Robot Design

**Choice:** Aluminium

Between the two metals we decided to use aluminium for most of the frame of the robot. This is because although it have the disadvantage of being expensive the advantages of being both strong and light outweighs this because for this challenge being able to expand upwards quickly is essentially and having a heavy robot would make this significantly harder.

**Pros:**

* Strong
* Cheap

**Cons:**

* Heavy

**Pros:**

* Strong
* Light

**Cons:**

* Expensive

For this robot due to the fact we are a high school team and not a university team (they can 3d print plastic) we are limited to using two different materials for this challenge, Steel and aluminium

### Steel

### Aluminium

## Material for chassis

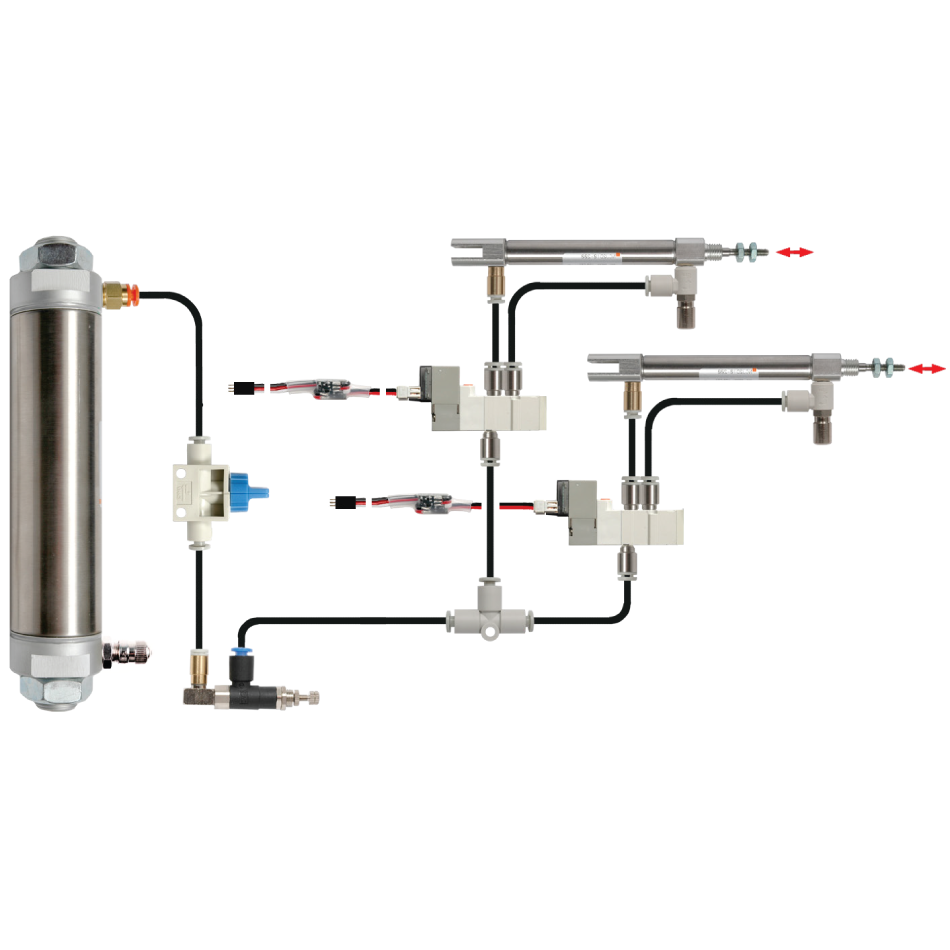
# General design considerations

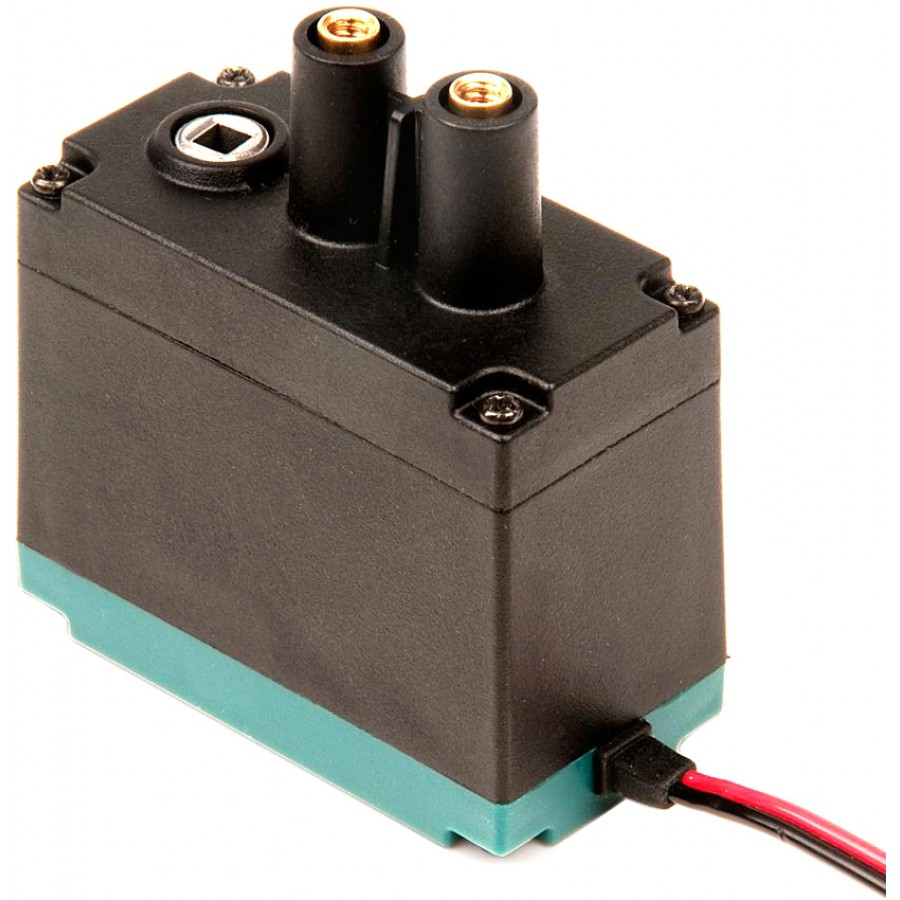
The design of a robot for this challenge can be broken down into three main sections. The drive, the lift and manipulator. The robot is lifted to only having one drive however it can have multiple lifts/manipulators if necessary. In this document, we will be going over the different sections of the robot and we evaluate the different designs we can use in each of these sections.

**Choice:** No Pneumatic

For this robot, we have the choice of using either twelve motors or 10 motors and a pneumatics system.

### Pneumatics





**Pros:**

* Linear motion
* Light

**Cons:**

* Expensive
* Must repump every match

Between the two choices we have decided to go for two extra motor over pneumatics. This is not because we think that using motors is better it is just that at this moment we do not feel the benefits of being light and having linear motion justify the high price tag that they currently have. If we do end up purchasing them in the future we will probably use them on our robot.

**Pros:**

* Stronger
* Cheap
* Reliable

**Cons:**

* Heavy
* Nonlinear motion

### No Pneumatics

## Pneumatics

When building a drive there are a few different wheel types to pick from. We want a wheel that has good traction but also allows smooth movement.

## Wheel type

# Drive design considerations

### Traction wheel

### Omni wheels





**Pros:**

* Cheap
* Reliable
* High traction
* No internal friction

**Cons:**

* 1 axis of movement

**Pros:**

* Cheap
* 2 axis of movement

**Cons:**

* Less traction

### Mecanum wheels

Between the three different wheels we have decided to use a mixture of omni wheels and traction wheels. Most likely two traction wheels at the front and two omni wheels at the back. The reason for this is that we can use the traction wheels at the front to get over the first bar into the 10-point zone and we can use the omni wheels at the back to have low friction turning. We are not using Mecanum wheels because they are inferior in every way to omni wheels.



**Choice:** Omni and traction wheels

**Pros:**

* 2 axis of movement

**Cons:**

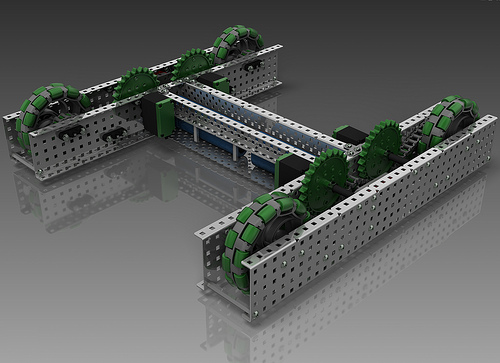
* Less traction
* Expensive
* High Internal friction
* Less grip

When building a drive there are a few different design types. For this robot we something fast but also strong.

## Drive Type

### X drive

### Tank drive



**Pros:**

* Any direction
* Fast
* Even number of motors

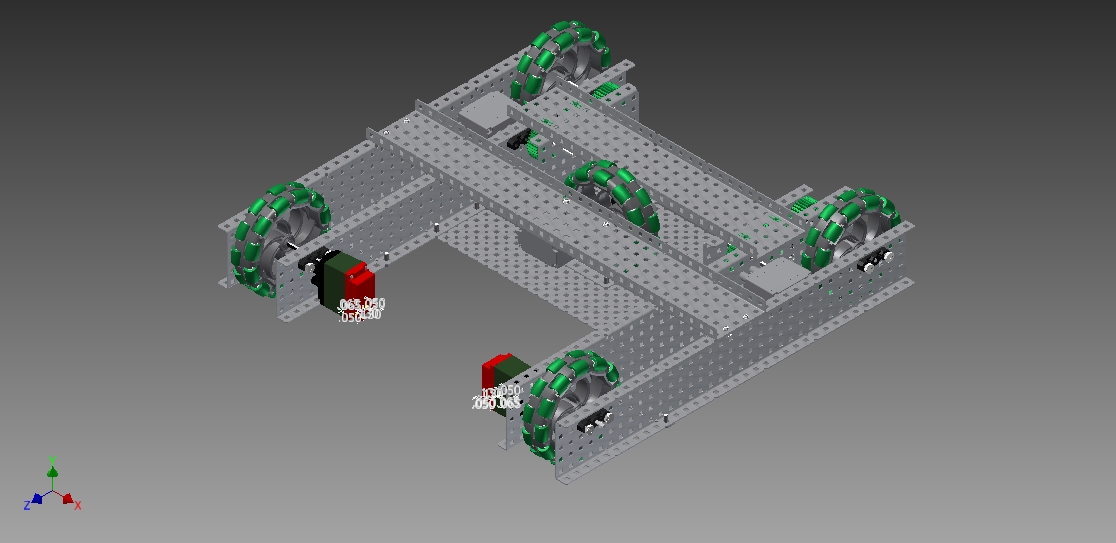
**Cons:**

* Weak
* Only multiple of 4 motors
* Complicated to build and program
* Bad at going over things

Between the three different drive types we have chosen to go with the simple tank drive. Although being able to strafe/move in any direction would be incredibly useful when picking up cones and mobile goals we feel that being able to go over the bar is more important and multidirectional drives will struggle with that because of the direction the wheels are facing.

**Choice:** Tank drive

### H drive

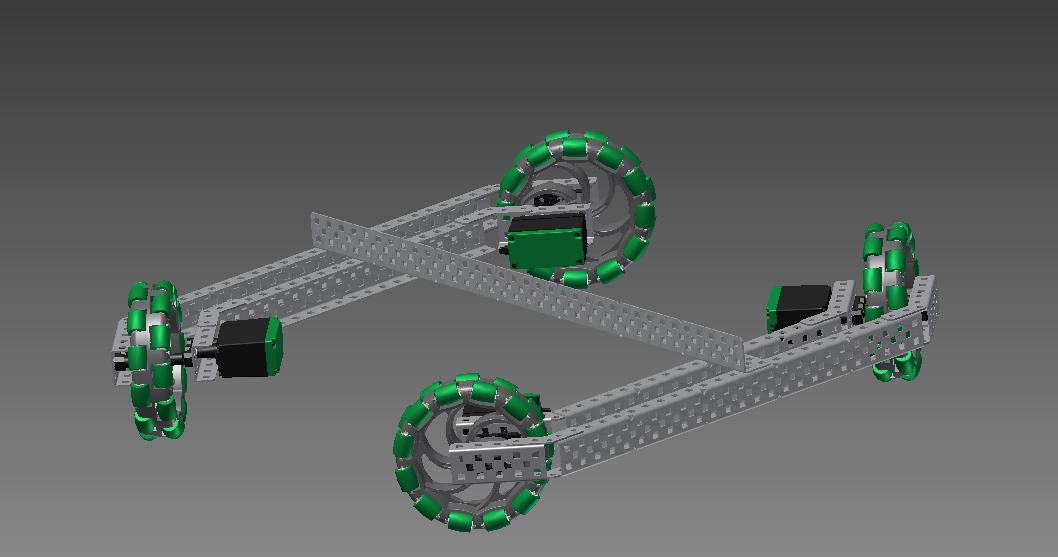


**Pros:**

* Strafe
* Any amount of motors
* Simple

**Cons:**

* Odd number of motors (usually)
* Bad at going over things



**Pros:**

* Simple
* Any motor amount (multiple of 2)

**Cons:**

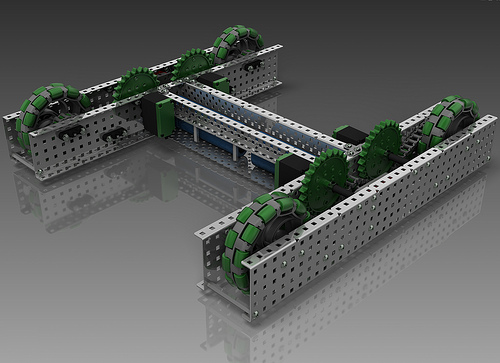
* No strafe

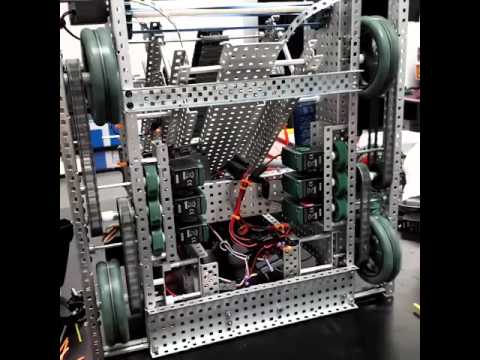
## Drive motor gearing and amount

Seeing as we have picked the tank drive we must decide how many and what type of motors we want to use.

### 6 high speed motors

### 4 standard motors





**Choice:** 6 motor high speed

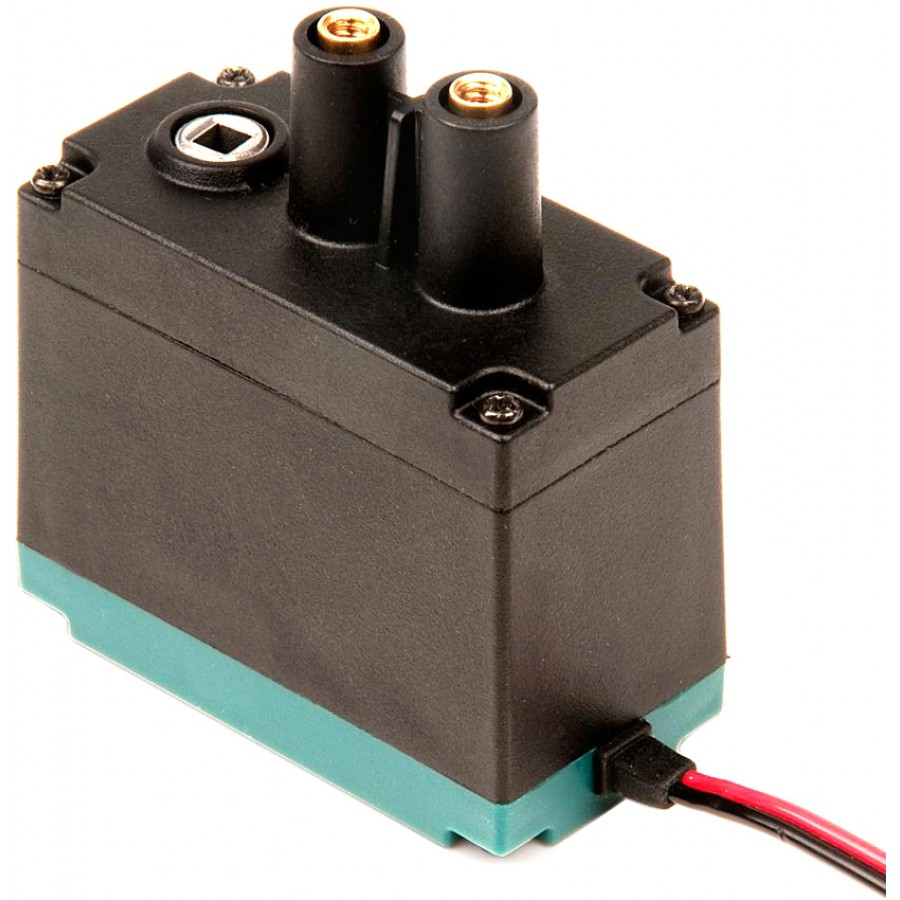
We have picked to use 6 high speed motors on our robot. This is because it is not going to be a self-stacker speed is important, however not important enough to justify using 8 motors.

**Pros:**

* Fast

**Cons:**

* 6 motors



### 8 turbo motors

**Pros:**

* Only 4 motors

**Cons:**

* Slow

**Pros:**

* Really fast

**Cons:**

* 8 motors

## Lift Type

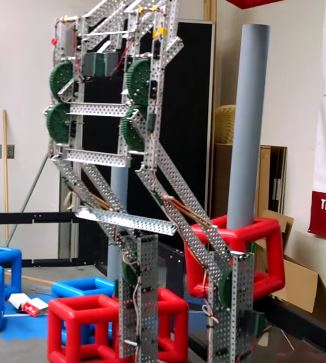
Now what we had picked the drive we must decide what type of lift we want to use. We want something fast and strong that going up in a linear fashion

# Lift design considerations

### Scissor Lift

### Double Reverse 4 Bar (DR4B)





**Pros:**

* Tall
* Vertical motion
* Static motors
* Fast

**Cons:**

* Unstable
* Uses a lot of parts

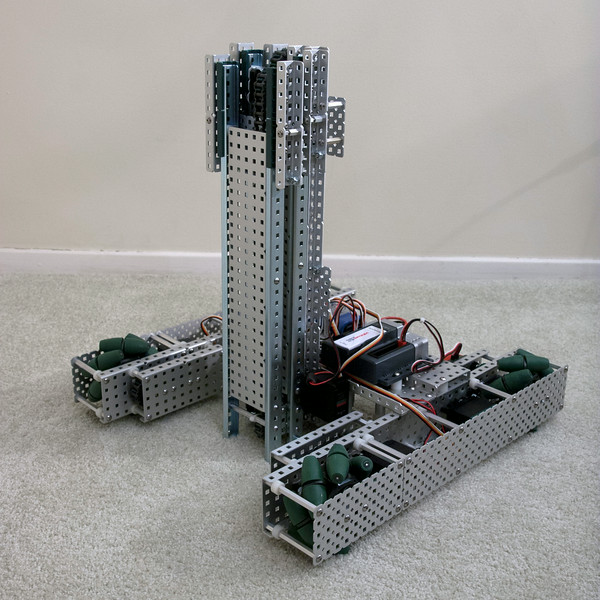
**Pros:**

* Tall
* Vertical motion
* Fast
* Low friction

**Cons:**

* Not static motors
* Can be flimsy

### Linear lift



Of the three option we think the two bests are the DR4B and the linear lift. This is because we do not have the parts to build a scissor lift. Between the Linear lift and DR4B we have decided to use the linear lift because it has less downsides and we don’t think the height of the DR4B will really matter in the early season.

**Pros:**

* Vertical motion
* Strong
* Static motors
* Stable
* Fast

**Cons:**

* Chain can snap

**Choice:** Linear lift

### 2 standard motors

**Pros:**

* Only 2 motors

**Cons:**

* Low lift strength

### 4 standard motors

**Pros:**

High lift strength

**Cons:**

* 4 motors

### 6 standard motors

**Pros:**

* Really high lift strength

**Cons:**

* 6 motors

We have picked 4 standard motors because we feel that 2 motors would not provide enough torque to lift the mobile goal and 6 motors would provide significantly more than we need and the chain would break at that point anyway making it redundant.

**Choice:** 4 standard motors

## Drive motor gearing and amount

Seeing as we have picked the tank drive we must decide how many and what type of motors we want to use.

We have to decide whether our robot will stack inside itself or outside itself.

## Internal vs External stacking

### External stacker

### Internal stacker

**Pros:**

* Simple
* Another robot can add to your stack

**Cons:**

* Complicated
* Inefficient
* Open to being blocked by other robots

**Pros:**

* Faster
* Does not need to move as much
* Protected

**Cons:**

* Complicated
* Other robots cannot add to your stack

We have picked to stack externally. This is not because we think it is better rather because a linear lift cannot internally stack without adding a rotating element which significantly makes the lift worse.

**Choice:** External Stacker

**Pros:**

* No motors
* No wires to claw

**Cons:**

* Can’t pick up mobile goals
* Unreliable
* Weak



**Choice:** Claw

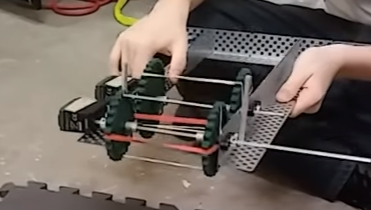
We have decided to pick the claw as it Is the only intake that pick up both mobile goals and cones and it is essential that robot can do that. Our next best choice would be the cylinder intake and we would use it if we had two separate lifts.

**Pros:**

* Simple
* Reliable

**Cons:**

* Can’t lift up mobile goal
* Uses two motors
* Wires down to claw



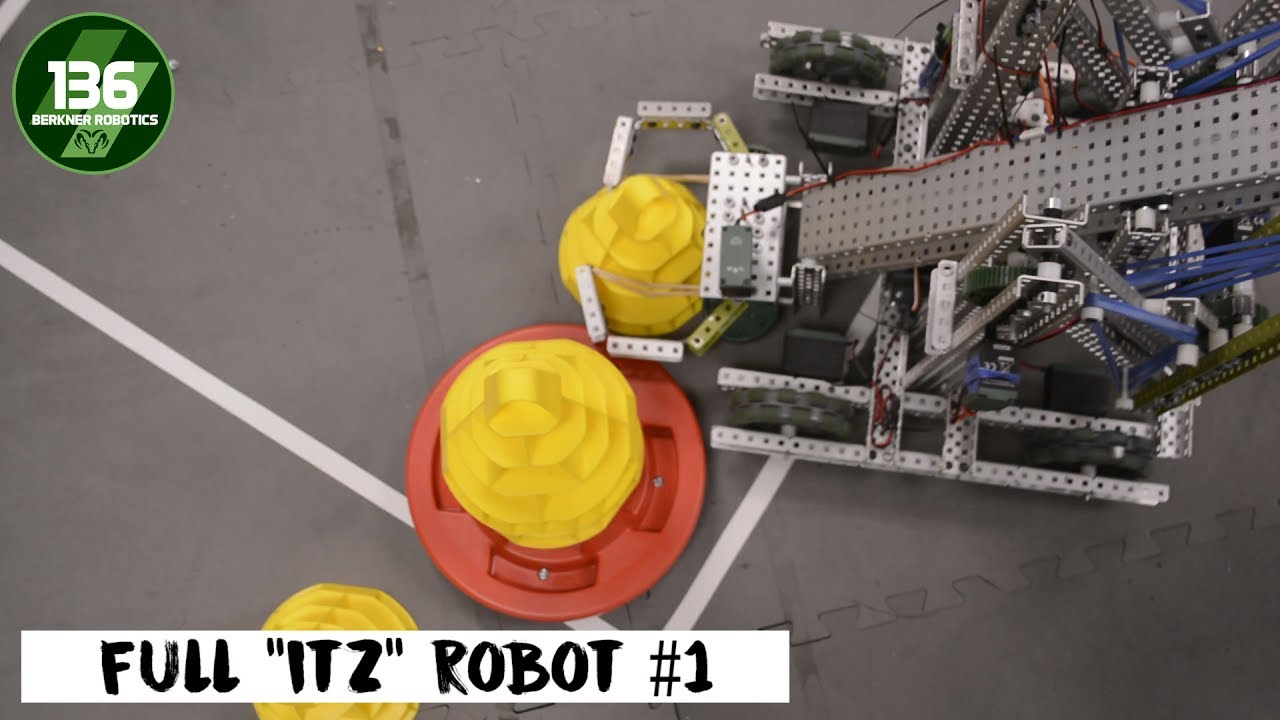
### Passive intake

**Pros:**

* Can have mobile goal manipulator added
* Strong
* Reliable

**Cons:**

* Uses two motors
* Wires down lift.



# Intake design considerations

## Intake Type

Now what we had picked the drive and lift we must decide what type of lift manipulator want to use. We want something strong and light that can lift both mobile goals and cones

### Claw

### Cylinder intake