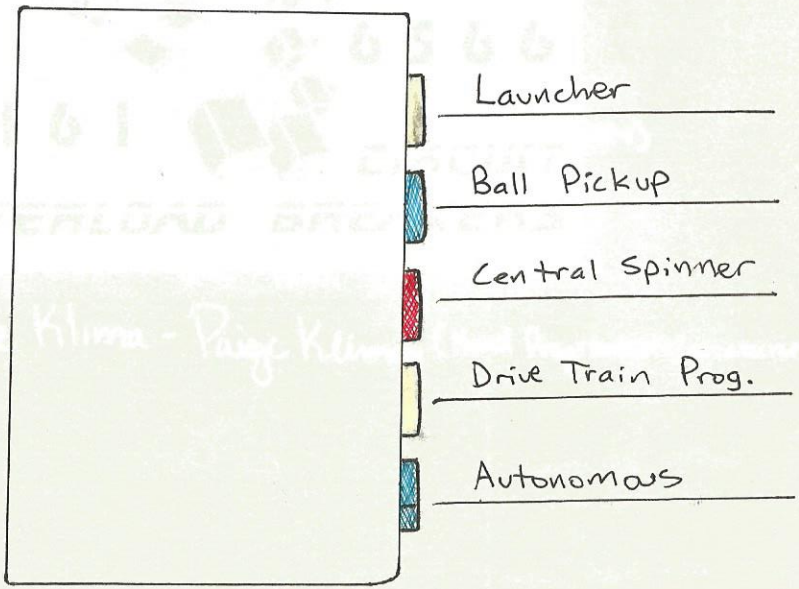
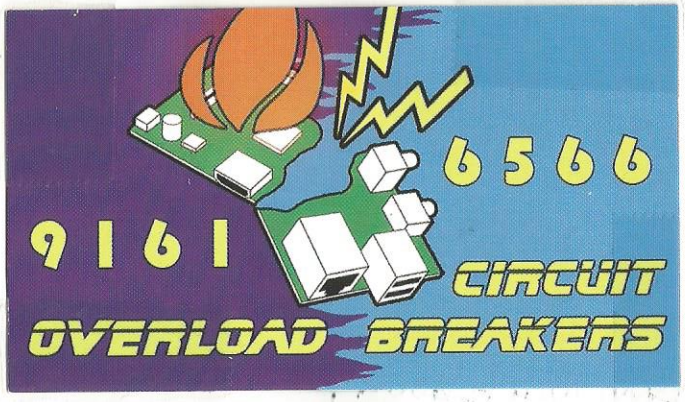
VELOCITY VORTEX 2016-2017

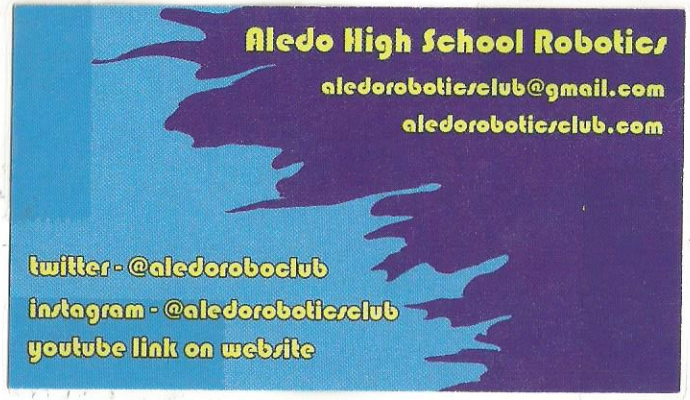
#6566

CIRCUIT BREAKERS

DESIGN NOTEBOOK/ OFFICER LOGS







TO HELP YOU (AND US) MANEUVER THROUGH THIS NOTEBOOK...

KEY

↻ = indicates a spinning part

↗ = (in any direction) indicates movement of part

↗ = (blue pen) indicates particle (ball) movement

⊏ = motor

[□ = possibility of being a c-channel

0 (HEBAH'S) = wheels, but Hebah draws them differently

★ ANY OTHER PARTS WILL BE LABELLED ★

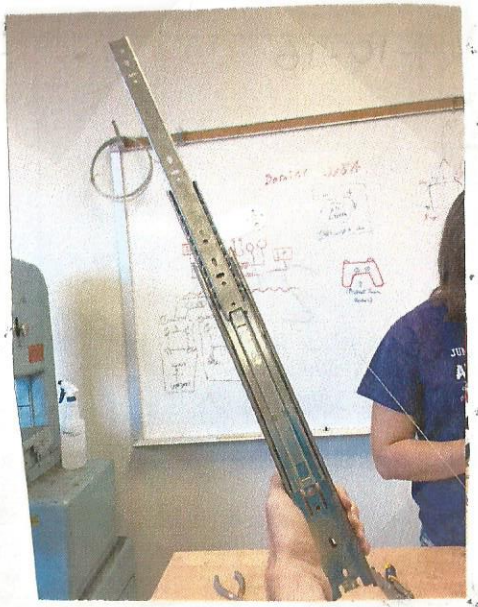
CONTRIBUTORS

HEBAH GODERYA - Hebah Goderya (SECRETARY)

Kevin Robb - Kevin Robb (President)

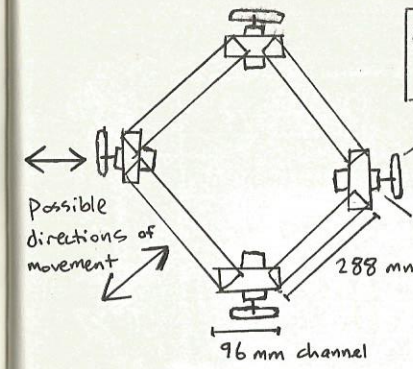
John Miller - John Miller (Head Engineer)

Paige Klima - Paige Klima (Head Programmer/Treasurer)



Kickoff

9-10-16

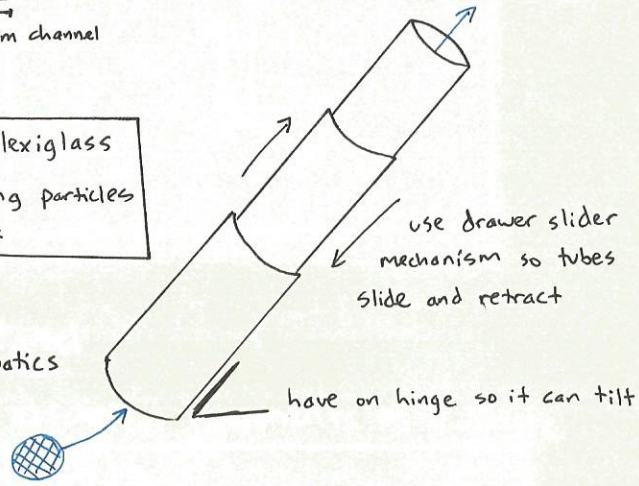


Omnidirectional Crabwalking Chassis design (idea)

LATER

The robot was named "The Demented Crab" based on the crawl like moving the drive train has.

Telescoping plexiglass tube for scoring particles in center vortex



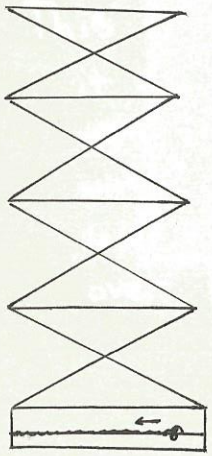
use drawer slider mechanism so tubes slide and retract

have on hinge so it can tilt

could use pneumatics to transit balls

↓

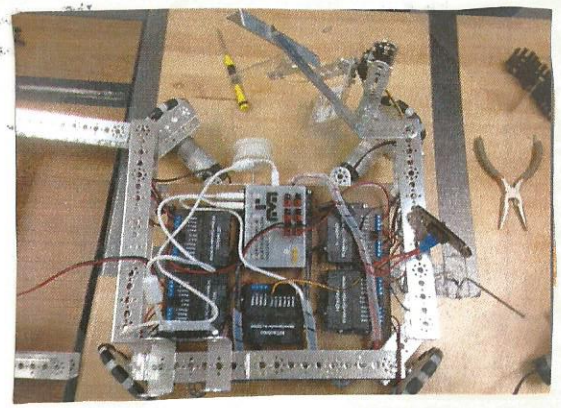
nevermind, no pneumatics allowed "

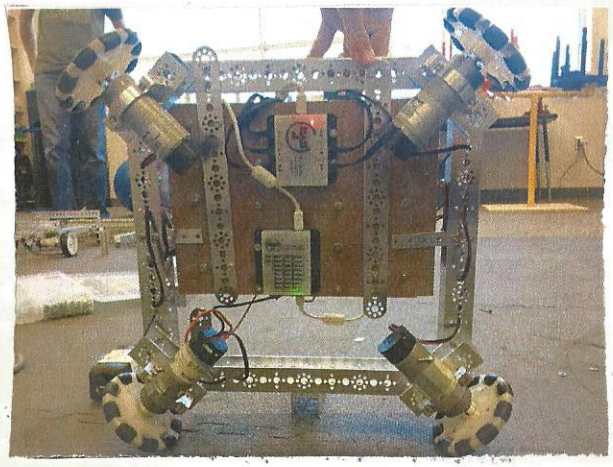


Consider utilizing scissor lift from cascade Effect to lift cap ball

IDEA!

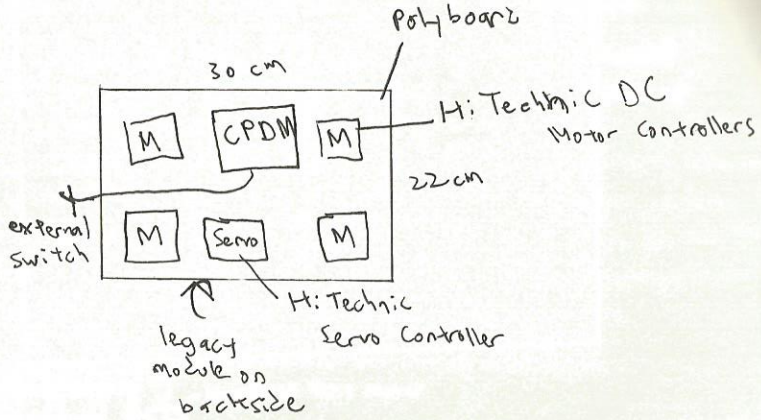
- Have a raised chassis with a lifted pickup mechanism in the center for the particles
- Can be like 2-3 in then load into shooter to save room for other structures.





10/5/16

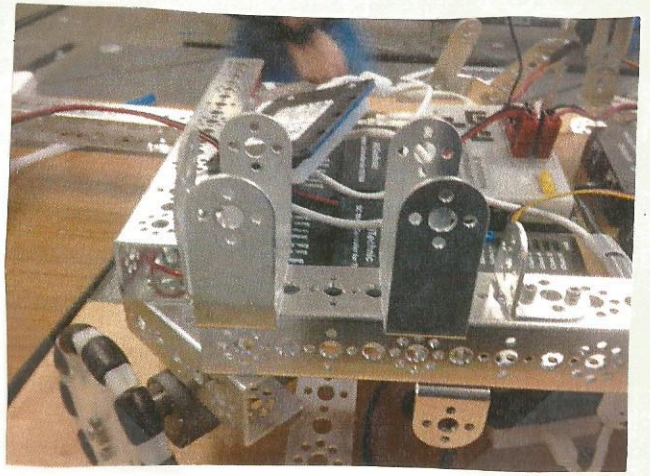
Wiring Panel



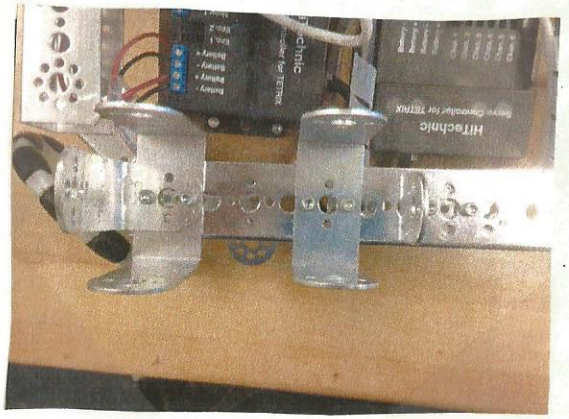
Wiring Panel

Put all electrical components on a single panel inset in the chassis in order to save space and simplify wiring.

This turned out to be more trouble than it was worth – we made the entire upper half of the robot removable for wiring access – and solved these issues later by simply flipping the board over. (see Wiring Panel Part 2)

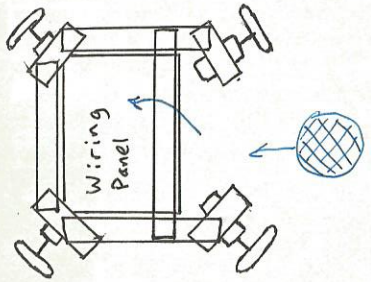


Battery Mount



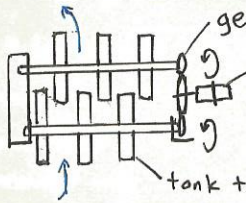
Ball Pickup

11-9-16

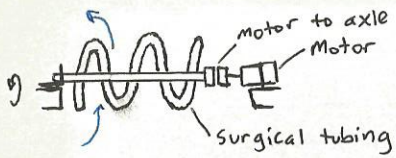


- removed 1 of side C-channels to open up side for ball pickup
- abandoned idea of having pickup in center; lowered chassis
- added structural bar (c-channel) across top of chassis to make up for gap on side

Ladder

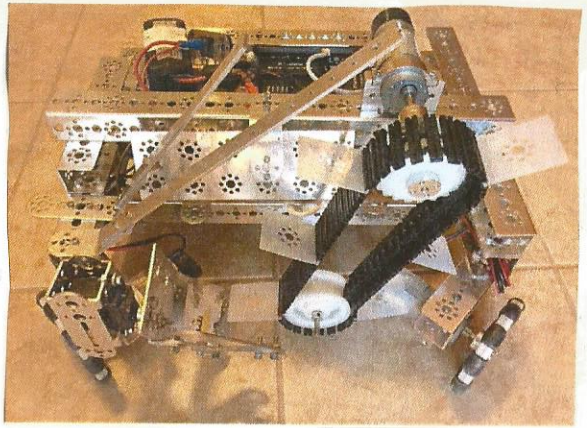


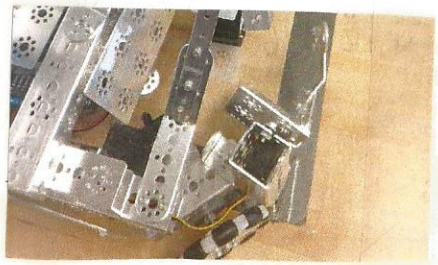
Issue: not enough room for balls in between "ladder" and wiring panel

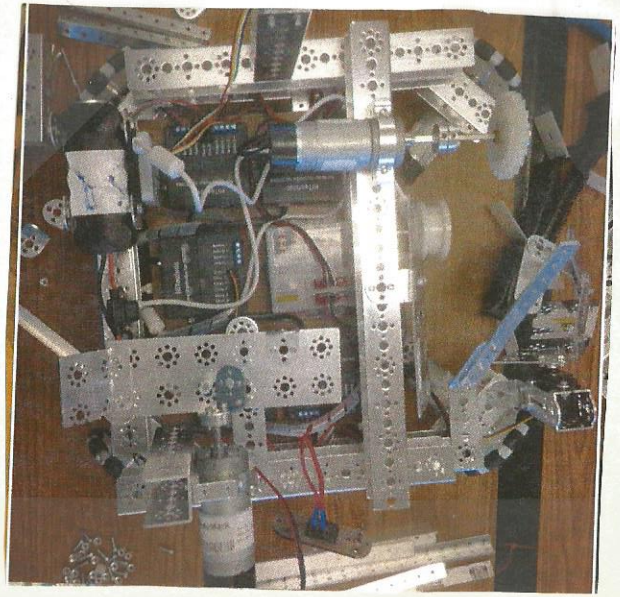


Single Spinner

Issue: same problem, still not enough room for balls; may need to move wiring panel





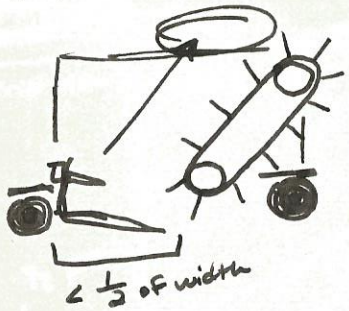


11-21-16

Ball Pickup (Part 2!)

GUYS, WE HAVE A PROBLEM...

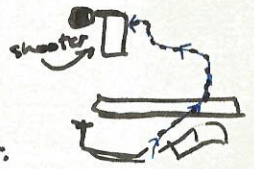
★THE BALL LIFT IS INEFFICIENT...



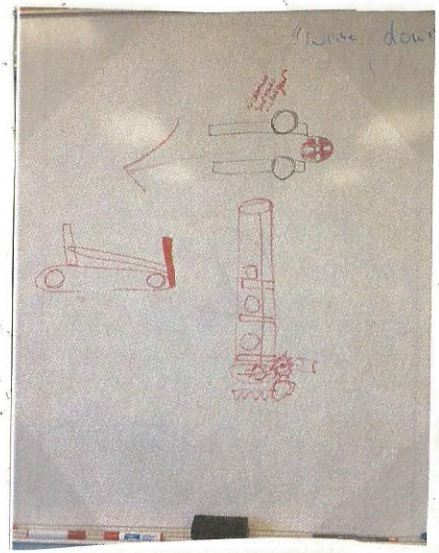
- Area is small so probability of picking up balls is lowered
- Treads (Elev-gate-or) slam down on the motor which causes an unstable drive train and will slowly destroy our motor over time.

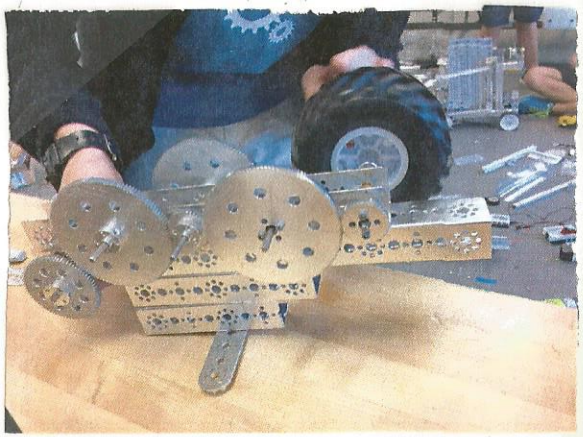
- In order to get to the shooting point the particle would need to travel up through the elev-gator and across the robot to the shooter.

★aerial view



(IT'S VERY LONG...)



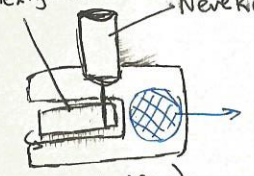


Launcher

11-26-16

piece of cut plexiglass tube

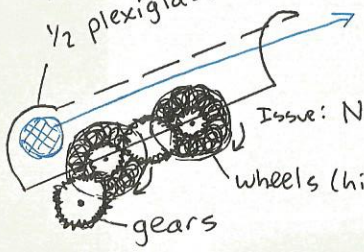
NeveRest 60:1 gearmotor



(aerial view)

Issue: not enough torque

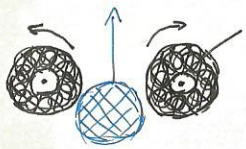
½ plexiglass tube



Issue: Not enough speed to reach vortex

wheels (high friction)

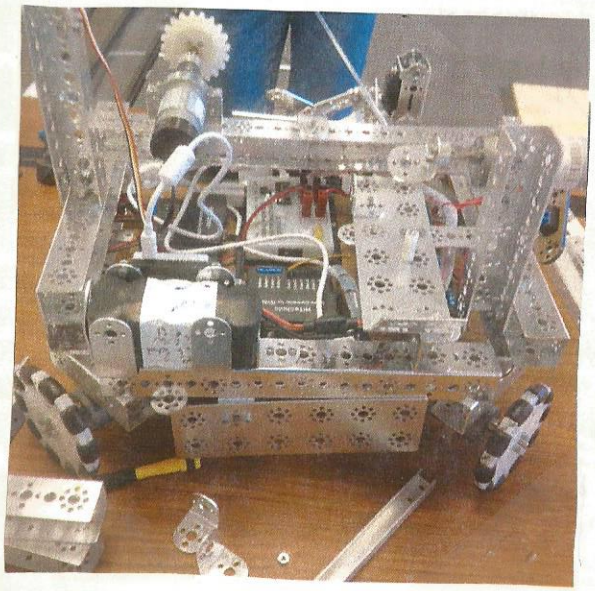
gears

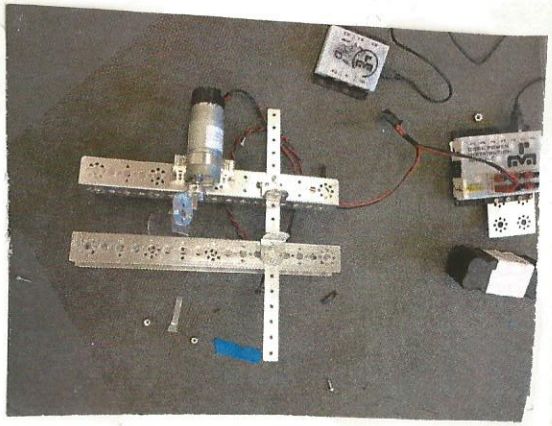


high friction wheels

Issue: wheels can't spin fast enough; consider ordering Neverest 4:1 gearmotors

None of the designs we have tried have been able to shoot the balls high enough; we will revisit our first design w/ different materials.

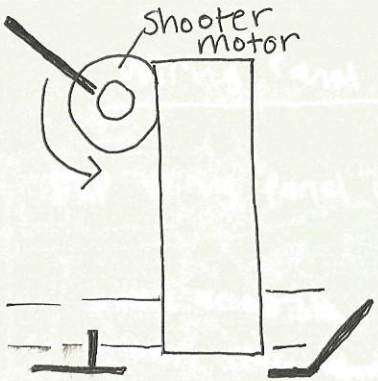


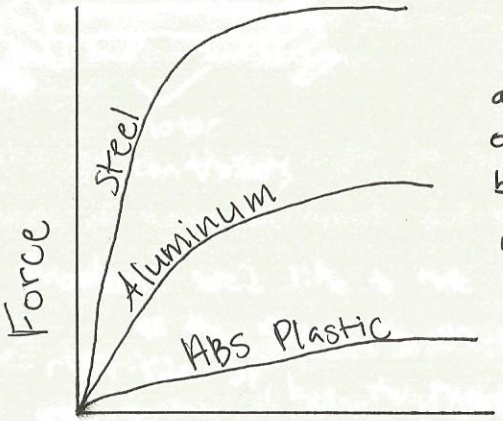


Original version of this launcher design from 11-26-16

Launcher Part 2

12-6-16





The steel reforms and takes a lot of force (many uses) before it will maintain its bent shape and we need to reverse or replace it.

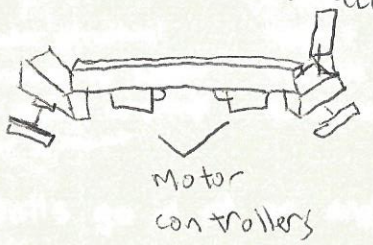
We decided to use spring steel to maximise torque on the ball to more accurately shoot the ball.

12/7/16

Wiring Panel Part 2

Flip wiring panel over, do wiring from beneath

- more accessible
- more space above for lift & shooter
- top half of bot doesn't need to be removed to access wiring

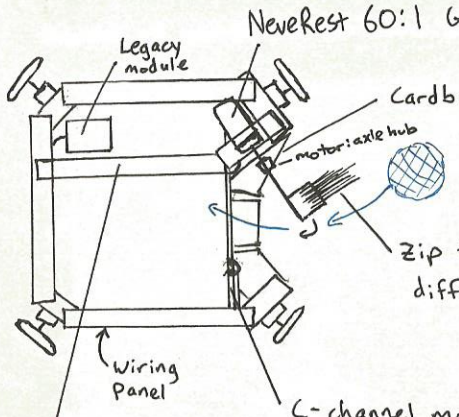


Problem: We'd like to make wiring panel all the way to the ground & keep it right-side-up, but the motors are in the way due to the chassis design and the panel cannot be lowered any further. Hopefully, it is now low enough for an efficient ball lift.

It turned out to be a good thing we moved the wiring upside-down so we can access it from beneath (see "Infrastructure" 12-29-16)

Ball Pickup Part 3

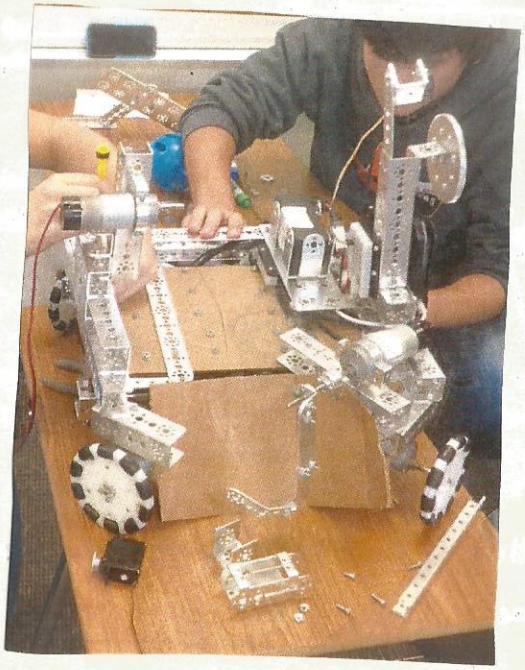
12-8-16



Balls go in at an angle to sidestep issue of lack of space in front due to wiring panel.

Added bonus: ramp pieces and short c-channels put in help further to keep the chassis together. Previously, we had the problem of this side continually & gradually widening.

Need to determine where launcher will go and how to get the balls there from the pickup.

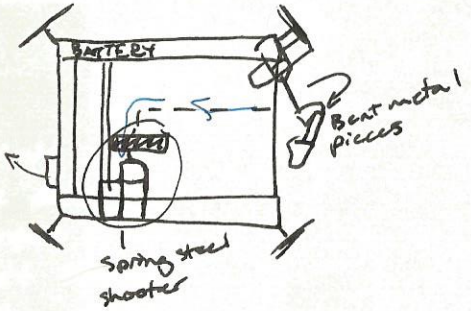


BALL PICKUP PART 4

12-12-16

RAMP IS MADE, STEP TWO: GET IT TO THE SHOOTER.

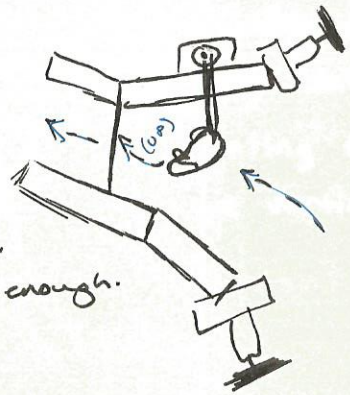
AERIAL VIEW



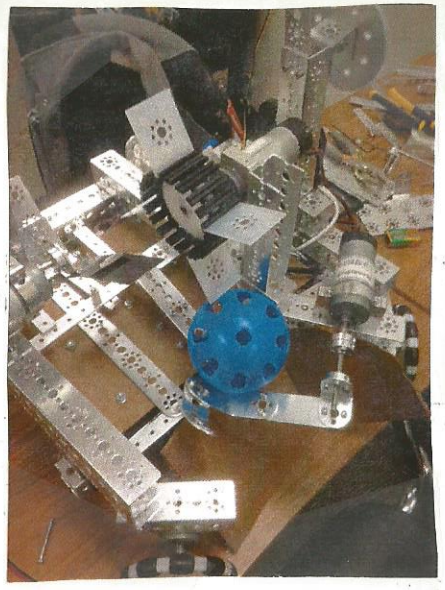
SOLUTION:

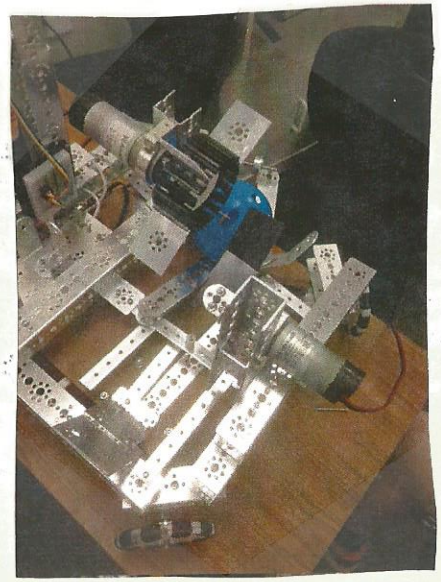
- ADD A CONVEYOR IN THE MIDDLE TO HELP THE PARTICLES ALONG THE RAMP.

LIFT VIEW



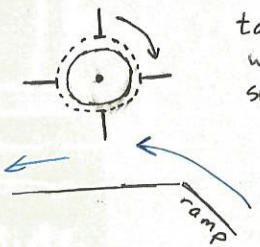
The Lift swipes up giving the ball some momentum, but not enough.





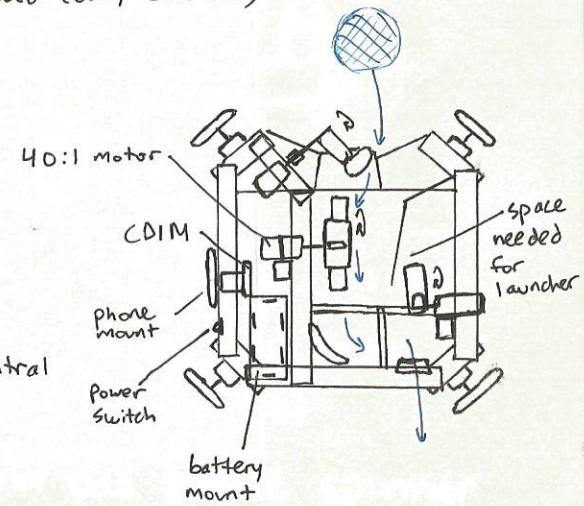
Central Spinner / Ball Track

12-13-16

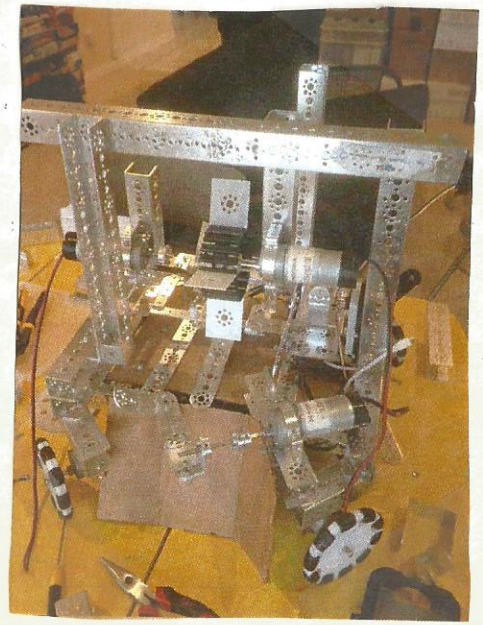


tank treads w/ tabs evenly spaced (every 5th tab)

Would work, except the chassis is too compact & the balls don't fit through central area.

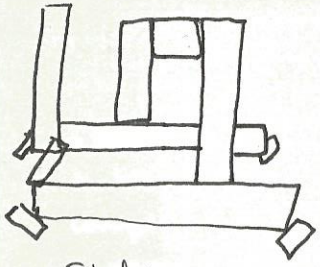


Height of opening is fine, but the horizontal gap needs to be widened; can potentially solve by removing center structural C-channel and re-mounting the central spinner motor on side vertical channel.

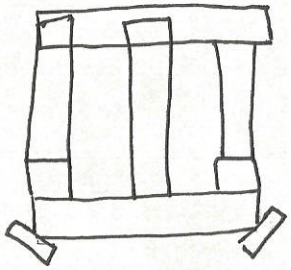


Infrastructure

12-29-16

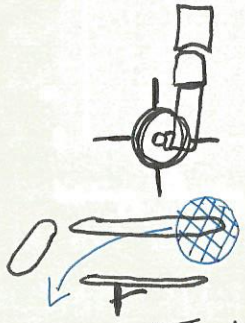


Side



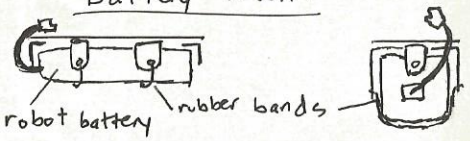
Back

- Added 3 vertical C-channel with a crossbar between forward two (serves as a carrying handle)
- Mounted central ball chute spinner motor from crossbar.
- Reworked central structuring to allow ball's passage
- Allows entire robot to be flipped upside down for easy access to wiring and for tightening drive motors.

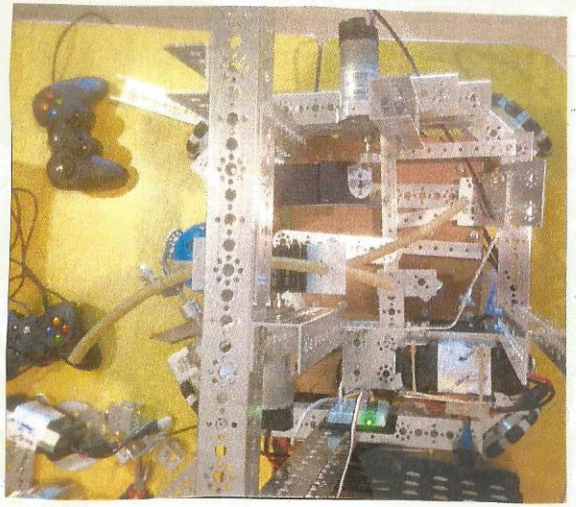


Internal

Battery Mount



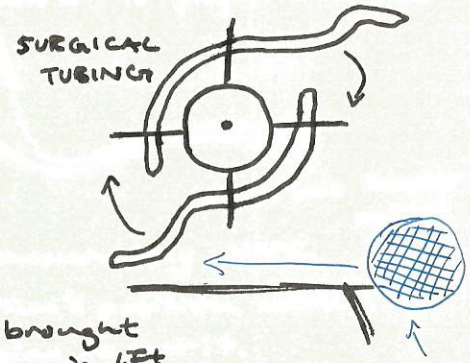
- Rubber bands keep battery from falling when robot is flipped over for wiring



1/2/17

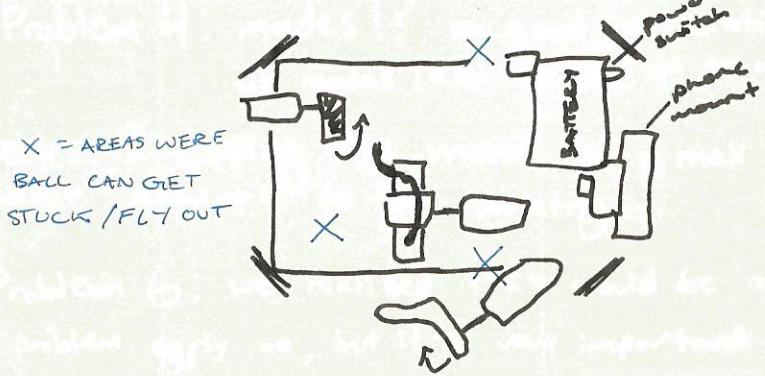
CENTRAL SPINNER PART 2

- Friction on surgical tubing as well as its compliancy make it a very good choice for our ball spinner / conveyor.



*Ball is brought here by main lift and rests until surgical tubing quickly brings it forward and it is fed into the launcher area

OH NO GUYS WE HAVE A PROBLEM!!!



- Need to add more panels/structuring to prevent ball falling off course or being flung out of robot.

Motor Encoders

1-3-17

Problem 1: We have a split-end connector, so it took us SO LONG to plug it into the motor controller.

(plugged into launcher motor)

Problem 2:
How do we measure accurately, NAY, exactly one full rotation's position value?!
Just guessing isn't going to cut it.

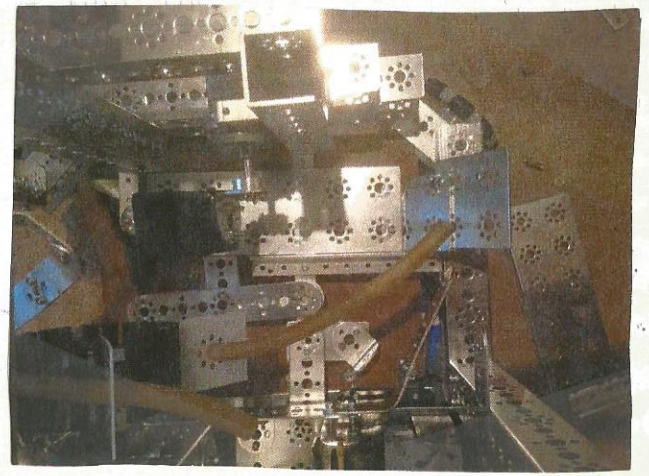
Problem 3: It's as if the motor can't update fast enough to send the info to the code to stop it in the right place.

Problem 4: modes!? no good w/ iterative op modes (a.k.a. the kind we are using)

Problem 5: capping the motor at a max value appears to do nothing...

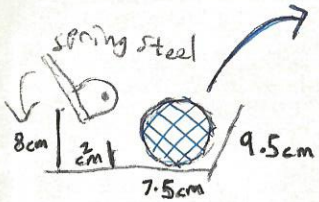
Problem 6: we realized this would be a problem early on, but it's very important that our launcher does not go backwards, so we have to have the code reset the runtime & encoder position on each rotation, which causes it to steadily mess up (would be fine if not for problem #2...)

Solution: HAH, yeah right, we're sticking to good ol' timing... See ya never motor encoders!



Launcher Part 3

1/3/17

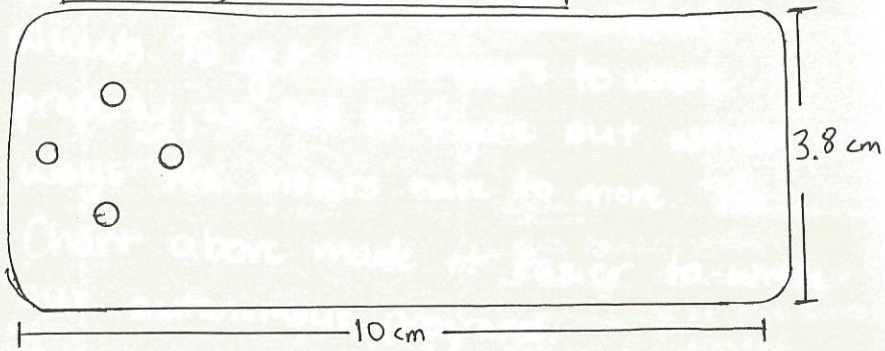


Successful launch from 53" (from center pole)

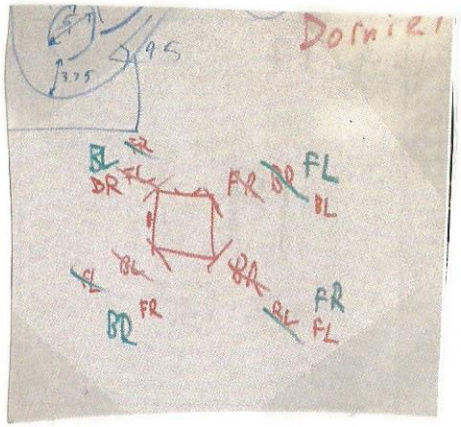
Problem: frame bends slightly after each use, lowering elevation of ramp

Solution: add support

Spring Steel Launcher



Attaches to Launcher motor via L-bracket to axle: motor hub to 60:1 gearmotor



I know what this means.

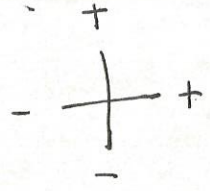
-John

Drive Train Programming Simplification

1-9-17

Direction

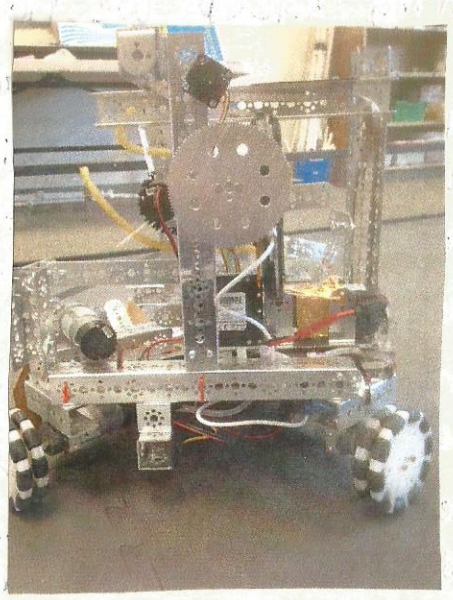
Motor	Forward	Backward	Right	Left
BL	.5	-.5	-.5	.5
BR	-.5	.5	-.5	.5
FL	.5	-.5	.5	-.5
FR	-.5	.5	.5	-.5



By default, "forward" is the ball pickup side, but we included modes that change the "front" to the shooter or the beacon presser side. (see whiteboard ponderings on left)

During TeleOp we have a formula to power each motor so we are able to work the omnidirectional wheels. To get the motors to work properly, we had to figure out which ways the motors have to move. The chart above made it easier to write our autonomous programs.

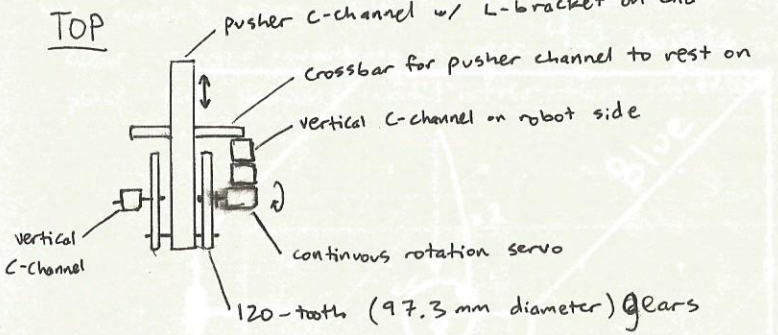
The diagram on the Left page was used so we ~~were~~ could change the front of the robot. Being able to change the front makes the robot easier to drive.



Beacon Presser

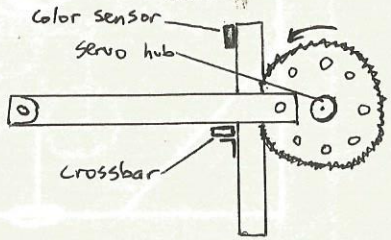
1-10-17

TOP

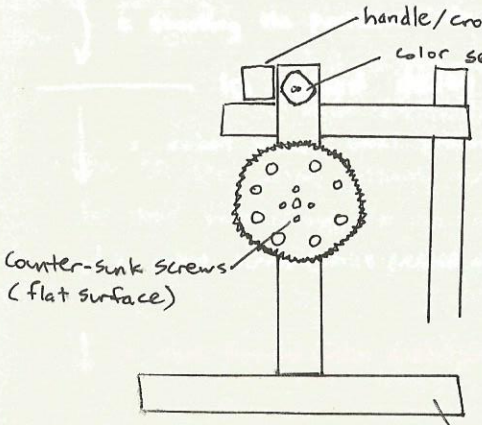


SIDE

Issue: very complex, still not very good at pressing the beacon → needs to be faster or straighter



Solution? → will go back to original idea but w/ more structural support from new frame



RESULT:

WORKS REALLY WELL!

The design is stable and the probability of the beacon being hit is increased.

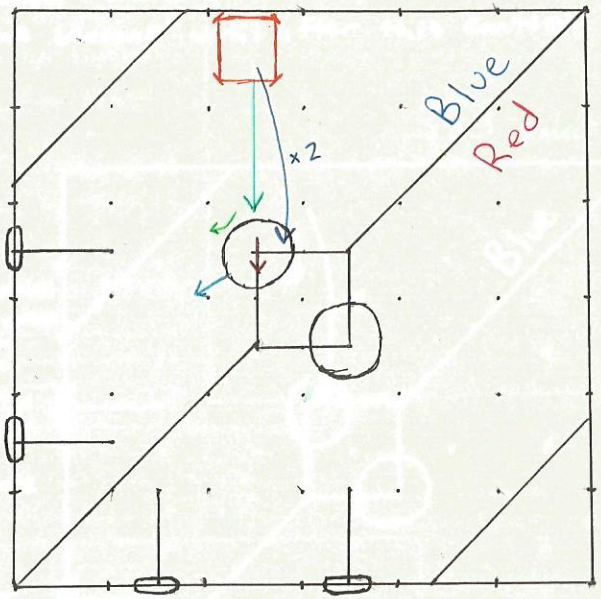
BONUS:

Its better at hitting the beacons than structures that aren't attatched to the robots.

Autonomous

1-11-17

40 points



= our robot (orange because our robot is the demented crab)

= shooting the particles into the center vortex

10 second delay for ally movement

= robot moves until pressing up against yoga ball

= robot turns (while pressed against ball) to push it out of way

= move forward (after dislodging ball) to partially park on center

= path of yoga ball as robot parks on center

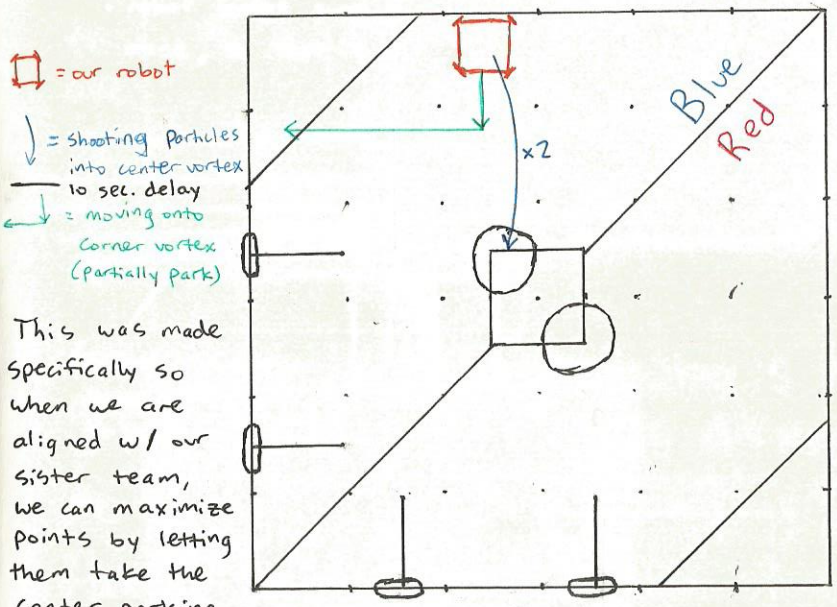
There is also a version which just shoots w/o moving if necessary.

Autonomous Part 2

1-12-17

We haven't been able to get more than one color sensor working at once, so we are forgetting about the beacons until after this contest!

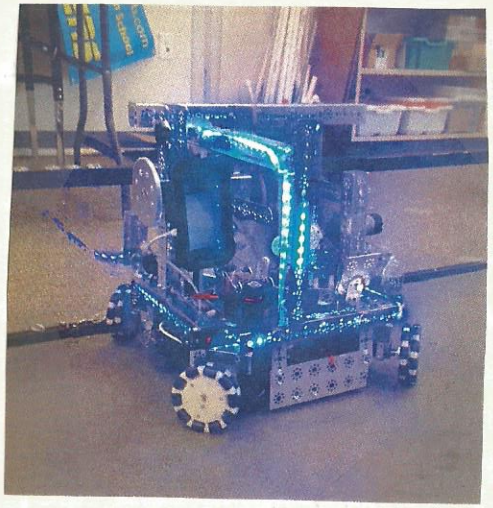
35 points

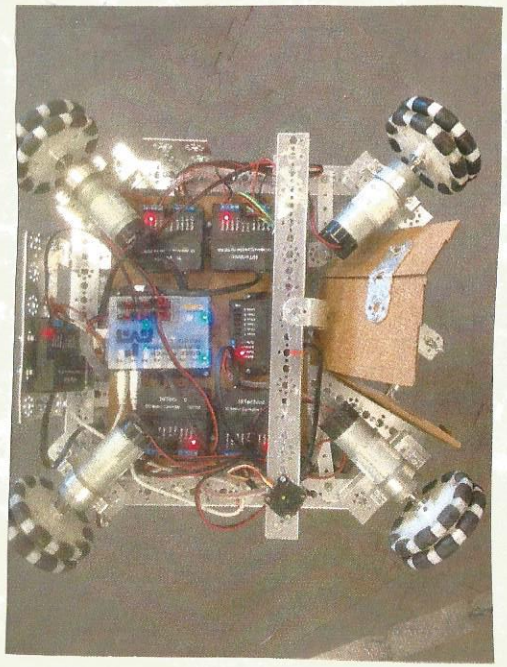


This was made specifically so when we are aligned w/ our sister team, we can maximize points by letting them take the center parking spot.

- All autonomous programs are duplicated and reflected for the red side

- The 10 sec. delay allows our alliance partner to move for their autonomous so we aren't in the way (& vice-versa)

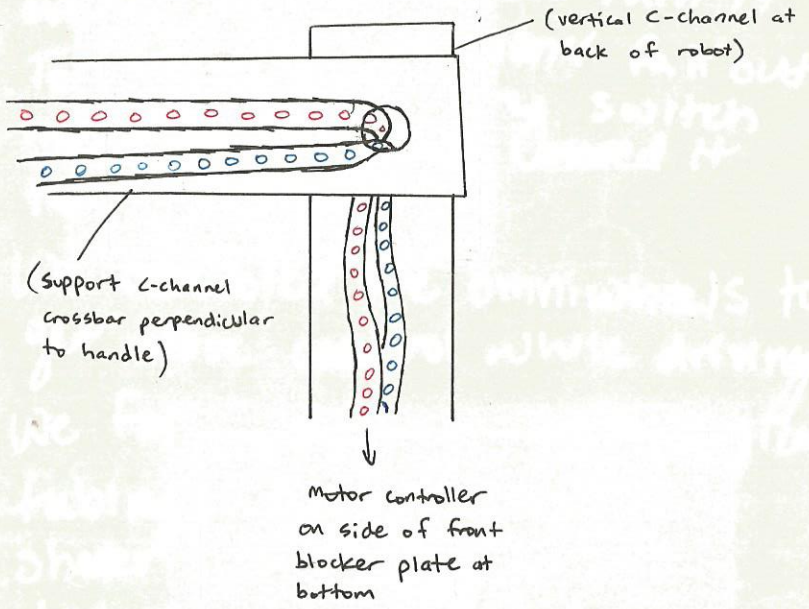




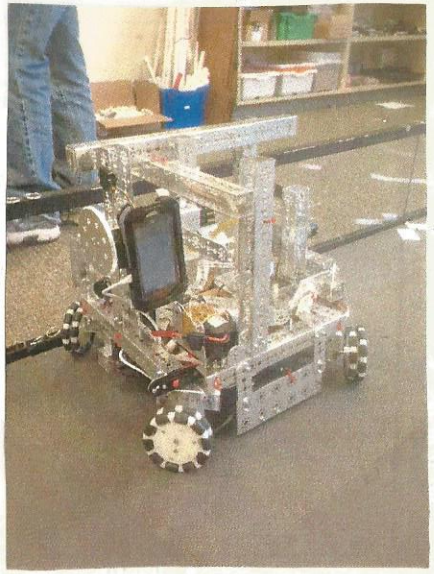
LEDs / Wiring Panel Part 3

1-17-17

- funnelled strips of blue & red LEDs through the main structural C-channels
- added another HiTechnic motor controller to hook up lights so we can use them in the code (on left in bottom picture)
- robot looks purple when both strips are on at once, so that is our default mode



- Also redid wiring throughout robot to simplify & clean up
- ran all wires through inside of chassis C-channels (no more loose/hanging wires)
- Zip-tied all loose points of wires or LED strips



Infrastructure Part 2

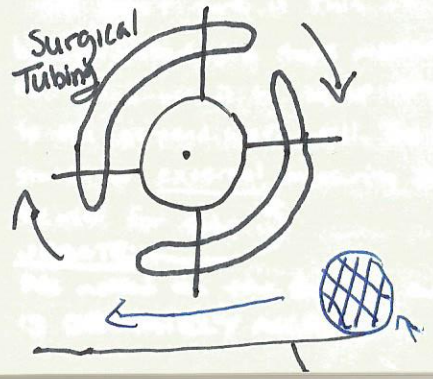
1-18-17

We moved the phone mount to be in a more structurely sound case.

We also changed the battery mount by adding rubber bands to the top so when we turn it over, the battery won't fall out. To make the battery switch more accessible, we moved it to the front.

We doubled the omniwheels to get more control while driving.

We found out that the surgical tubing was affecting the shooter, so we shortened the tubing, so it will still be able to move the particle to the shooter.



Autonomous Part 3

1-24-17

- we still can't use >1 color sensor at once
- we can't get motor encoders to work
- we decided to use timing & 1 color sensor & hope for the best (1 sensor → no using white floor line)

= our robot

= shooting particles into center vortex (no delay)

= move diagonally to 1st beacon (timed)

or = use color sensor to pick a side and press 1st beacon

= move backwards until the sensor sees any color (i.e. 2nd beacon)

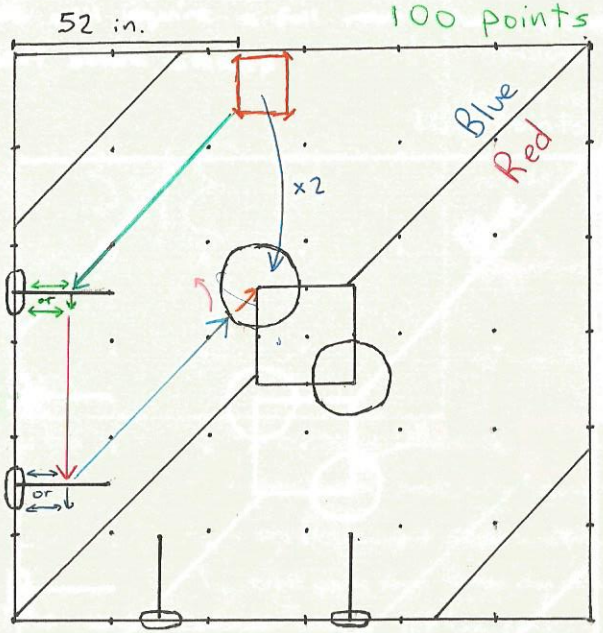
(oh, the "front" of the robot (as we call it in code) starts facing wall)

or = use color sensor to pick a side & press 2nd beacon

= move diagonally until pressed against ball

= turn robot to dislodge yoga ball

= move diagonally & partially park on center



This autonomous path isn't too difficult thanks to our omnidirectional chassis & our improvements to the beacon presser!

We aren't sure if this is allowed, but we attached a tape measure to our bot & use it to setup using distance to the perpendicular wall. The rules state no external measuring devices may be used for setup...

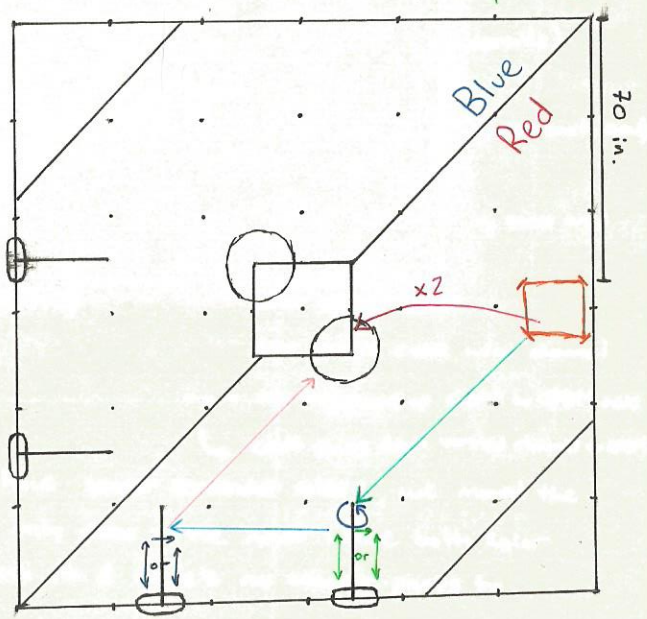
UPDATE:
We asked on the forums and it IS DEFINITELY ALLOWED!

Autonomous Part 4

1-26-17

- We realized that we can't simply reflect our 3rd (100 point) autonomous program onto the red side, because our color sensor and beacon presser are on the left of our robot, while the launcher is on the back.
- The red side will require a full robot turn-around at some point before beacons

100 points



□ = our robot (starts w/ "front" against wall)

← = shooting particles into center vortex

↙ = move diagonally to 1st beacon (timed)

↻ = robot does full 180° rotation (so color sensor is facing beacon)

↕ or ↔ = use color sensor to pick a side & press 1st beacon

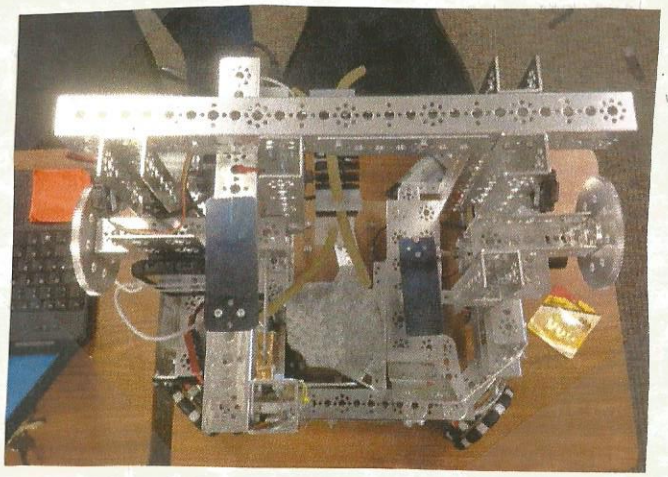
← = move forwards until the sensor sees a color (i.e. the 2nd beacon)

↕ or ↔ = use color sensor to pick a side & press 2nd beacon

↗ = move diagonally (back-right) to center, pushing off Yoga ball & partially parking on center

We are considering adding a version of this autonomous where the robot, after pressing the 2nd beacon, will simply move away from the wall, & go straight backward all the way to park on corner vortex (partially).

This is in case our alliance partner wants to take the center parking spot, we can maximize points.

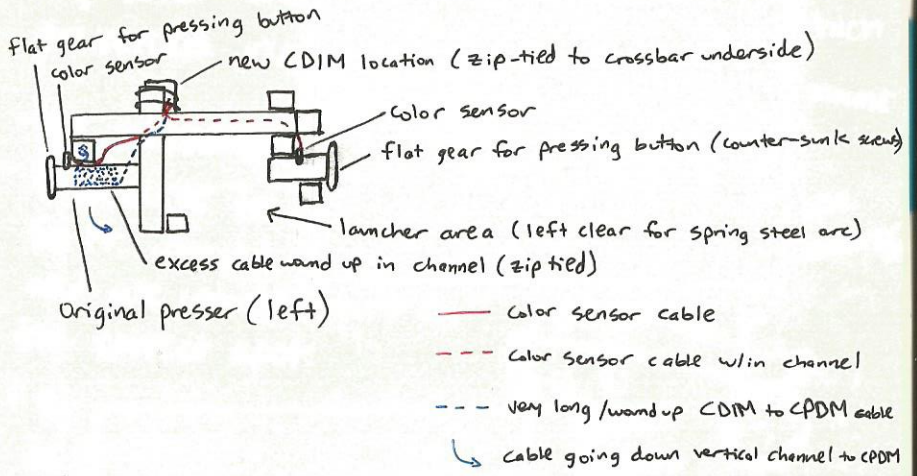


Beacon Presser Part 2

1-30-17

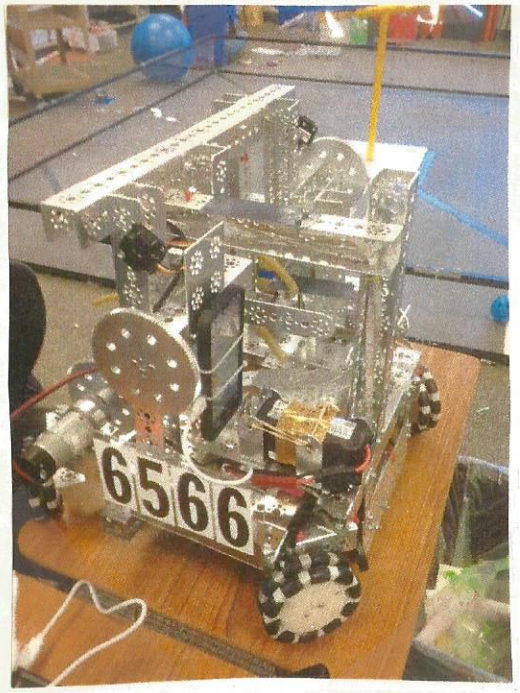
- We are having trouble w/ our Red side full autonomous b/c since the color sensor / beacon presser is on the left (which works great for Blue), in Red auton the robot must do a full 180° turn in b/w shooting & beacon pressing

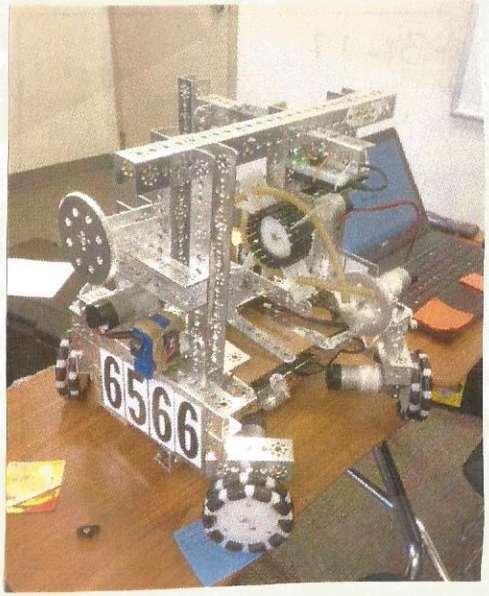
Solution: mirror onto right side & use 2 color sensors (which we think we finally figured out how to do!)



- Since we don't have sensor extender cables, we moved the CDIM to the only place on the robot where both color sensors can reach it & there's no moving parts to endanger it

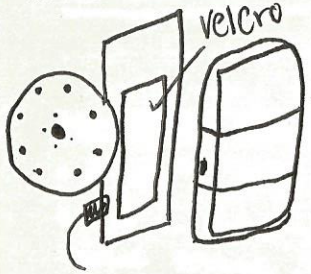
We are experimenting w/ an optical distance sensor on each side for detecting distance to the wall. Range sensors may be preferable but we don't have any so...



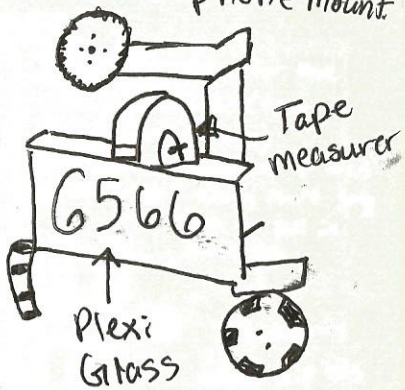


Infrastructure Part 3

1-31-17

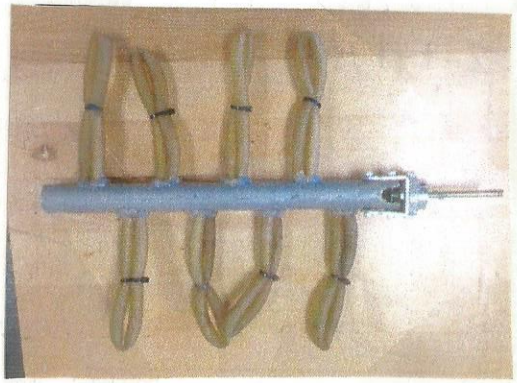


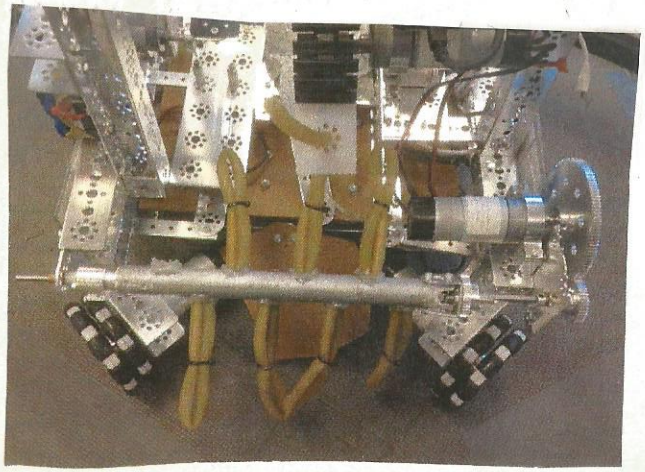
- We changed the phone mount to the phone with a case that has velcro on the back. We put zipties on the phone to make sure it stays on.
- We had to do this because the wound up cord was put in the channel which prevented remounting our old phone mount.
- We attached a tape measurer to our robot so it would be internal and we would start in the correct spot.



- We attached acrylic team numbers on plexi glass panels with industrial velcro so we can easily attach them.
- We also added "official" power switch label to our robot.

MAIN ROBOT POWER





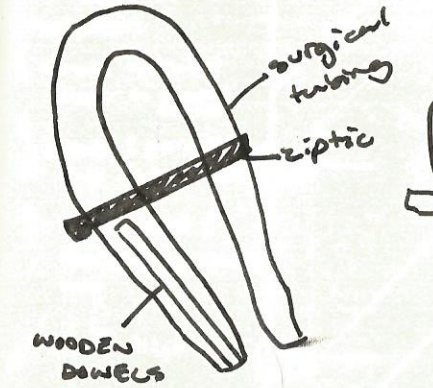
BALL PICKUP PARTS

2-1-17

SOMETHINGS WRONG WITH OUR PICKUP

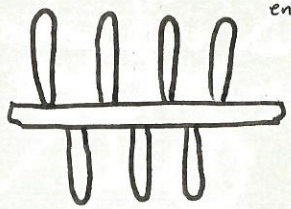
- doesn't rely on grip to pickup particles
- not a continuous rotation so accuracy and time is skewed.
- if held constant if wouldn't attract the particle but more so push it away.

NEW DESIGN!



Issues:

- wasn't enough room for the balls to go through (b/w spin rod & wiring panel)
- we moved the whole system up ~1.5" & now the surgical tubing isn't long enough to pull in particles

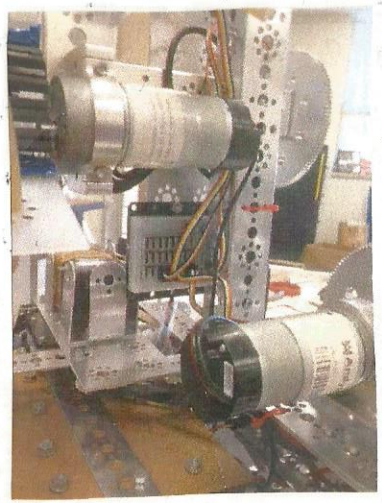


↓

temporarily added zip ties to ends & a duct tape ramp but we need a more permanent solution

- surgical tubing adds grip
- wooden dowels added inside for a sense of support so it's not too flimsy
- continuous rotation to decrease time and expand the range of intensity.

- We will try extending the surgical tubing and perhaps replacing it with sturdier vinyl tubing

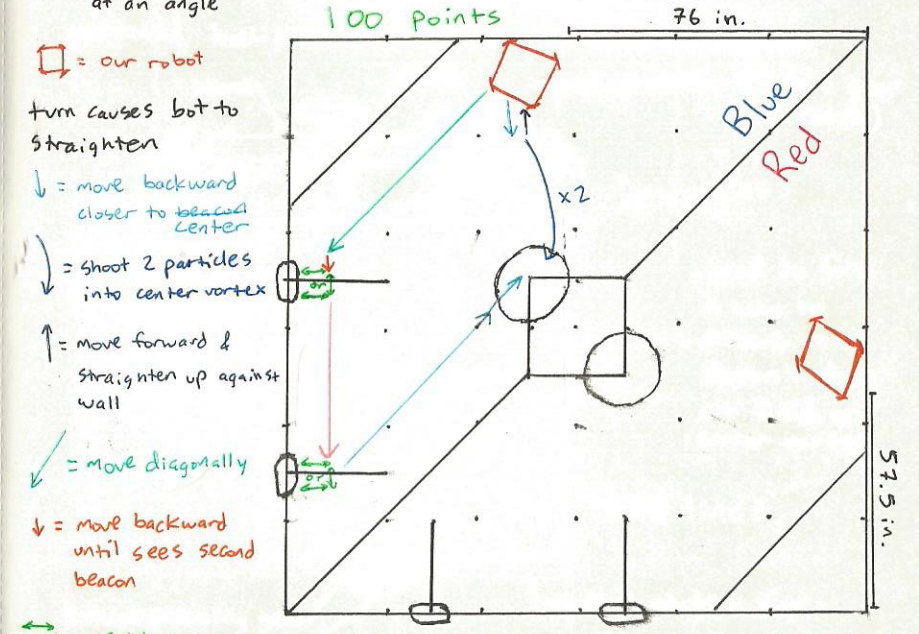


Our new CDIM location
(all I2c ports in use)

Autonomous Part 5

2-2-17

- our launcher has been having consistency problems when shooting from against the wall, so we added a segment to our auton. which moves the bot closer before shooting & then back to the wall afterwards
- we massively simplified our code by creating a file of drive methods which we call instead of typing out our logic for each step, & now we had to update all of our code to use the new system
- now that we have a beacon presser on both sides, a full 180° turn is no longer necessary for red auton
- the robot does a strange turn upon initiation, so we start it at an angle



= our robot

turn causes bot to straighten

↓ = move backward closer to beacon center

↓ = shoot 2 particles into center vortex

↑ = move forward & straighten up against wall

↙ = move diagonally

↓ = move backward until sees second beacon

↔ or ↕ = use color sensor to press correct beacon side

↓ = move backwards until sees 2nd beacon

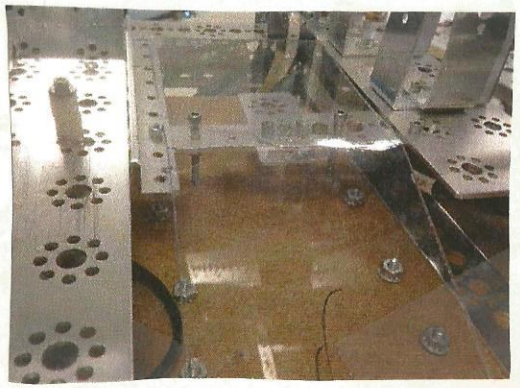
↔ or ↕ = use color sensor to press correct beacon side

↗ = move diagonally to center, dislodging cap ball & partially parking on center

Red side is perfect mirror of Blue

if bot never sees 2nd beacon, failsafe initiated, robot stops & LEDs turn on

we are experimenting w/ using optical distance sensors to keep the robot the same distance from the wall during the beacon-pressing sequence



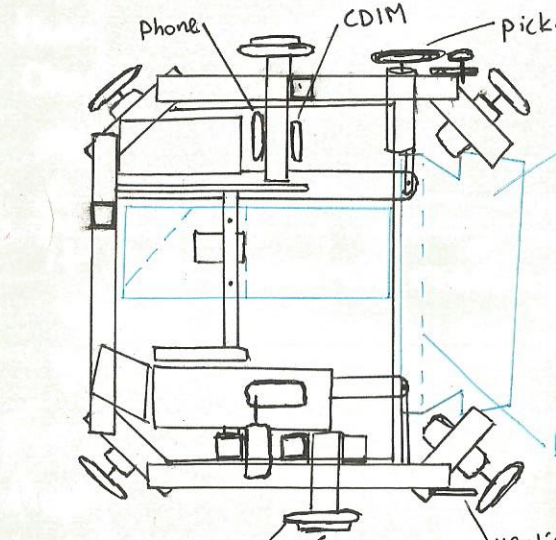
Infrastructure Part 4

2-8-17

- removed tape measure (forums changed their mind)
- removed impromptu duct tape/polyboard ball ramp that we built the morning of competition...
- dismantled center field structure from Cascade Effect to use its clear plastic ("plexiglass") for our particle ramp and internal path → shaped it using Chapin's super heat gun
- added furniture pads onto beacon-pressing gears

The motors were changed back to 60:1 for ease of use.

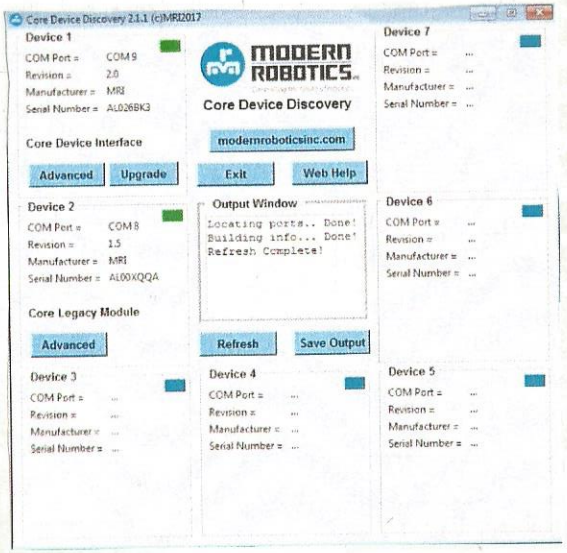
- replaced our drive motors (60:1's) with 40:1's to speed up our drive train and make us more competitive for beacons
- removed ball-pickup spinner → will rebuild and replace

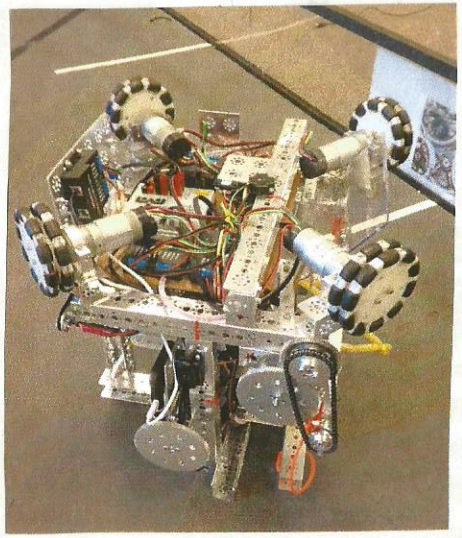


- need to find a way to ensure ramp doesn't drag on field or corner vortex

Problem

- we only have 3 working 40:1 motors → will have to order more and wait for arrival before we can use drive train
- puts a hold on us testing autonomous until we can get the new motor so we can get the new timings correct w/ faster drive train

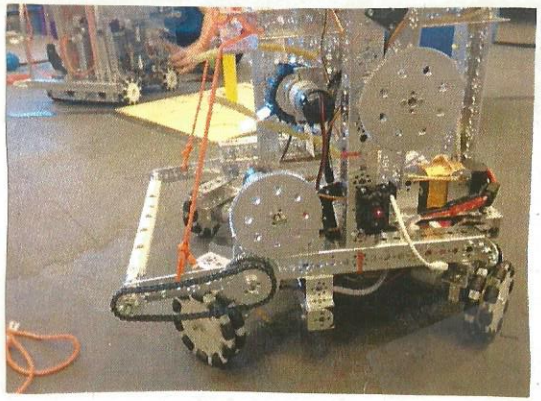


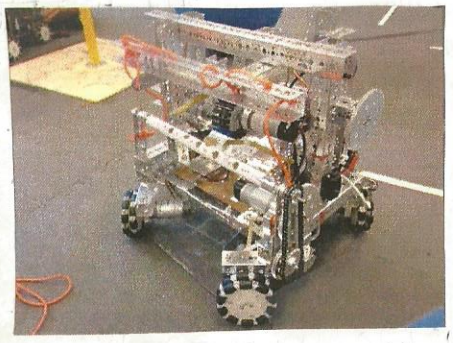


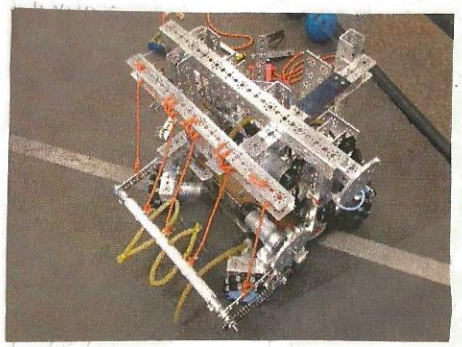
Autonomous Part 6

2-21-17

- We ended up switching back to 60:1 motors with encoders to make our driving and movement more accurate. This also caused us to change all of the autonomous programs and teleOp.
- A modern robotics integrating gyro sensor was added to our robot so we are able to use degrees to turn instead of relying on timing.
- The color sensor on the right side of our robot is reading the values differently than our left color sensor. We tried to change the command, which we were able to through the Modern Robotics Core Device Discovery software, but it still wasn't reading the red values correctly, so with the gyro sensor, we make a 180° turn.
- For our initial movement to the first beacon, we added a color sensor to the bottom of the robot to sense the white line. We move forward until the sensor sees the white line.
- We also don't have to start the robot at an angle during autonomous anymore, because the gyro sensor has corrected the issue of the robot turning upon initialization.



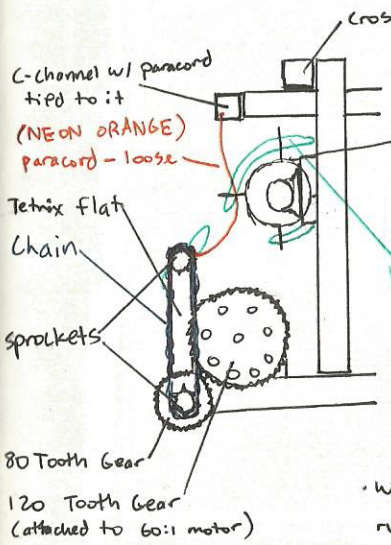


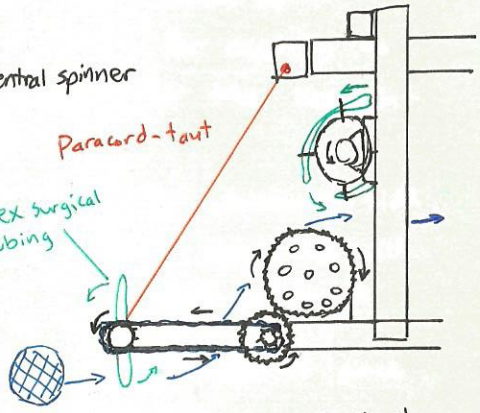


Ball Pickup Part 6

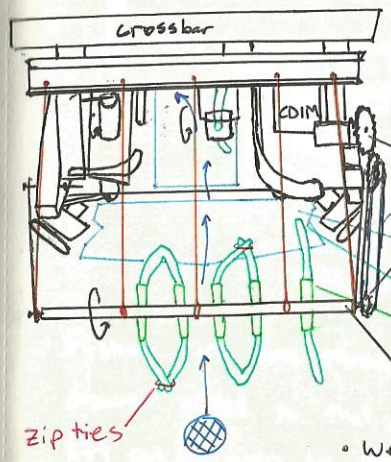
2-23-17

- problem w/ other pickup was that there wasn't enough room in between the actual pickup and the ramp / wiring panel for particles to easily pass





- when we begin tele-op, we simply run the pickup motor, which drops the pickup bar to its appropriate height (outside the 18" cube) where it remains until the end of the match when we reset it



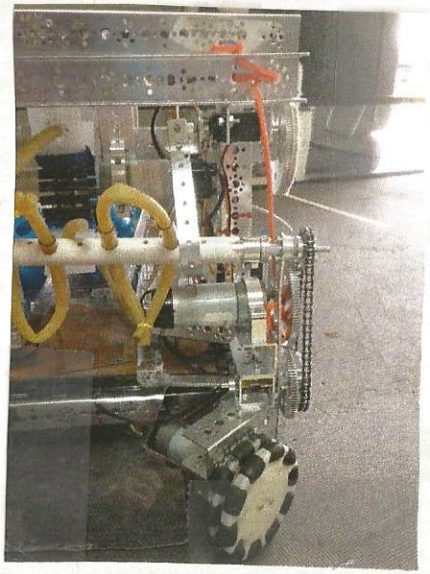
gears (120 tooth to 80 tooth)
chain (rotates with system when released)
sprocket
plexiglass ramp
latex surgical tubing (weaved thru vinyl tubing)
vinyl tubing
PVC pipe (1" diameter)

- we also made several structural additions to prevent particles getting stuck or falling out of the pickup area

Cap Ball Lift

3-1-17

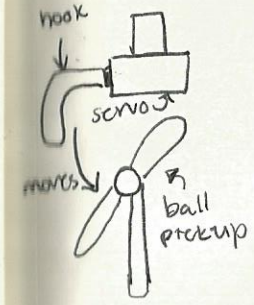
- 16" drawer slides
- a system with three slides should reach high enough for scoring the high zone
- our robot doesn't have space for a lift high enough for capping so we will just go for the 20 point high zone
- we will attach it to whichever side of crab has enough space and will not create a weight imbalance
- not sure if we will use it since there are more important things to be working on during the meetings
- we have had a servo controller on our wiring panel since the beginning in case we were to ever use servos, and we anticipate that we will use two or three for the part of the lift that grabs the cap ball
- Fishing line runs through the system of connected drawer slides so that, with the aid of a pulley, the lift can be risen by pulling the upper line downwards with our one remaining allocated motor on a winch



Infrastructure Part 5

3-16-17

- Got 4 new launchers, cut out of blue steel from a drywall knife, same as before
- Flipped the phone upside down and closer to the edge for a better view for the camera to use Vuforia, image processing. (fixed most of our problems during autonomous for beacons)



- servo added to hold up ball pick up mechanism for ease of set up in autonomous.
  - hook lifts up as the robot moves forward during autonomous.
- removed all para cord hanging down, suspending pickup except the ones on the edges. Middle ones were getting caught on central spinner and almost broke a motor.
- Switched drive motors to 40:1's again, which caused similar problems before. One of the internal motor encoder of a new motor was broken, so with telemetry and the method getCurrentPosition() we found the broken motors. We are now able to use the 40:1's.
- Changed beacon pusher by getting and cutting a larger furniture pad on the left side. Removed the gear on the right side and used a C-channel and long furniture pad as backup pusher.