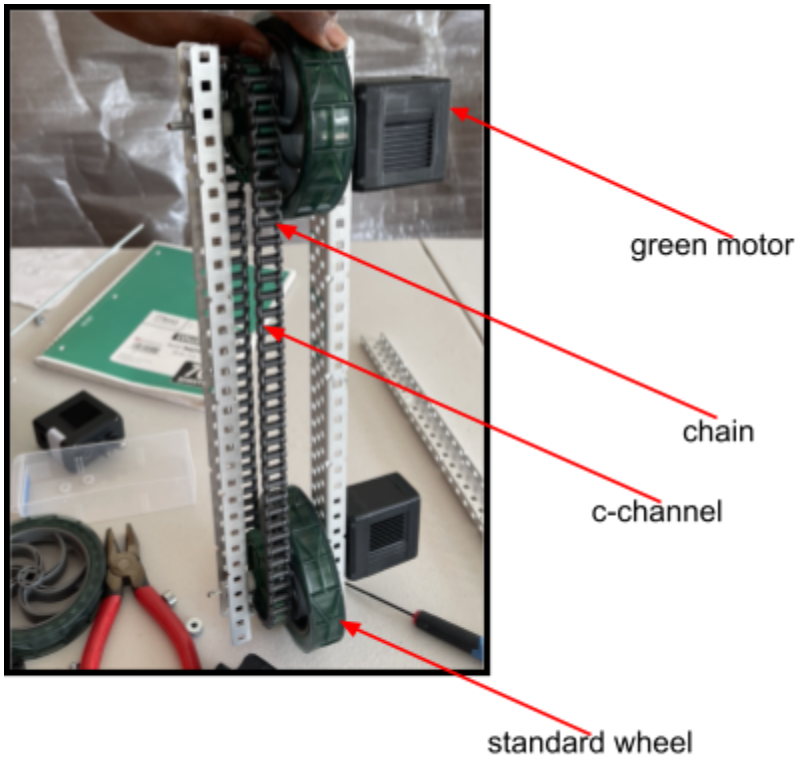

Fig: 1 Motor Drivetrain

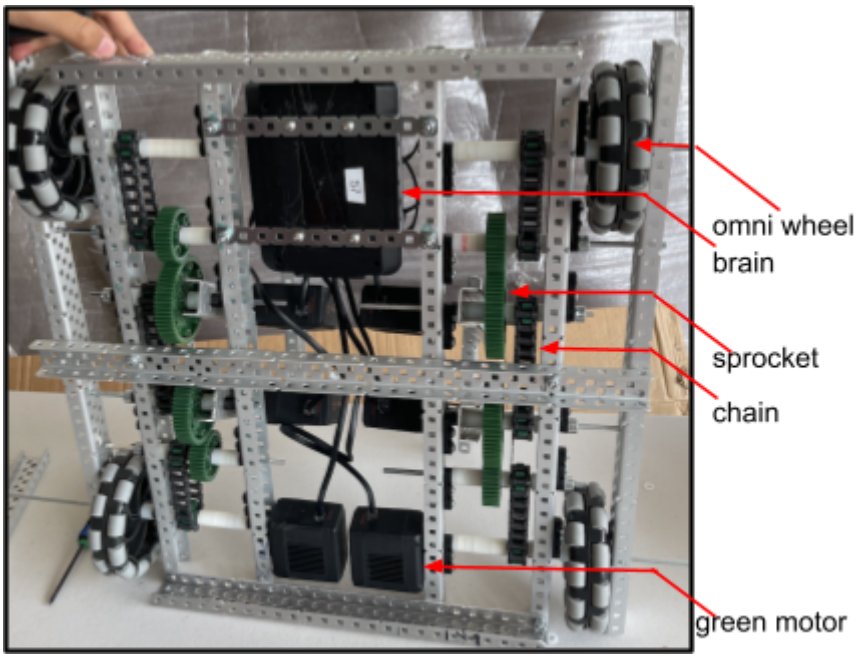

Fig: 2 Bar Differential Drivetrain

If we code in that meeting

Team 2: name and name (project)

Code:

(Indented properly with all parentheses to close it, highlight different starts of loops or functions in code, consistent font between code and journal, if picture of code do normal picture format)

example:

```
void function(){
    stuff
    If (condition){
        stuff
    }
}
```

I

If we design/ideate:

DESIGN

Fig 1

Detail 1
Detail 2
Detail 3

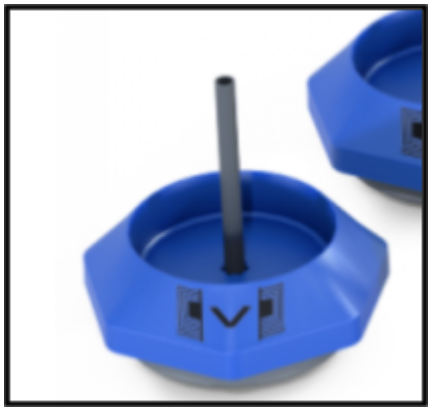

Fig: name

End each meeting with action items

Example -

Action Items for Next Week:

Start building
- 4 bar differential
- Hood differential
- DR4B Lift
- Ringpoker

Game Overview, Rules, Challenges and Goals

VEX EDR 2021-2022 Game Tipping Point

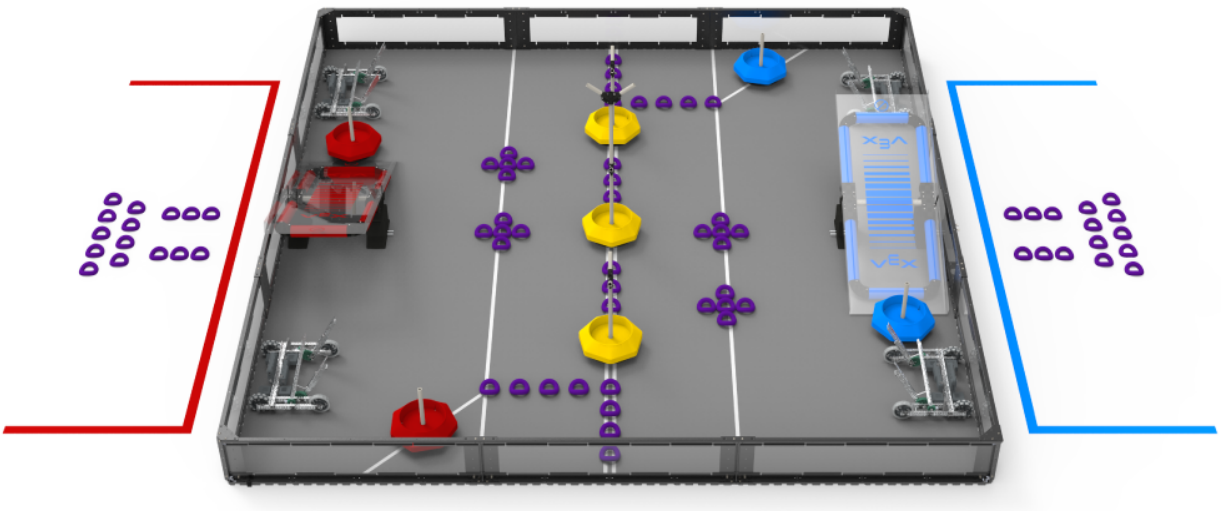

Fig: Alliance mobile goals

There are 2 Alliance mobile goals per Alliance
The Alliance mobile goals are placed in the Home Zone
The Alliance mobile goals are 12.29 inches tall and 13 inches wide

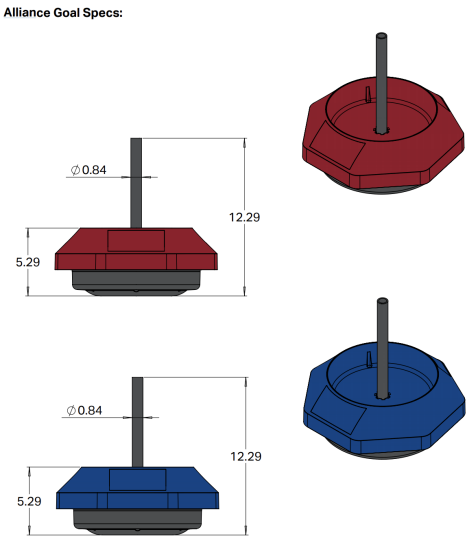

Fig: Small Neutral mobile goals

Designed by _____Witnessed by: _____ Date: _____

There are 2 small neutral goals
The small neutral goals are placed in the neutral zone
The neutral goals are 22 inches tall and 13 inches wide. The branches on the mobile goals are 21.333 mm thick.

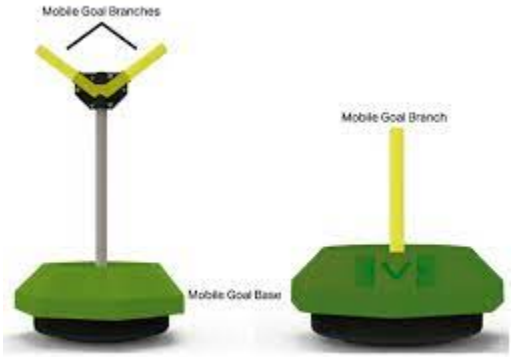

Figure 15: A Mobile Goal. The Base and Branches are highlighted.

Big Neutral Mobile Goal

There is 1 big neutral goal
The big neutral goals are placed in the neutral zone
The big neutral goal is 40 inches tall and 13 inches wide. The branches on the mobile goal are 21.333 mm long.

Rings

There are 72 rings
The rings are 4.125 inches in diameter
The rings are curved

Platform

There are 2 platforms
For the points to actually count the platform can not touch the floor.
The platform is 1,346.2mm x 511mm

Win point line - Auton

There is 1 win point line on each side of the field.
You need to move the alliance mobile goal across that line so you can receive a win point

Game Rules

Before the Game

Robot must be touching at least one gray foam tile (Fig 1)
Must not be touching any tiles, not within the home zone (Fig 1)
Not contacting any game object (other than preloads (3 rings))
Not contacting ramp/platform
No more than 3 preloads/ rings
    Preloads can only contact one robot
    Preloads must not be in positions considered scored
    If preloads are not used, three rings may be used as match rings
Robot size must not exceed 18”x18”x18”

During the Match

When the match begins, your robot is only allowed to extend 36” by 36” by 36”
During the autonomous period, your team is not allowed to go into an opposing alliance’s home zone
During the last 30 seconds of a match, you are not allowed to touch the opposing team’s balancing platform
Removing rings from an Alliance Mobile Goal is against the rules
Robots may not guard more than 1 mobile goal.
You may not remove scoring objects from the field intentionally
You may not tip a goal intentionally.

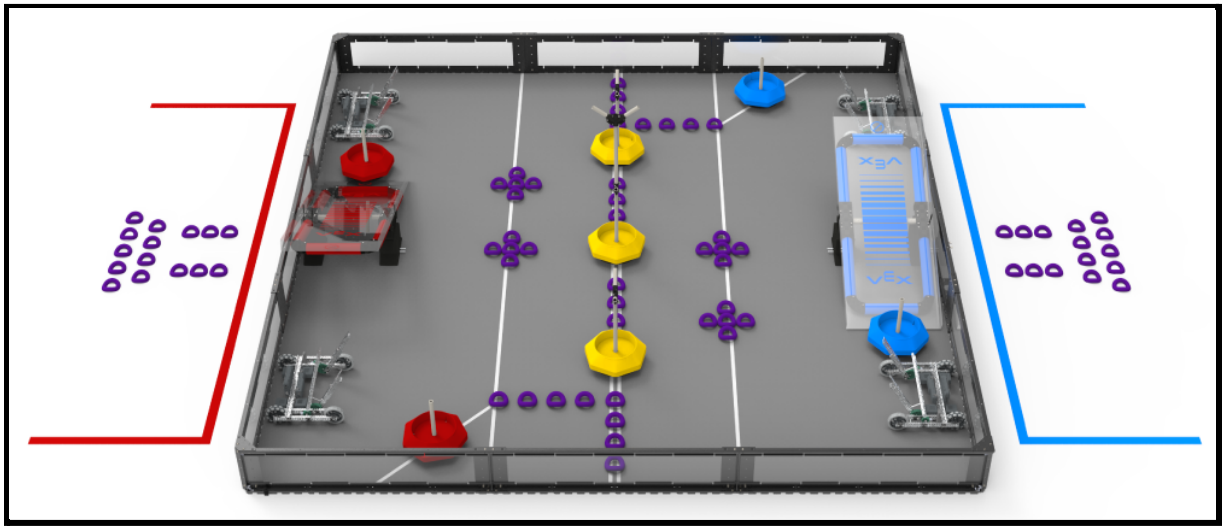

Fig: 1 Field

Figure 1: https://www.vexrobotics.com/v5/competition/vrc-current-game

Designed by _____Witnessed by: _____ Date: _____

Field objects and dimensions

Alliance mobile goals

There are 2 Alliance mobile goals per Alliance
The Alliance mobile goals are placed in the Home Zone
The Alliance mobile goals are 12.29 inches tall and 13 inches wide

Small Neutral mobile goals

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The small neutral goals are placed in the neutral zone
The neutral goals are 22 inches tall and 13 inches wide. The branches on the mobile goals are 21.333 mm thick.

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The rings are curved

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For the points to actually count the platform can not touch the floor.
The platform is 1,346.2mm x 511mm

Win point line - Autonomous

There is 1 win point line on each side of the field.
You need to move the alliance mobile goal across that line so you can receive a win point.

Scoring Rules

Ring on / in a *Scored Mobile Goal*	*Mobile Goal* High Branch	10 Points
	Any other *Mobile Goal Branch*	3 Points
	Mobile Goal Base	1 Point
Neutral Mobile Goal	Either *Alliance's* Home Zone	20 Points
	Elevated on a *Balanced Platform*	40 Points
Alliance Mobile Goal	Correct *Alliance's* Home Zone	20 Points
	Elevated on correct *Alliance's Balanced Platform*	40 Points
Robot	*Elevated* on correct *Alliance's Balanced Platform*	30 Points
Alliance	Wins *Autonomous Bonus*	20 Points

Fig: Scoring Points (Basic)

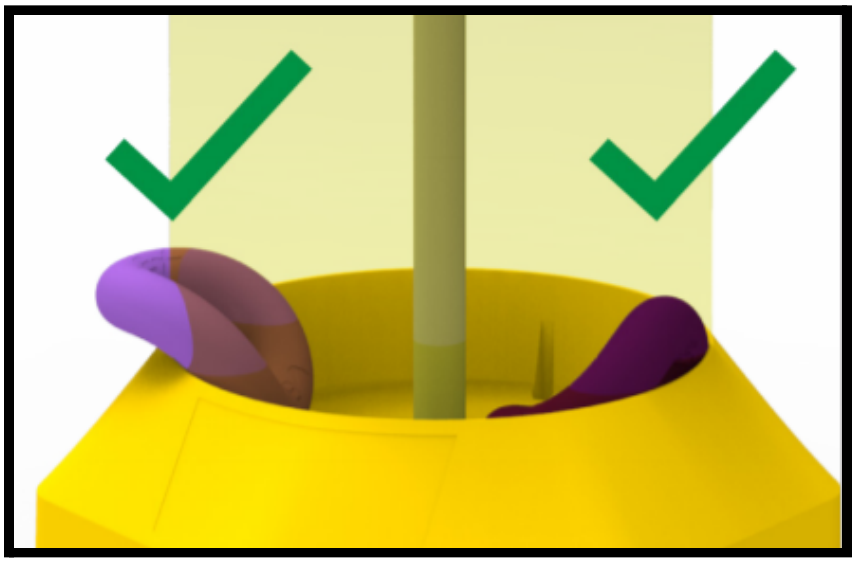

Fig: Ring Scoring (Base)

Scoring rings (Base):
- Only counts if:
  - Not touching robot
  - Is partially between "bowl" of goal base

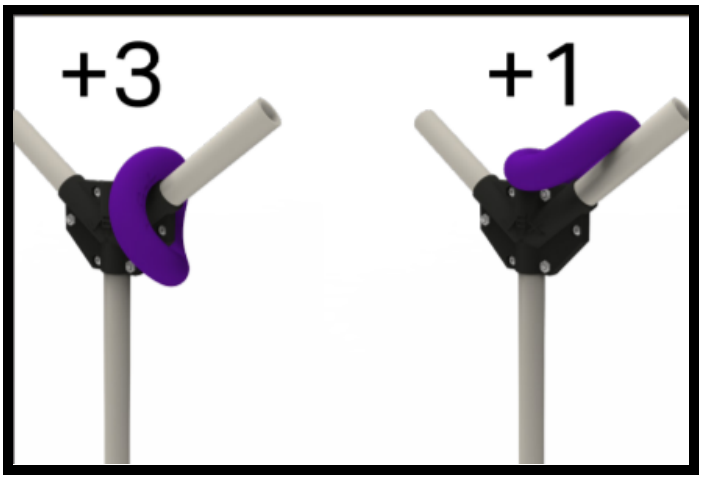

Fig: Ring Scoring (Poles)

Scoring Rings (Poles):
Only counts if:
Not touching Robot
Any part of the pole is within the volume by the outer edges of the ring

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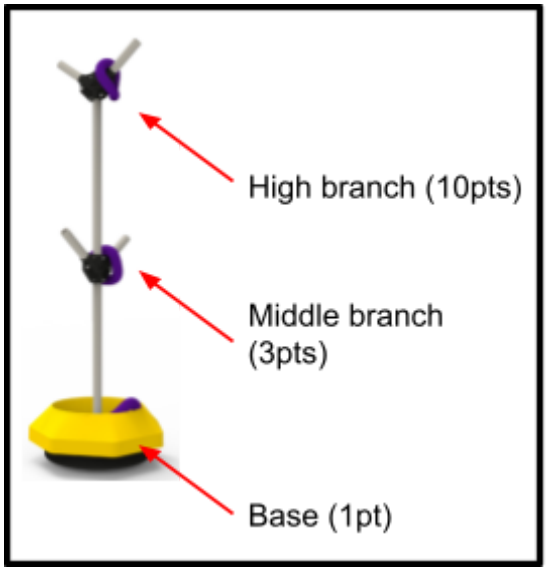
Ring on / In scored mobile Goal:



Neutral Mobile Goal In Alliance Home Zone:

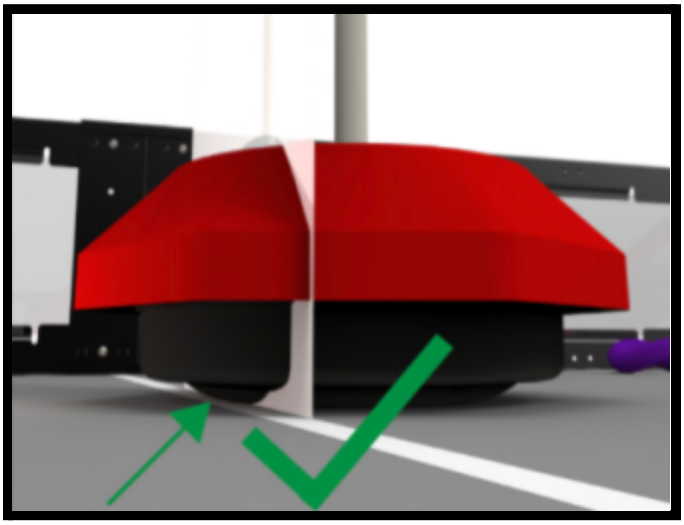


Fig: Neutral Mobile Goal in Alliance Home Zone

At the end of the match, if any part of the mobile goal crosses the white line for the Alliance Home Zone, it is counted for 20 Points.

Neutral Mobile Goal Elevated on Alliance Platform:

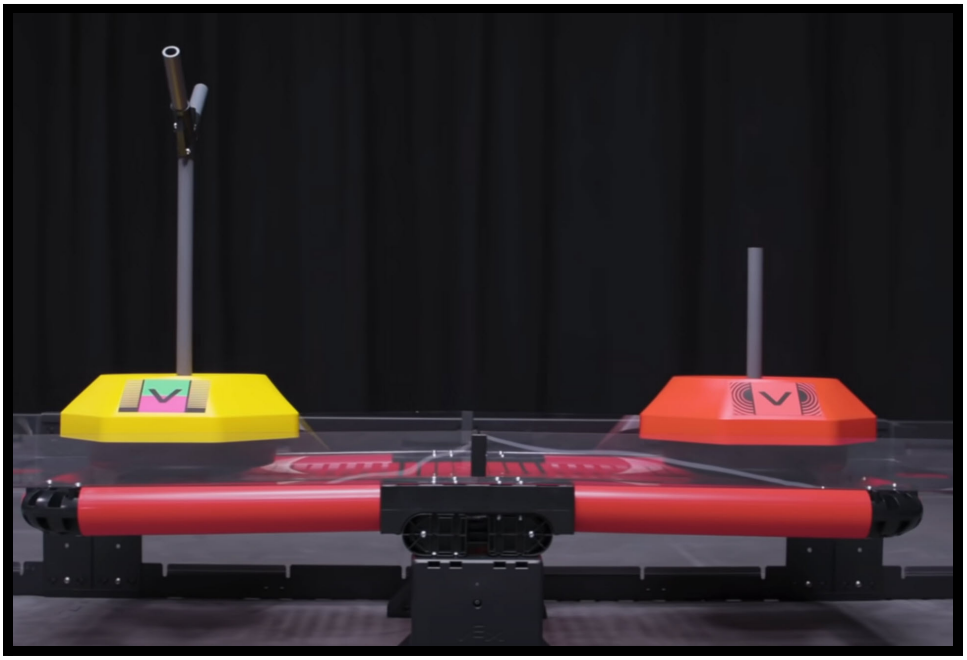
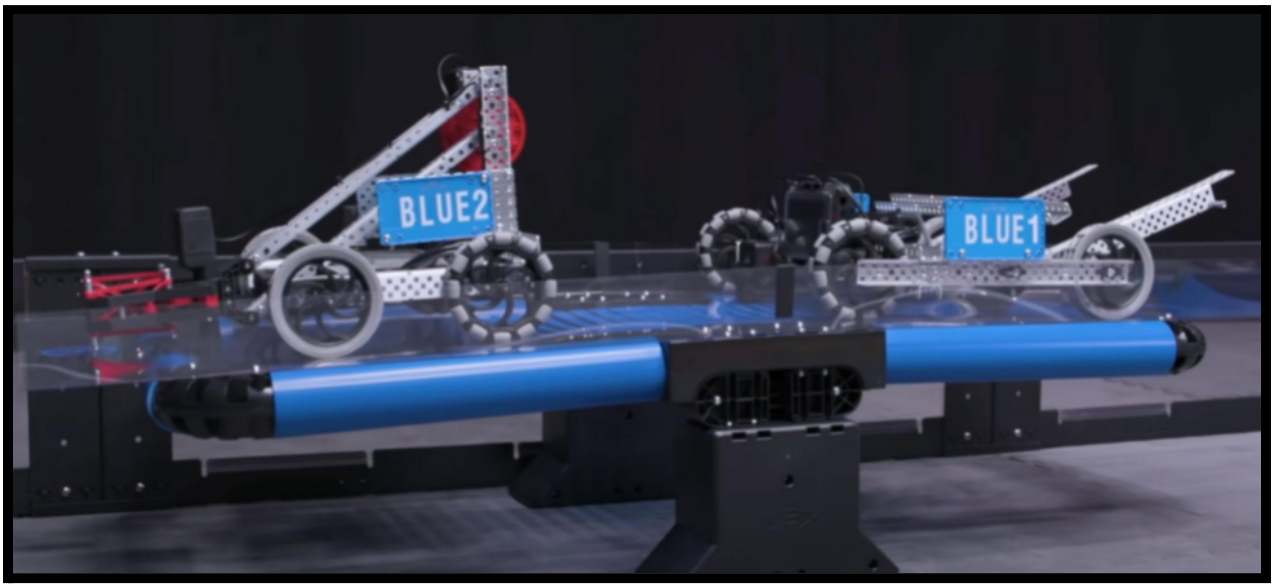


Fig: Neutral Mobile Goal Elevated on Alliance Platform

At the end of the match, the goal must not be touching the robot, foam tiles, or the outside ring to count for 40 points

Robot Elevated on Alliance Platform:



At the end of the match, the elevated robot cannot touch anything in contact with the foam tiles except for the platform to count for 30 points.

General Game rules

Robot can only extend up to 36” by 36” by 36” during the match
Robot size can not exceed 18” by 18” by 18” at the beginning of the match
Removing rings from an Alliance Mobile Goal is against the rules.
Only one robot can guard a goal at a time.
Preloads
Can only be on one robot
If not used, 3 rings will be used as match rings in there place

Scoring

Action	Description	Points
Ring on/ in a scored mobile goal	Mobile goal high branch	10 points
	Any other mobile goal branch	3 points
	Mobile goal base	1 point
Neutral mobile goal	Either alliance’s home zone	20 points
	Elevated on a balanced platform	40 points
Alliance Mobile Goal	Correct alliance’s home zone	20 points
	Elevated on correct alliance’s Balanced platform	40 points
Robot	Elevated on correct alliance’s Balanced platform	30 points
Alliance	Wins Autonomous Bonus	20 points

Fig: Point distribution

Mobile Goals count for the alliance if it is penetrating their white line
Rings on Alliance Goals count for the team regardless where they end.

Game Challenges and Goals

1. Auton and related strategy
2. Getting goals
    a. Speed - to get goals sooner than other side
    b. Retain - Not letting goals get snatched away
    c. Capacity - Getting multiple goals loaded on robot
    d. Loading goals on platform
3. Obtaining rings
4. Defending goals obtained
5. Putting goals on the alliance platform
6. Putting Robot on the alliance platform
7. Balancing with alliance partner

Robot Design Challenges and Goals

Different subsystems

- Drivetrain
- Front Clamp and Lift
- Back Clamp
- Ring Poker
- Preload
- 4 Bar Differential
- Sensors - Gyro and Vision
- hood differential, and the DR4B lift.

Coding

- Coding for Driving
- Coding for Autonomous

Project Management

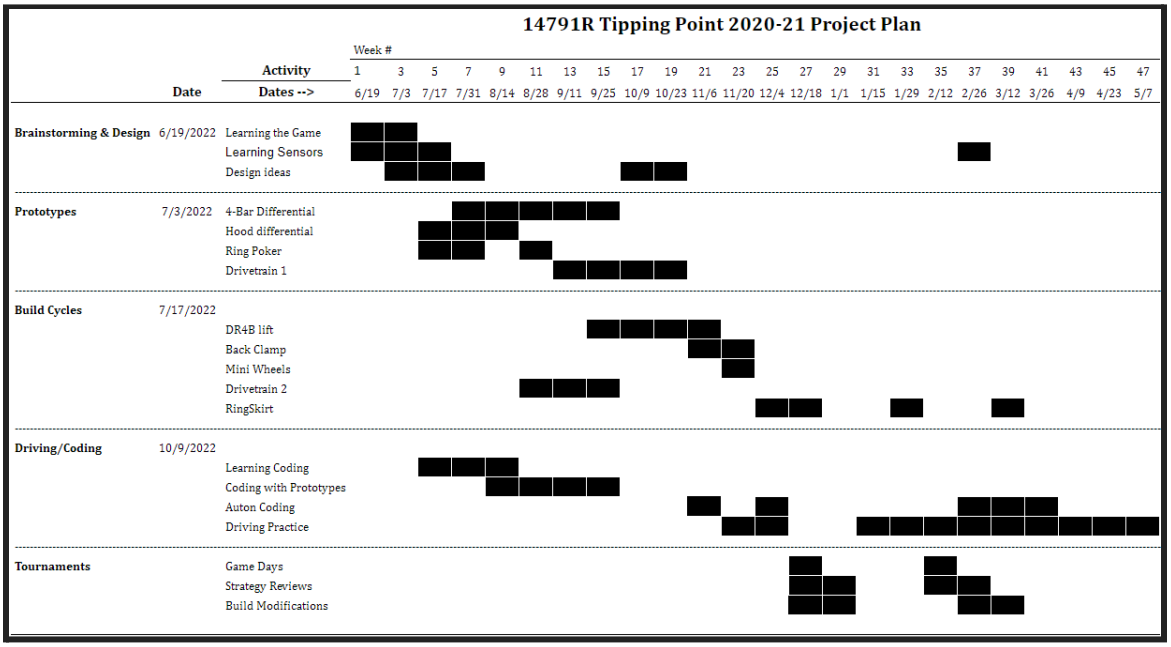


Fig Project Plan by week

Brainstorming & Design

Prototypes

Build Cycles

Driving/Coding

Tournamenta & Improvements

06/26/21 Meeting 2 - Concepts Review

Attendees: Rohan, Ayden, Krishna, Orion, Risa

IDEATE

Quick Summary: We presented our brown-bag presentations and prepared our presentations for the next meeting.

Pneumatics

It is the study of mechanical gases
Controlled air pressure is the main cause of movement
Specific movements can be used in many ways such as:
Pushing opponents away
Powering a lift (picking up goals and rings)
Providing an exerting force in general

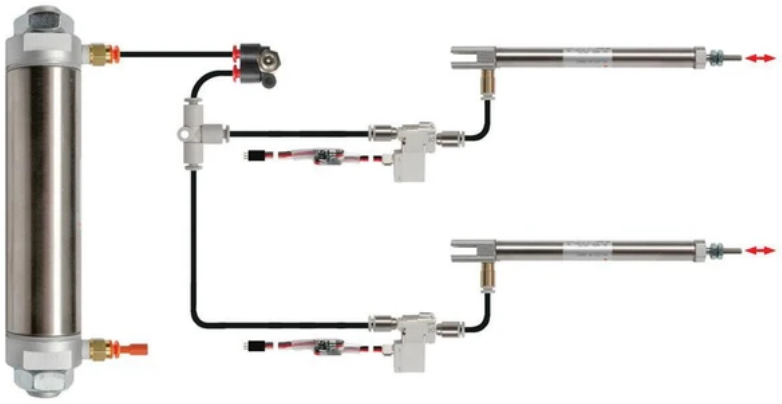


Fig: Vex Edr Pneumatic

Ultrasonic Sensor

The ultrasonic sensor measures distance by sending sound waves. (emitter)
The sound waves bounce back and are measured. (detector)

Distance=½*T*S
T=(time for the sound waves to bounce back)
S=(speed of sound)

Uses - sensing goals and opponents.
Accurate to the nearest cm.

<u>Infrared Sensor</u>:

Infrared Sensor

Infrared sensors detect infrared radiation and light
Two types of infrared sensors - Active and passive
<u>Active IR sensors:</u>
Have a LED and a receiver
Emit light from the LED
Light reflects of object
Receiver detects how much time it takes for light to come back
From this it runs the calculation, D = ½ T*S
Used to measure distance

d. <u>Passive IR sensors:</u>
A Passive IR Sensor only have a receiver
When an object moves, it generates Infrared radiation
The sensor detects this radiation
Used as motion sensors

We decided that an Active IR Sensor was more optimal because light travels faster than sound. This would help our robot be more accurate.

Action Items for Next Week:

Rohan/Orion: Calculate max possible score and discuss few winning game strategies
Rohan: Pneumatic (add more)
Krishna: Field elements
Ayden: Ultrasonic sensor, scoring rules (add more)
Orion: Sensor
Risa: DriveTrain, journal plan

07/03/21 Meeting 3 - Game Challenge, Ideation, Build Drivetrain

Attendees: Rohan, Ayden, Orion, Risa

Quick Summary: We continued to ideate, build initial project plan and started building the drivetrain of the robot.

Game and Robot Design Challenges and Goals

IDEATE - Drivetrains for Game Challenge:

Idea 1 Four Wheel Drivetrain

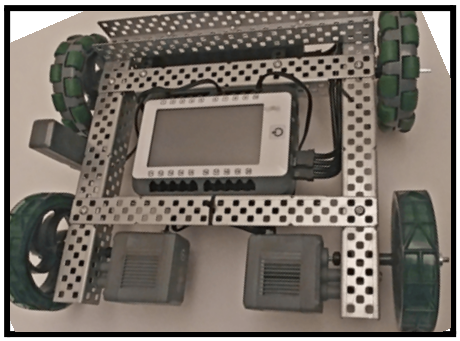


Fig: Example of a four-wheel drivetrain

Pros:

- The four-wheel drivetrain is easier to build
- More familiar with it from last year
- Balancing is easy

Cons:

- More friction when turning
- Loss in fights

Idea 2 Six Wheel Drivetrain

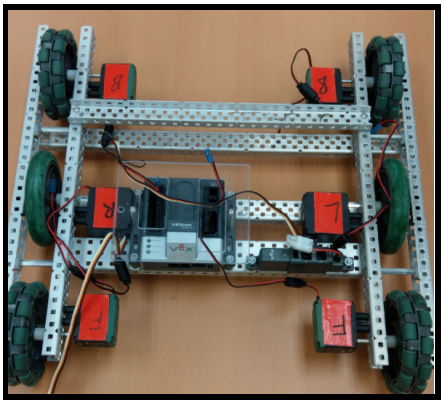


Fig: Example of six-wheel drivetrain

Pros:

- Better steering capability
- Better turning torque
- Ramping is easier
- Win in auton because of more power
- Win in fights, no robot damage

Cons:

- Uses up lots of motors

Idea 3. Kiwi Drivetrain

Fig: Example of Kiwi Drivetrain

Pros:

- Can move sideways
- Turn smoothly

Cons:

- Difficult to go onto platform

Harder to drive
Loss in fights

Conclusion

In the end we decided to go with a six wheel drivetrain to help with stability, ability to balance on the elevated platform, and auton.

IDEATE - Max score:

Max score possible: 566 points

Breakdown:

20 point auton: 20
40 points per goal on platform: 40x5 = 200
30 points per robot on platform: 30x2 = 60
10 points per ring on top branch: 10x10 = 100
3 points per ring on lower branches and alliance goals: 3x62 = 186

20+200+60+100+186 = 566

IMPLEMENT - Drivetrain:

We started building our first half of our prototype drivetrain:

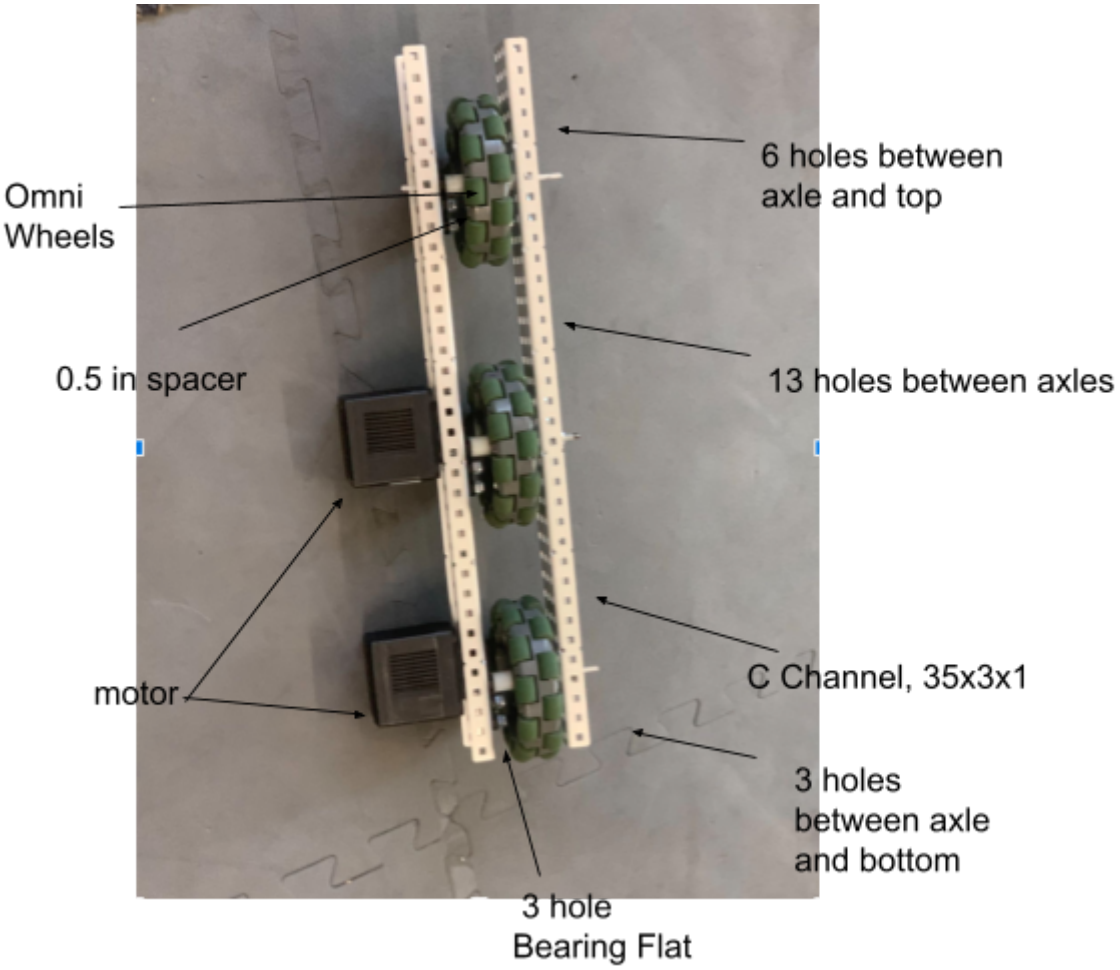


Fig: Drivetrain Design

07/10/21 Meeting 4 Coding, Field Rules review

Attendees: Risa, Orion, Ayden, Krishna, Rohan

IDEATE

Quick Summary: We went over the field rules presentation and the code we made for the auto-balance method.

Field Rules

Alliance Mobile Goals

2 alliance mobile goals per alliance
Placed in the home zone
12.3 in tall and 13 in wide

Fig: Alliance Mobile Goal

Small Neutral Mobile Goals

2 small neutral mobile goals
Placed in neutral zone
22 in tall and 13 in wide
Branches are 21.3 mm thick

Fig: Small Neutral Mobile Goal

Big Neutral Mobile Goal

1 big neutral mobile goal
Placed in neutral zone
40 in tall and 13 in wide
Branches are 21.3 mm thick

Fig: Big Neutral Mobile Goal

Rings

72 rings

4.125 inches in diameter

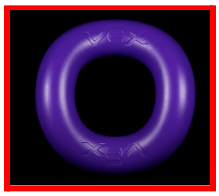


Fig: Ring

Platform

2 platforms

Points only count if platform does not touch floor

1,362.2 mm by 511 mm

Win Point Line

1 win point line on each side of field

2. **Auto-Balance Method Code:**

```
void GyroFlat() {
    Set degrees to x;
    while degrees !=0 {
    if (degrees > 0) {
    FrontLeft.spin(directionType::fwd, speed - speed_correction,  velocityUnits::pct);
    FrontRight.spin(directionType::fwd, speed + speed_correction, velocityUnits::pct);
    BackLeft.spin(directionType::fwd, speed - speed_correction, velocityUnits::pct);
    BackRight.spin(directionType::fwd, speed + speed_correction, velocityUnits::pct);
    }
    if (degrees < 0) {
    FrontLeft.spin(directionType::rev, speed + speed_correction, velocityUnits::pct);
    FrontRight.spin(directionType::rev, speed - speed_correction, velocityUnits::pct);
    BackLeft.spin(directionType::rev, speed + speed_correction, velocityUnits::pct);
    BackRight.spin(directionType::rev, speed - speed_correction, velocityUnits::pct);
    }
    }
    return;
}
```

Action Items for Next Week:

Start building

4 bar differential

Hood differential

DR4B Lift

Ringpoker

07/17/21 Meeting 5 - Build - 4 Bar differential, other subsystems

Attendees: Krishna, Ayden, Orion, Rohan, Risa

Quick Summary: Continued the build on 4 bar differential, ring poker, hood differential, and the DR4B lift.

4 Bar differential: The 4 Bar differential uses a motor for moving forward and backward and using gears the same motor can make the lift go up and down.

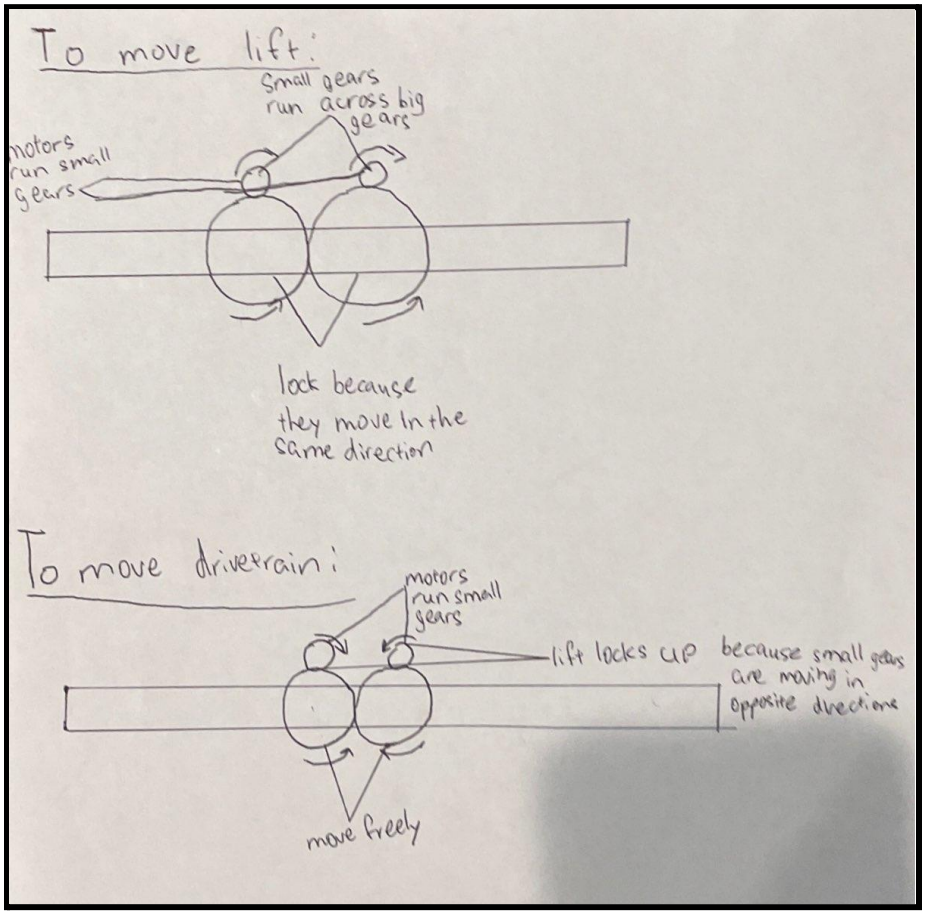


Figure 1: 4 Bar Differential

DR4B Lift: The DR4B lift was made for the ringpoker so that the poker can capture rings from the floor and release it on the goals and so we can capture goals to put on platforms or hold them higher up.

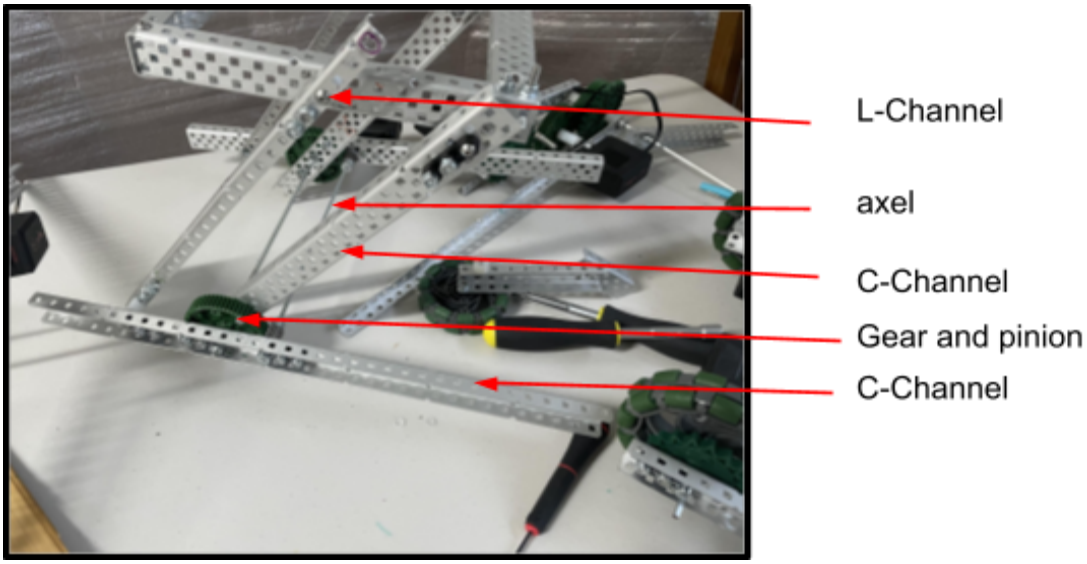


Figure 2: DR4B Lift

Hood differential: The hood differential was made for us because we needed to understand the concept.

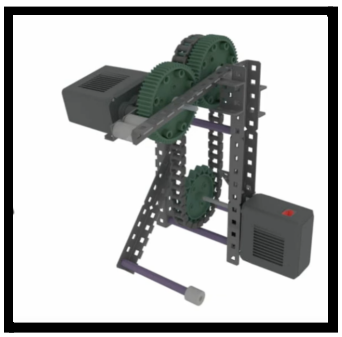


Figure 3 : Hood Differential

Ringpoker: The Ringpoker was made to store rings and release them in goals.

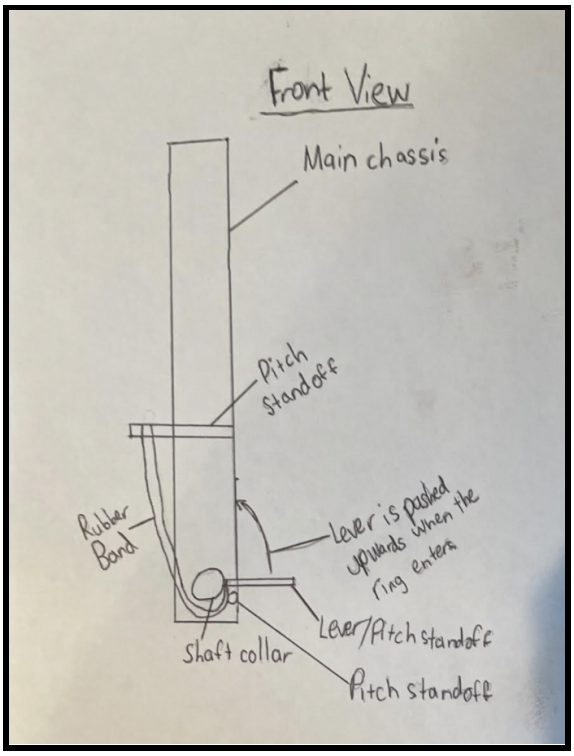


Figure 4 : Ring Poker

07/24/21 Meeting 6 - Build - Various subsystems

Attendees: Rohan, Risa, Krishna

Quick Summary:
Today, we continued building our mini projects

Build Project 1: Ring Poker (Krishna)

Objective

Create a ring poker that can passively (w/o motors) pick up rings

A pitch-standoff is attached to a shaft collar is used as a lever that lets a ring enter the magazine.
When the poker is pushed on a ring, the lever bends inwards and allows the ring to enter the magazine. (Fig 1)
However, the ring cannot fall back down because of a support pitch standoff supporting the lever from giving.
The rubber band pulls the lever against the support pitch standoff making it a flap of sorts.
Usefulness:

It can effectively hold more than one ring, passively.

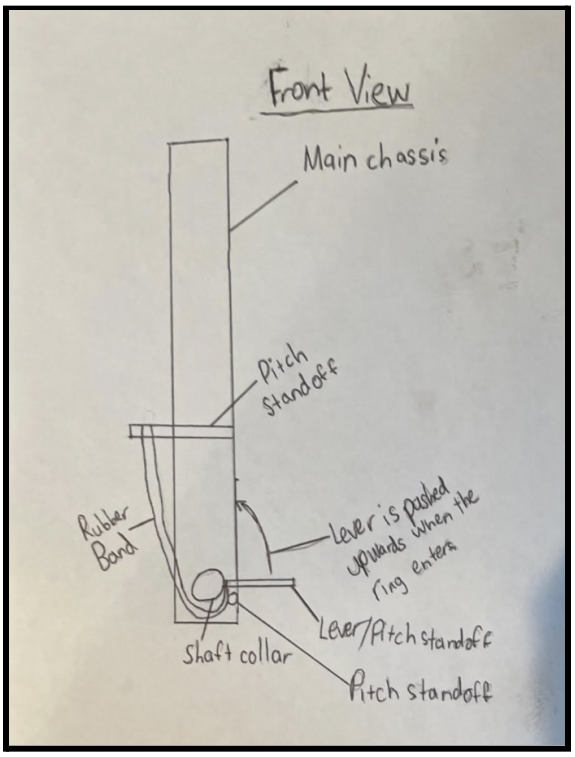


Figure 1: Ring Poker

Build Project 2: Bar Differential (Rohan, Risa)

Objective

Create a four-bar differential

When the pinions run in opposite directions, the lift locks up and the bottom gears run.

However, when the pinions run in the same directions, the bottom gears lock up and the lift can move back and forth

Usefulness

The four-bar can be used to create a 4 motor lift and a 6 motor drivetrain for the cost of 6 motors.

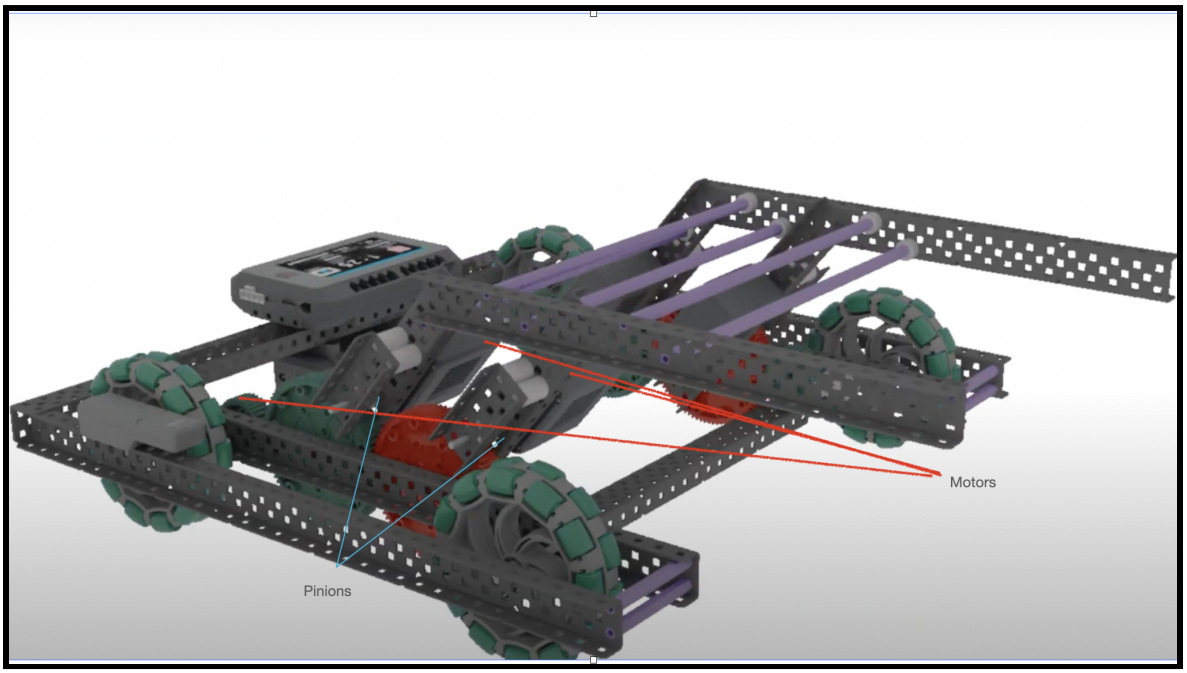


Figure 2: 4 Bar Differential

Next steps:

Implement the four-bar differential onto a real drivetrain.

Picture Sources:

Figure 1: Own-source

Figure 2: https://www.youtube.com/watch?v=2NL3bhBeIWk&t=18s

07/31/21 Meeting 7 - Drivetrain - Design and Build

Attendees: Rohan, Orion, Risa, Krishna

DESIGN PHASE

Quick Summary: We designed a new drivetrain and started building it.

We finalized our design for a 4-Bar-Differential for our drivetrain on the bot
Some of our reasons for selecting this approach were

Controlling the drivetrain and giving the robot more stability
The Four bar can allow a robot to distribute it's motors across more than 1 parts of the bot.

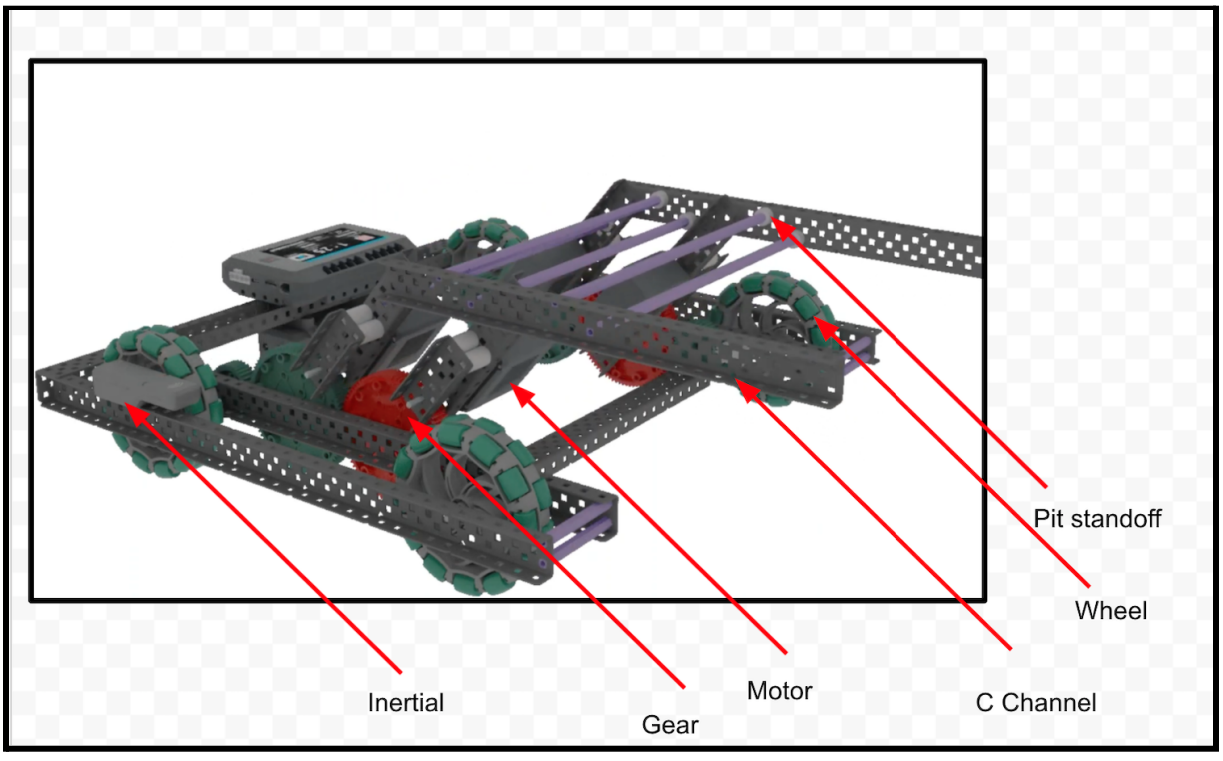


Figure: Side/Top view of the 4 bar differential

Other approaches we looked at and rejected

One other idea we looked at was making a simple 4 wheel 4 motor drivetrain. We decided against it because the 4 bar would help the robot carry goals easier.

09/04//21 Meeting 8-12 - Various subsystem builds, programming

Attendees: Ayden, Rohan, Risa, Orion, Krishna

BUILD

Quick Summary: In these meetings, we continued building our drivetrain, ring poker, and started programming the drivetrain. We split into project teams accordingly.

Team 1: (drivetrain)

Continued building drivetrain
Started connecting both sides

Team 2: (coding)

Started a new program on Vex v5 text
Wrote the code for moving the robot forward and basic functions

Code:

```
void Forward(){

      BackRight.spin(reverse);
      FrontRight.spin(reverse);
      MiddleRight.spin(reverse);

      Backleft.spin(reverse);
      FrontLeft.spin(forward);
      MiddleLeft.spin(forward);

      wait(2,sec);

      Backleft.stop();
      BackRight.stop();
      LRightF.stop();
      LRightB.stop();

      LLeftF.stop();
      LLeftB.stop();
}
```

Team 3: (Ring Poker)

Ideate - Design 1 of Ring Poker:

Concept:

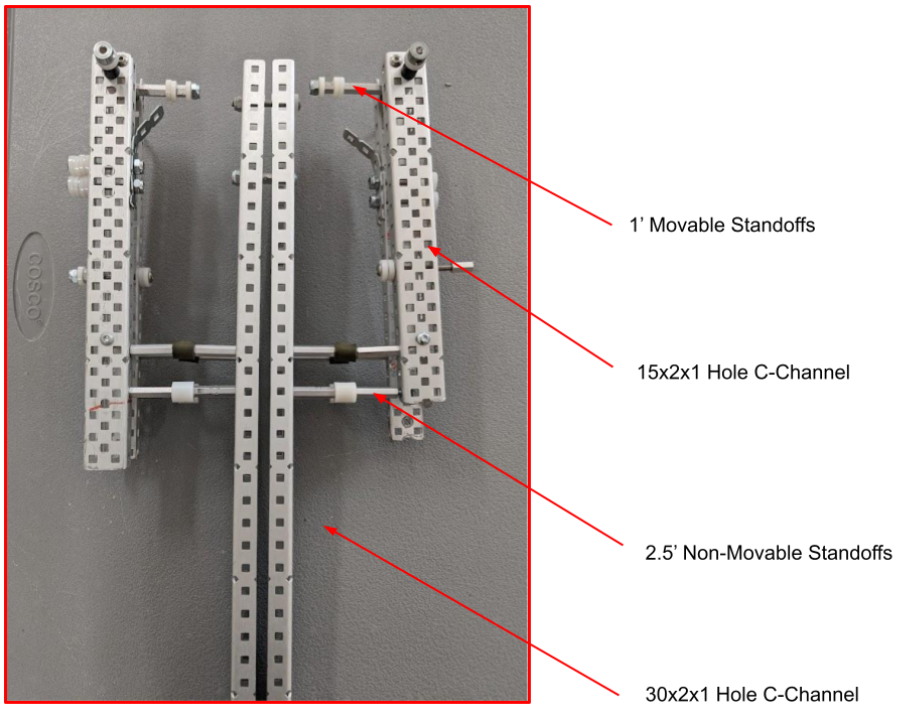


Fig: Design 1 of Ring Poker

Test - We noticed some flaws:

Big → not enough room for other systems
Pickup was not as reliable

Ideatev2 - We then researched new designs and found a new design:

Concept:

The Bendy tabs allow the rings to come in around the Pneumatic
When the pneumatic extends, the connecting bar bends the tabs and the rings fall out

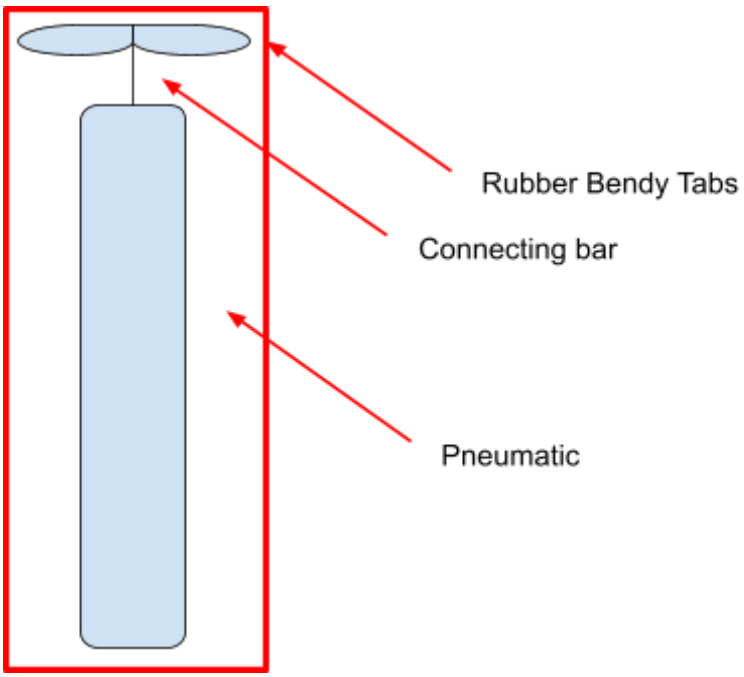


Fig: Design 2 of Ring Poker

Test - Reasons for change:

Compact
Reliable

We will attach the ring poker in a future meeting when other parts are complete

09/18/21 Meeting 13 - Redesign drive train and build

Attendees: Rohan, Orion, Ayden, Risa, Krishna

Quick Summary: We continued building the drivetrain and started building the 4 motor 4 wheel drive train.

BUILD PHASE

We decided to split off into two groups. Rohan, Ayden, and Orion would continue building the 4 bar differential while Krishna and Risa would start making a basic drivetrain. We decided to do this so we have a backup plan if the 4 bar differential does not work

Build Project 1: 4 Bar Differential (Rohan, Ayden, and Orion)
We made a list of some things we have to do on the drivetrain.

- Stabilize the robot
- Install the Brain
- Replace the green motors on lift, with blue motors

While we were trying to stabilize the bot, we noticed 2 key problems in the bot

Problem: The width of the bot was too large, and it exceeded the 18x18 limit
Solution: We reduced how far apart the 2 sides of the drivetrain are.

Problem: The spacing on the bot was off, and when we tried to attach a stabilizing bar, the holes wouldn't line up.
Solution: First, we tried changing all the spacers, and that solved the spacing problem, but the holes still weren't aligning. We decided that next meeting we would drill holes into the bar so it would align, and the bot would be stabilized.

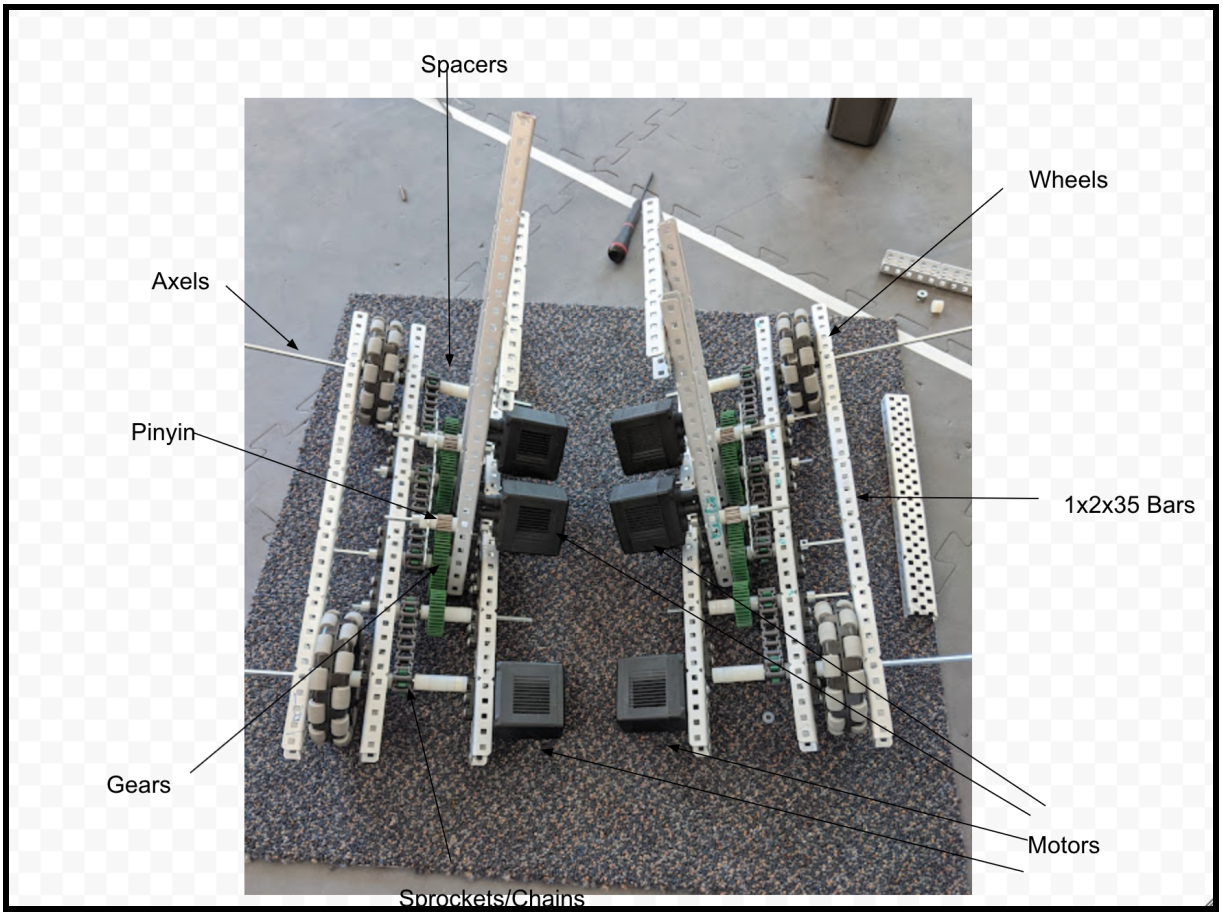


Figure: Top view of 4 bar differential

Team 2: We started building a simple 4 motor 4 wheel drivetrain

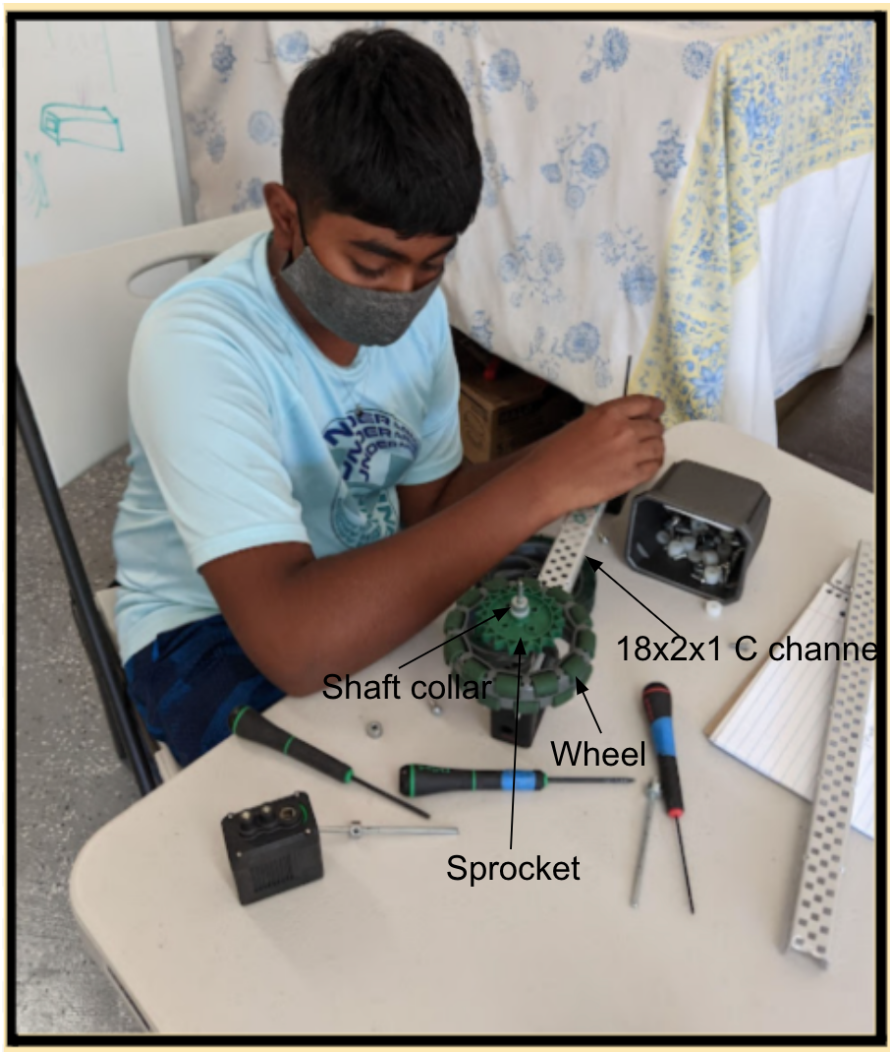


Fig: Krishna building drivetrain

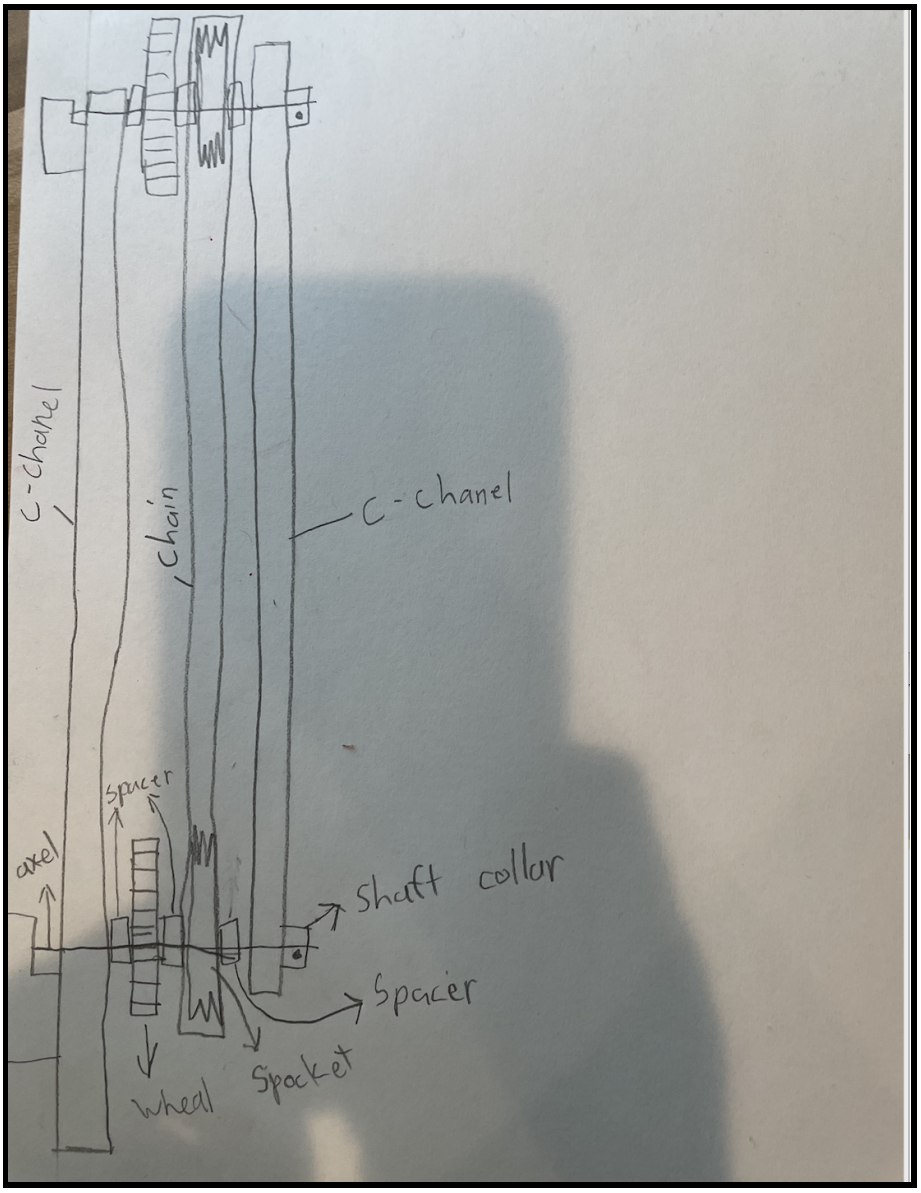


Fig: Design of Drive Train

09/25/21 Meeting 14 - Build - Drivetrain

Attendees: Risa, Ayden, Krishna, Orion, Rohan

Quick Summary: We continued building our drivetrains

BUILD:

Build #1: 4 Bar Differential Drivetrain (Ayden, Orion, and Rohan)

Problem to address: Stabilize the base

Attach stabilizing bars

Drill holes into the bar so the bars will align

Problem: When we tried to attach a bar to stabilize the robot, the holes would not line up

Solution: We drilled holes into the bar so it would align

Install the Brain

Wire the motors to the brain

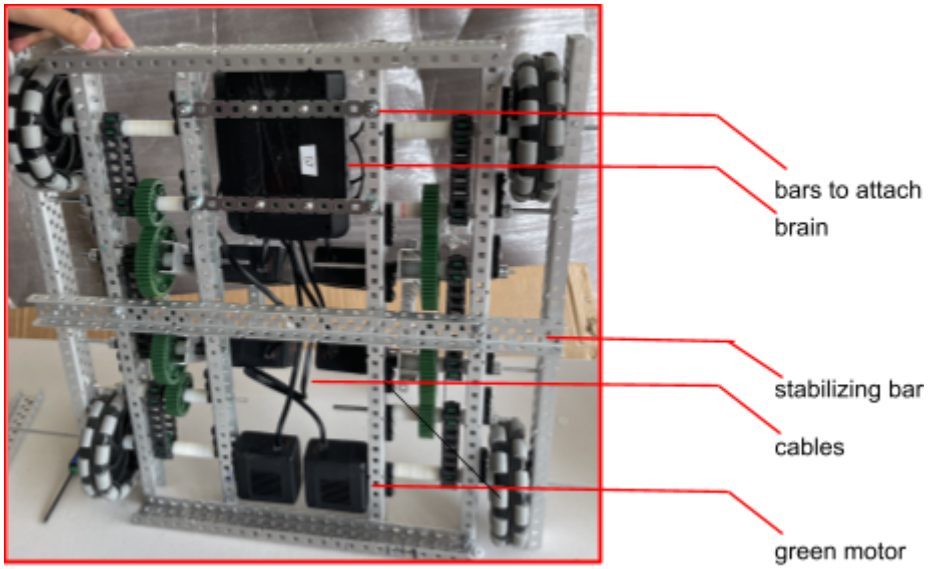


Fig: 4 Bar Differential Drivetrain

Build #2: 4 Motor Drivetrain (Risa and Krishna)

Problem to address: Make a backup basic drivetrain for our 4 bar differential drivetrain

Build each side of the drivetrain

30 holes long

2 wheels on each side

2 motors on each side

Basic drivetrain with sprockets

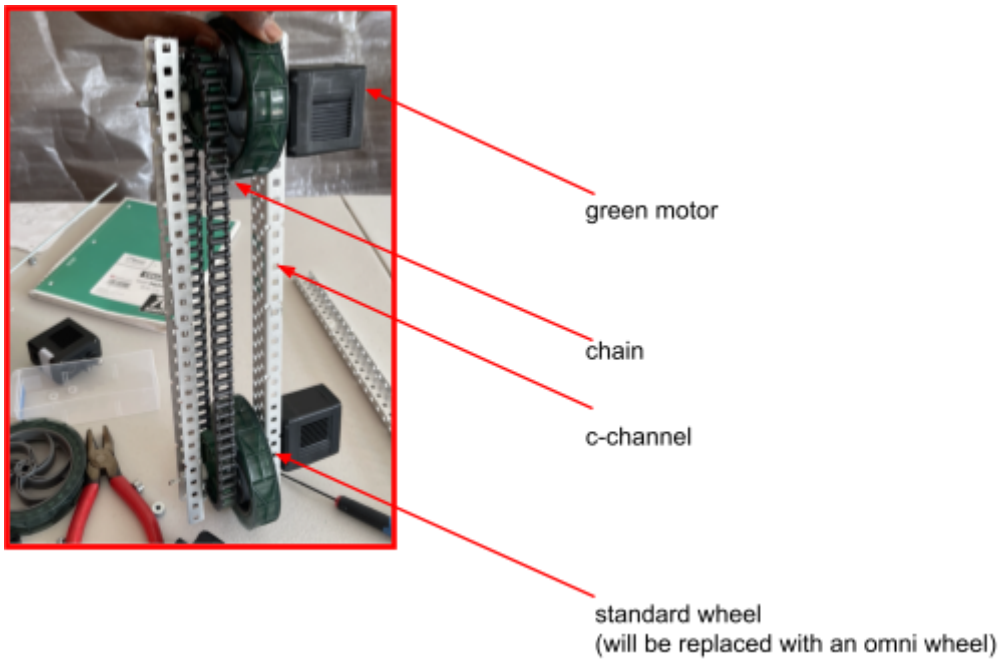


Fig: 4 Motor Drivetrain

10/02/21 Meeting 15 - Build - Lift, Drivetrain

Attendees: Krishna, Rohan, Ayden, Orion, Risa

Quick Summary: Today in the class we split into 3 groups. Group1 was building the new lift, group 2 was fixing the old drive train and programming it and group 3 was working on the new drivetrain to get it finished. The reason we are making a new drivetrain is because if the old one does not work then we will have some point to start at.

Old Drivetrain: The old drivetrain is connected with a four bar differential so picking up goals are easier.

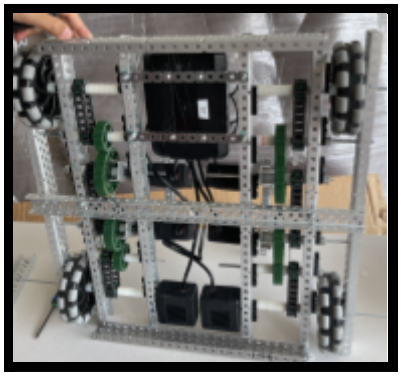


Figure: Old Drivetrain

New Drivetrain: The new drive train is basic and four motored with four wheels connected with a chain. This drivetrain's purpose is to be a backup if the current one doesn't work.

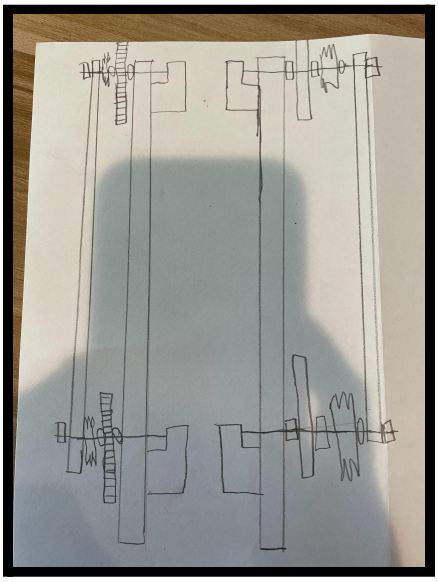


Figure 2: New Drivetrain

New Lift: The new lift is an attachment to the new drivetrain so it can lift goals and the ring poker.

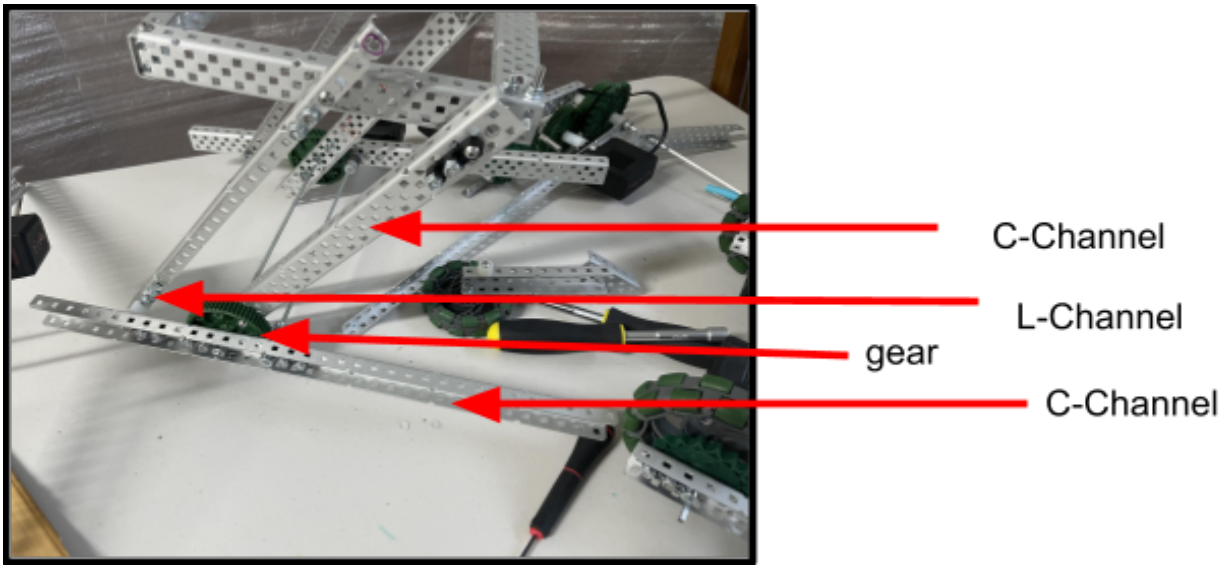


Figure 3: New Lift

10/09/21 Meeting 16 - Build Test - Lift, Drivetrain

Attendees: Rohan, Ayden, Orion, Risa, Krishna

Phase:
BUILD

Quick Summary:
We continued building our new drivetrain and lifts.

New Drivetrain (Krishna, Risa):

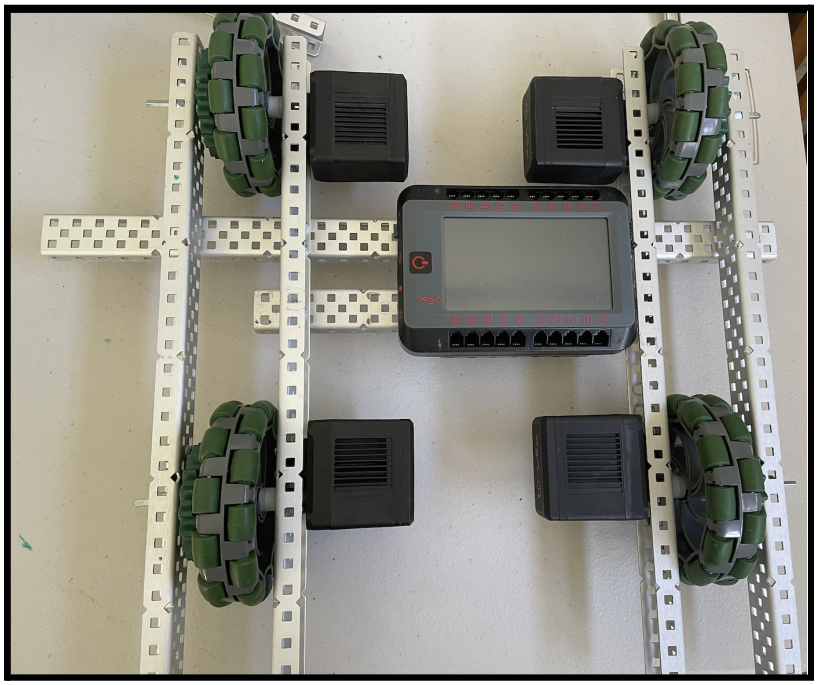


Figure 1: Drivetrain

Overview:
We continued building our new drivetrain. It is a 4-motor/4-wheel drivetrain.

Reason:
We realized that the four-bar-differential drivetrain would be too heavy and clumsy. We started building a new drivetrain on which we could mount lifts.

Lifts (Orion, Ayden, Rohan):

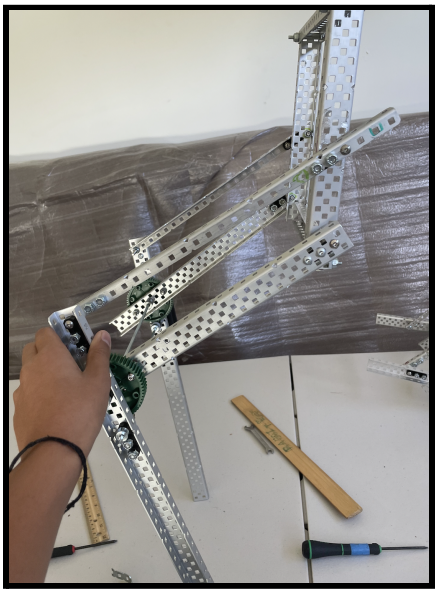


Figure 2: Lift

Overview:
We are building 2 DR4B lifts; one in the back and another in the front.

Reason:
To compensate for not using the four-bar-differential, we are building 2 lifts that can lift goals.

Next steps:

- Finish new drivetrain
- Finish both lifts
- Add lifts onto the drivetrain

Picture Sources:
Figure 1: Own-source
Figure 2: Own-source

10/16/21 Meeting 17 - Design Build - Lift, Stabilize Drivetrain

Attendees: Risa, Orion, Krishna, Ayden, Rohan

Quick Summary: We continued working on the lift, and stabilized the drivetrain

We split up into 2 teams:
Team 1: Orion, Ayden, Rohan
Team 2: Risa, Krishna

BUILD

Team 1 continued working on the lift. We noticed some problems with it:

Problem: Instead of building the right and left side of the lift, we built the right side twice, so the 2 sides wouldn't connect.

Solution: Rebuilt the left side of the lift

Ayden and Orion worked on rebuilding the left side of the lift, and connecting the 2 sides, while Rohan worked on creating another lift for the back of the robot. Our goal is too have 2 lifts so we can carry 2 goals at a time

Team 2 stabilized the drive train

Risa and Krishna realized the drive train was flimsy, so got to work stabilizing it by adding some stabilising bars connected with stand-offs.

10/23/21 Meeting 18 - Build Test - Refine Drivetrain

Attendees: Ayden, Risa, Orion, Krishna

BUILD

Quick Summary:

We continued building our robot and improved a problem on the drivetrain

Drivetrain:

Problem:

The dimensions of our robot were exceeded the 18” limit

Solution:

We switched the screw and nut sides to save space inside the chamber by 0.25”

With both sides like this, we save 0.5” and have more room to connect systems

The nut on the outside will not exceed the size limit due to the C shape of the channel

This also allows for easier changes in the future

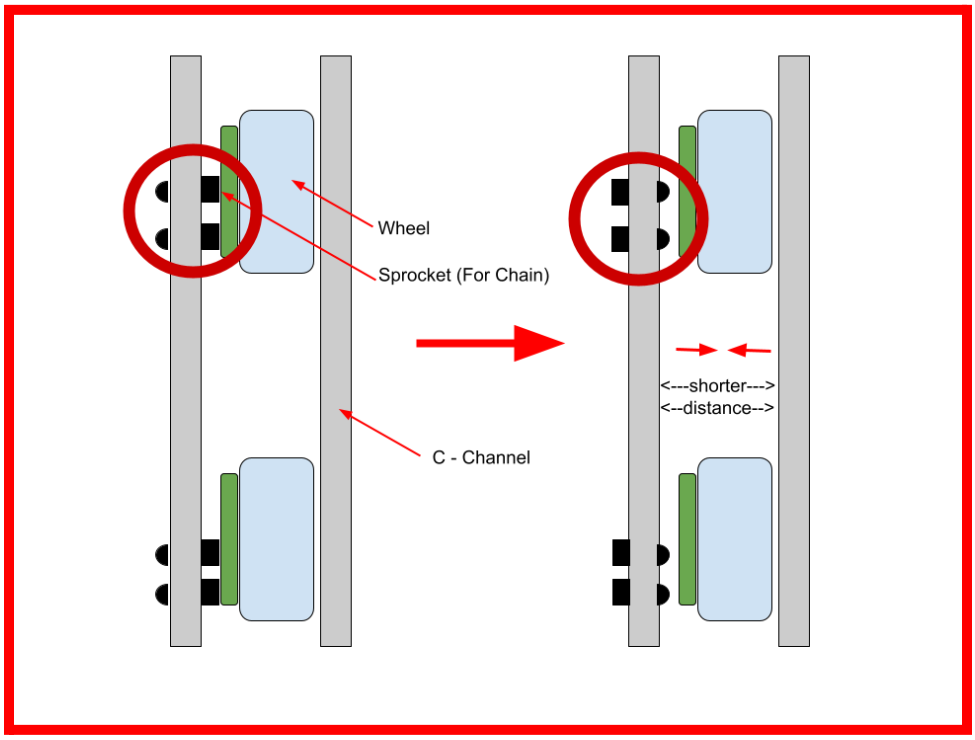


Fig: Shortening Distance

Lift:

We continued building the lift. (More specifics in future meetings)

10/29/21 Meeting 19 Design Build - 4 motor drive train

Attendees: Risa, Ayden, Krishna

BUILD

Quick Summary: We shrank the drivetrain by making it less wide to fit the required dimensions.

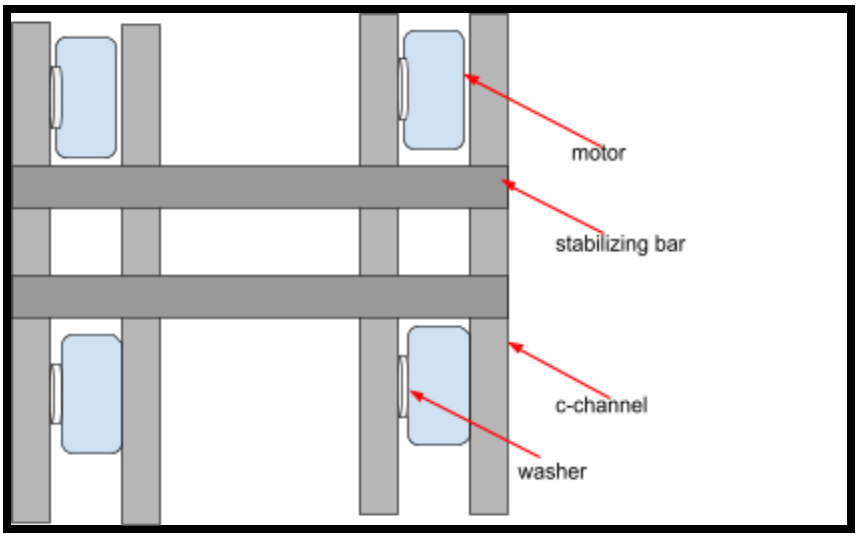
Team 1: Risa, Ayden, and Krishna

Design Problem: The drivetrain was out of the constraints in the rules for the robot.

Alternate Design Solution: Shrink the drivetrain by removing the extra spacers.

We reduced the width of the 4 motor drivetrain by

- Removing stabilizing bars
- Open up both sides of the drivetrain by taking off the c-channel (see figure below)
- Take out all of the spacers on each side and replace them with a thinner washer
- Put c-channels back on
- Reapply stabilizing bars to match the new width



Conclusion - This 4 motor drive train served as a back-up solution as we decided to keep the six motor drive train as it provided more torque during tournament situations

Action Items for next week:

- Switch sprockets used in 4 motor drivetrain (Krishna)
- Switch sprockets used in lifts (Ayden, Rohan)
- Finish the lifts (Ayden, Orion, Risa)

11/06/21 Meeting 20 - Build Test - Finish Lift Drivetrain

Attendees : Krishna, Ayden, Rohan, Risa and Orion

Quick Summary: In today's meeting we finished up one of the two lifts and we finished the new drivetrain. T

his allows us to find the right height and placement for the lift to be placed in.

We are making the second lift currently and will soon finish it. At the time when we were building the second lift, we thought it would be fine because the last lift worked, but we had used too many motors so we had to change our design using a pneumatic.

We changed the Design for the lift for we did not want to use a motor.

We changed it because we could change the motor for a pneumatic

11/13/21 Meeting 21 - Assembly of Lift and Drive Train

Attendees: Risa, Ayden, Orion, Krishna

Phase: Build

Quick Summary:

We mounted one lift on top of the drivetrain and continued correcting the problems we encountered in the second one.

We mounted the lift on the drivetrain

First Lift

Problems encountered:

P: The lift was too high and it couldn't reach the ground
S: We cut off 10 holes from the bottom so that it could touch the ground.

Second Lift:

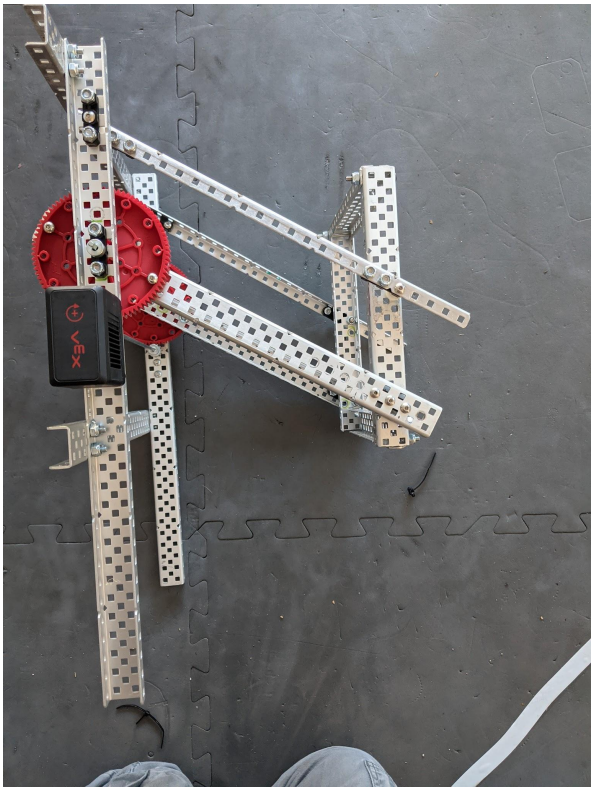


Fig: Lift alignment issues

We continued fixing problems we encountered in the design

Problems encountered:

P: The spacing between the end and beginning of the c-channels were different
S: We readjusted it so that the distance was a constant length (18 holes)

P: The distance between the c-channels in the end and beginning were different
S: We moved the main chassis around until it became a constant length (9.75 in)

11/20/21 Meeting 22 - Replacing Back Lift with Back Clamp

Attendees: Rohan, Ayden, Krishna, Orion, Risa

Phase: Build, Design

Quick Summary:

Instead of using a back lift, we went back to the drawing board and decided to instead build a back clamp.

Back Clamp:

Our initial robot design included two lifts, one in the front and in the back (Recently, we attached the one in the front). However, we realized that there was really no need for the one in the back. Instead, we opted for a clamp that could drag goals around using pneumatics. We started by attaching a small ramp to the back so that the goal could be slightly tilted upwards if we were to push into it. Once it was on an incline, a seesaw-type mechanism would be pushed down into the base of the goal (a pneumatic on the other side of the fulcrum would push it upwards).

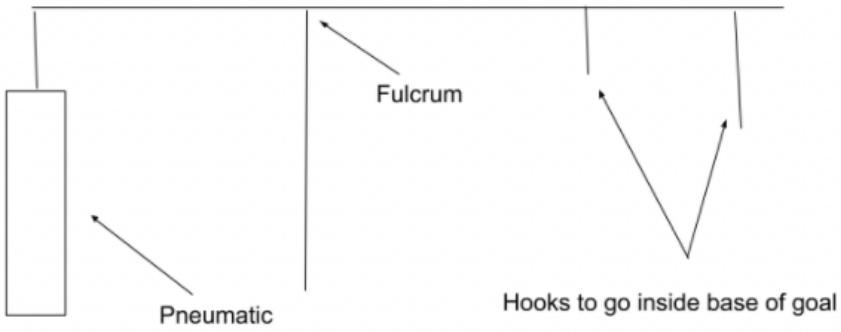


Fig: Schematic design of back clamp

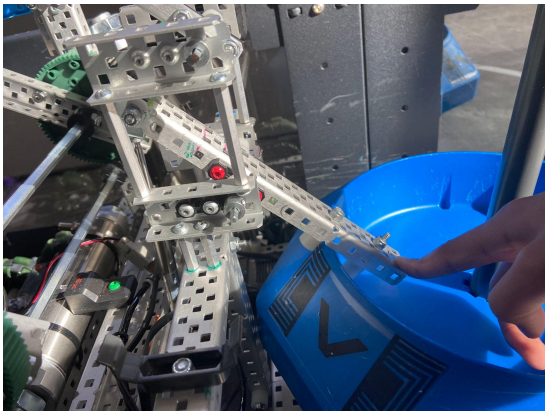


Fig: How the Back Clamp will hold the goals

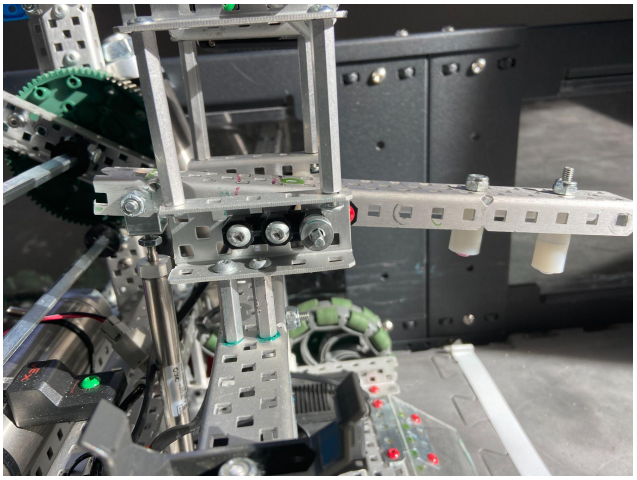


Fig: Back Clamp setup

12/04/21 Meeting 23 - mini wheels and brain and battery attachments

Attendees: Krishna, Ayden, Risa, Rohan, Orion

Phase: Build, Design

BUILD

Quick Summary: In this meeting, we designed mini wheels, and attached the brain & battery.

Mini Wheels:(Team 1)

Design Purpose: These wheels are to counteract balance when we pick up goals with our front lift as we would fall forward when the load of the goal was too much.

Ideas considered but not applied: Considered adding more weight in the back but decided against that as the wheels also help in climbing up the ramp.

Fig: Picture of climbing up the ramp
FIg: Front mini wheels preventing from falling forward.

Brain: (Team 2)

Design Purpose: Good spot to counteract weight of air reservoirs, sturdy design to withstand combat forces

Where: We are planning to put our brain on the side of our robot

Ideas considered but not applied: Looked at putting in the center as it would have been safer but it was harder to access given the wiring needed.

Design: We created a platform branching off of our lift, and attached our brain there.

Battery: (Team 2)

Where: On top of brain.

Why: Easy access to change batteries quickly.

Ideas considered but not applied: We considered attaching the battery to our back clamp, but decided against that due to our up-coming design changes.

12/11/21 Meeting 24 - Build Miniwheels and Pneumatics and 12/18/21 Meeting 25 - 1st Tournament Key Takeaways

Attendees: Ayden, Rohan, Krishna

Quick Summary:

We saw this tournament as a practice one to learn different present-game strategies and future designs we could take inspiration from.

We survived one elimination round and were eliminated during the semi-finals when opposed to the first seed alliance.

Takeaways from tournament

From this tournament there were clear takeaways:

1. We needed a ring skirt
    a. This would block the rings from interfering with our wheels while driving

2. Driving up the ramp
    a. We did not practice this as much as we should have
    b. We will begin regularly driving up to 3 goals on the ramp to ensure victory in competitions

We will practice improving these for our next tournament.

01/01/22 Meeting 25 - Post 1st Tournament Review

Attendees: Rohan, Risa, Ayden, Orion

PHASE: Build, Design

Quick Summary:
We looked at problems we faced in the tournament, how to solve them, and what would be the next steps.
Problems We Encountered:

- Rings would get stuck under the robot during our matches and limit our movement

Possible Solutions:

- We decided to add a “ring skirt.” This would provide a barrier to rings on all four sides of the robot.

Next Steps/Designs:

- During the tournament, we noticed that we had trouble climbing the ramp, especially with goals. We decided to start practicing that and set our driving goal to being able to climb the ramp with 3 goals.

- We came into the tournament without an autonomous. We decided to start coding one for our upcoming ones.

- We also wanted to tackle the task of using the three preloads in the autonomous period in order to gain the win-point. We decided on building a contraption that could swing down and deliver the rings onto the pole of an Alliance Mobile Goal.

01/22/22 Meeting 27 - Driving practice post tournament and 01/22/22 Meeting 28 - Second Tournament

Attendees: Orion, Risa, Ayden, Rohan, Krishna

Quick Summary:
In this tournament, we made it to elims but lost in the first round. We identified some mistakes we made in the tournament and got to work on how to fix them.

In the tournament

- **We won the innovate award!**
- Our auton worked most of the time, but occasionally we would accidentally tip over the neutral middle goal.
- Our ring skirt was able to work
- We were able to double park

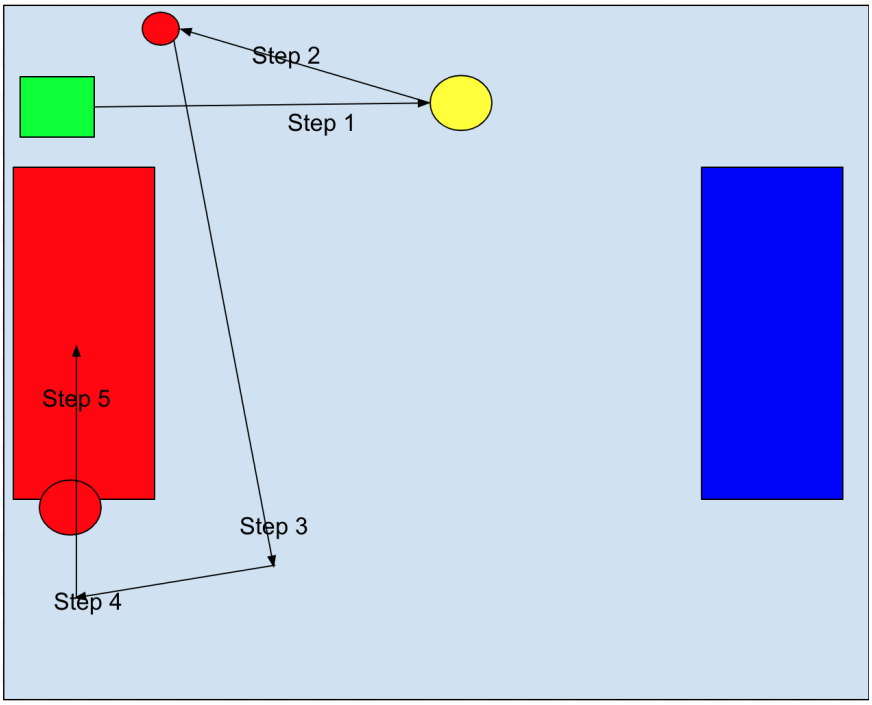
Problems we encountered:

- We did not put a ring skirt on the wheels, so we would still get stuck on rings
- We did not have a clear strategy of what we were going to do each match

Possible Solutions:

- At a metal bar in front of the wheels to protect them

Use the turtle strategy:

- 

    - Step 1: Pick up the neutral mobile goal in front of you in your front lift
    - Step 2: Pick up the alliance home goal in your back lift
    - Step 3: Drive to the other side of the field
    - Step 4: Camp right outside the ramp until 30 seconds, protecting the 3 goals over there
    - Step 5: Climb up the ramp while pushing the alliance home goal up with you so you park with 3 goals

Next steps for future tournaments

- We decided to update our ring skirt
- Our driving skills were poor, so we decided to start practicing driving more
- We decided to update our back lift because it wasn't that strong. Opposing teams were able to steal goals from it every time.

01/29/22 Meeting 29 - 3rd Tournament (ICC)
02/05/22 Meeting 30 - 4th Tournament (Fairfield)
02/20/22 Meeting 31 - Signature Tournament

Attendees: Krishna and Risa

Quick Summary:

The Signature Tournament is a big tournament with around 45 teams. The Signature tournament is used to let more players into the world's tournament by getting the Excellence, Tournament Champion or the Skills Winner Award.

Our team placed second in the tournament because of game day strategies
We lost in the finals because battery cable came out. We designed and built a new idea to address this.

First Qualifier:

The Strategy for the first match is that our bot does our right side auton and our teammate does the left side auton.

The driving strategy is that our team climbs up with two goals and the teammates put 1 goal on our bot so we have 3 goals and 1 bot on the platform.

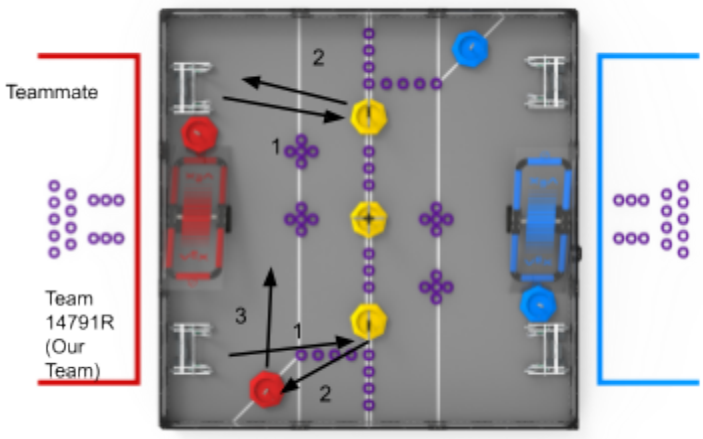


Fig: Strategy for Auton:

In the figure above our team is the red team on the bottom left.

During Auton, our robot gets the small neutral goal. Then goes backwards, gets the red goal and moves it out of the win point line

After the first match our back lift stopped working on the ramp so we could only drag goals on the ground

As a result, we changed the strategy to our teammates climbing the ramp and our team put 2 goals on our teammates that have ramped.

Key Takeaways

- Placement of backlift needs refinement
- Battery placement needs to be reworked

02/26/22 Meeting 32 - Refining robot based on game experience

Attendees: Krishna, Ayden, Risa, Rohan

Phase: Build

Quick Summary:

We fixed minor problems on various elements of our robot:

1. Ring Skirt
2. Strengthening/fixing preload swinger
3. Adjusting the placement of pneumatic air reservoirs

Ring Skirt:

Design Objective:

- Rings would get under the wheel and create jams
- We had already attached a ring skirt on the sides of our robot, but we now want to attach them around the wheels → as that is where we have seen rings get under our robot most commonly

Solution:

- In the back 2 wheels
    - We simply extended the sides of the drivetrain with pitch standoffs and attached a piece of cut plexiglass

        - This effectively stopped rings from getting underneath the wheels
- In the front 2 wheels
    - Since our free-spinning/supporting wheels are not as important, we decided to mainly protect the larger wheels that are run by motors
        - We did this by attaching a 1x5 strip onto the bottom of the robot

Solution thought about but not implemented:

- Something around the free spinning wheels but would risk getting beyond size limits.
- Something in the front free spinning wheels similar to the back but that would be too big of a structure.

Strengthening/fixing preload swinger:

Design Objective:

- We wanted to strengthen the platform on which the preload swinger rested as it was very shaky (see figure)
- We also noticed there was a spacing difference in the actual axle on which the swinger was on → this was bending the two ends in opposite directions when they were supposed to be parallel.

Solution:

- Strengthen:
    - The platform rested on three pitch standoffs which were not enough, so we added two more → this eliminated the swinger's shakiness
- Fix spacing:
    - We simply removed an extraneous spacer

Adjusting the placement of pneumatic air reservoirs:

Objective:

- We noticed that one of the air reservoirs was not placed as sturdily as the other. We wanted to make it equally as strong

Solution:

- We replicated our design that we used on the other air reservoir.

03/05/22 Meeting 33 - Vision Sensor, Fix Backlift malfunctioning

Attendees: Ayden, Orion, Risa, Rohan, Krishna

Quick Summary:

In this meeting, we reviewed Vision Sensors and designed ways to implement them on our robot. We also encountered a problem with our back lift malfunctioning.

DESIGN, BUILD

Vision Sensors:

- We needed to attach the vision sensor in both the front and the back of our robot.
    - This would help with our programming skills and autonomous

- We calibrated our vision sensors and will program with them in our next meetings.

Back clamp:

- We encountered a problem with our back clamp

Problem:
- Our double-acting pneumatics was firing very slowly

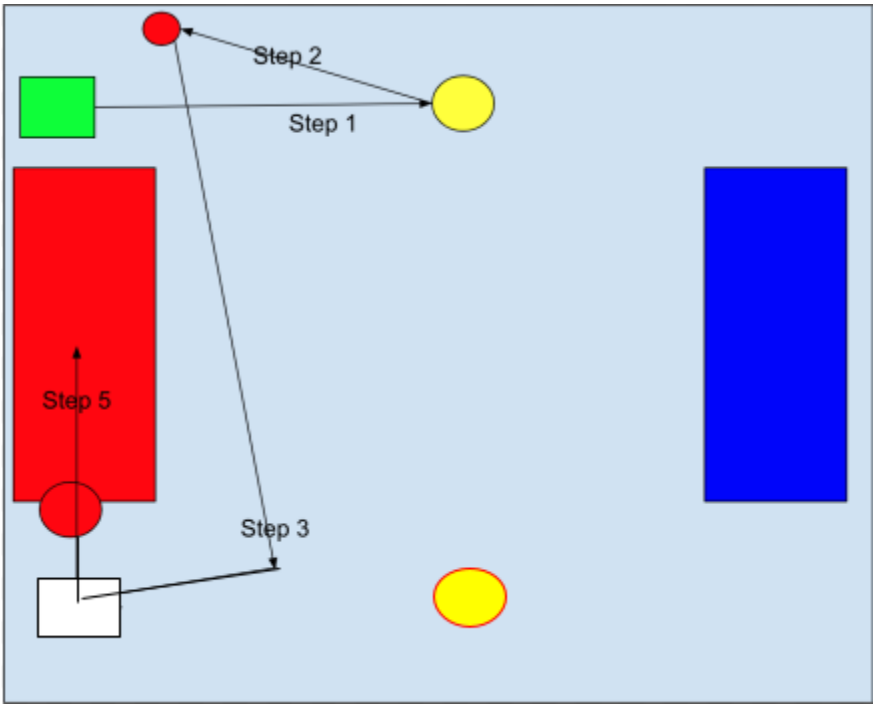
Solution:
- We need to test more to find a solution

03/12/22 - States Tournament

Attendees: Rohan, Orion, Krishna, Risa, Ayden

Quick Summary: In this tournament, we placed #7 in ranking and #3 for skills. We won the think award for our auton and programming skills. Our main alliance game our driving strategy during this tournament was the turtle strategy.

Turtle Strategy:



- Step 1: Pick up the neutral mobile goal in front of you in your front lift
- Step 2: Pick up the alliance home goal in your back lift
- Step 3: Drive to the other side of the field
- Step 4: Camp right outside the ramp until 30 seconds, protecting the 3 goals over there
- Step 5: Climb up the ramp while pushing the alliance home goal up with you so you park with 3 goals
- We would tell our alliance to secure 1 neutral goal and defend it.

Matches we won:

- In the 6 matches we won, we were able to follow the strategy
- We got the neutral goal in front of us during auton
- We grabbed the Alliance home goal on the right side
- We came around and camped the ramp
- We ramped on the platform, pushing another alliance home goal up

Matches we lost:

- In the 2 matches we lost, our auton got outsped
- 95070D, and 95070H both outspeeded our auton and got the neutral goal
- Because of this, we were only able to park with 2 goals
- The opposing team parked with 3, and we lost

Project Plan Update

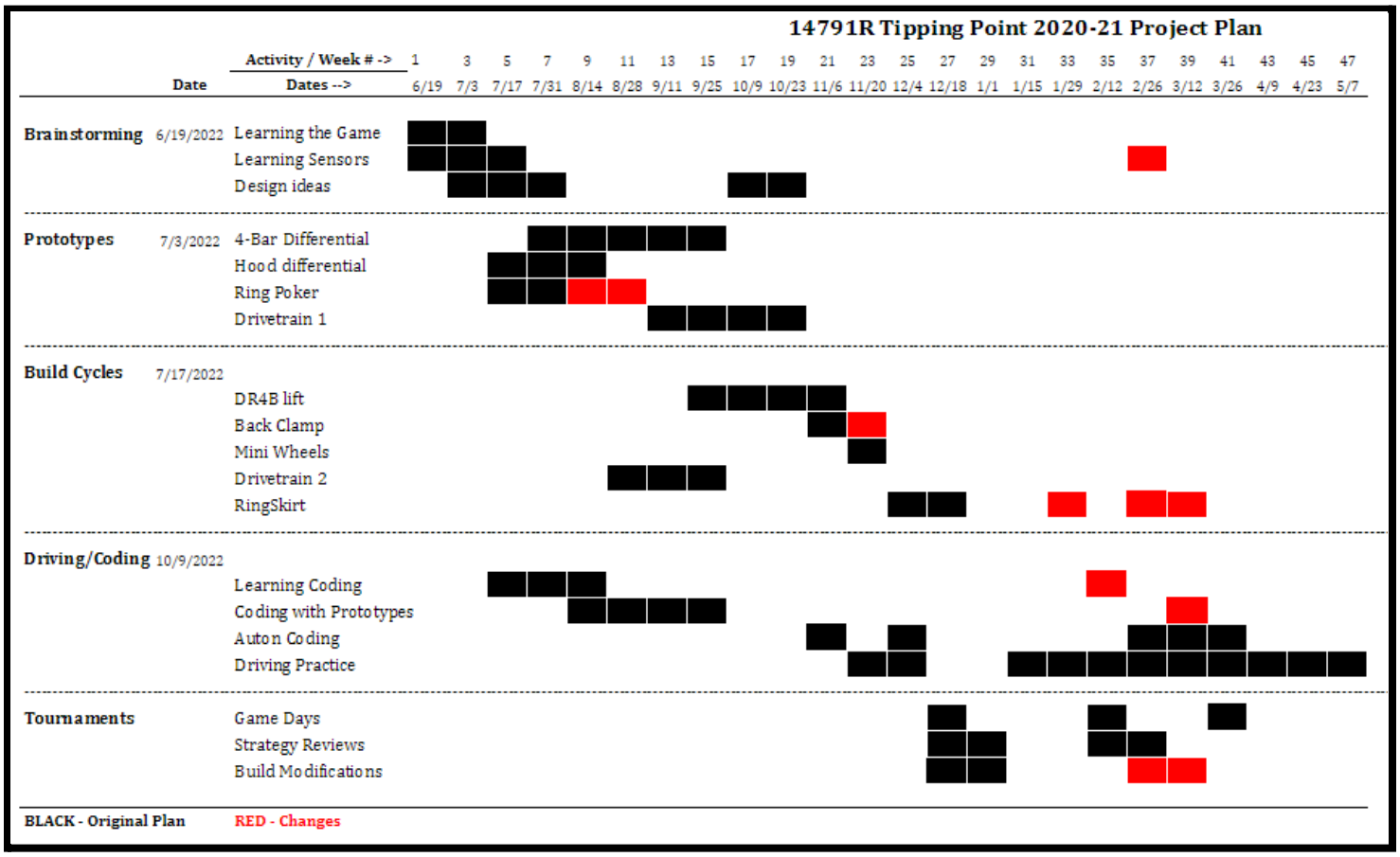


Fig: Project Plan Update

Designed by _____Witnessed by: _____ Date: _____

Programming code/explanations:

Autonomous:

Code:

```
// WORKING AUTON
drivetrain(128, 17);
drivetrain(100, 5);
delay(100);

//first neutral goal clamping and lift
fc.set_value(true);
delay(100);
fl.move(100);
delay(750);
fl.move(0);

//alliance goal backward
drivetrain(128, -30);
// WORKING AUTON
```

Drivetrain Method:

```
void drivetrain(int speed, double dist)
{
  double degrees = dist/wheelCircum*360; //150
  double curr_deg = lb.get_position(); //90
  double final_deg = curr_deg +degrees; //240
  int dir = 1;
  if (dist<0) {
    dir = -1;//true
  }
  lf.move(speed * dir);
  lm.move(speed * dir);
  lb.move(speed * dir);
  rf.move(-speed * dir);
  rm.move(-speed * dir);
  rb.move(-speed * dir);
  while((dir==1)?curr_deg<final_deg:curr_deg>final_deg)
  {
    curr_deg = lb.get_position();
    delay(100);
  }
  lf.move(0);
  lm.move(0);
  lb.move(0);
  rf.move(0);
  rm.move(0);
  rb.move(0);
}
```

Explanation:
Code walkthrough:
Our autonomous is very simple. We just want it to go forward, clamp down onto the goal in front of us, and bring it back into our home zone.

Drivetrain method explanation:

1. Find amount of degrees that we need to move (degrees of wheel)