
ECHO
7701E
ECHO
Engineering Notebook

continued from page 1

Mia Brake

Roles: Lead Designer

Grade: 12

Years in robotics: 5

I love life sciences but enjoy robotics as ~~a passtime and~~ extracirricular. I like solving problems and designing things, so robotics is ~~a great~~ the perfect passtime. Outside of robotics I do a lot of additional clubs such as debate and mock trial. I also enjoy reading and drawing in my little free time. I plan to go to college but don't know what I want to major in.

Camilla Wallbank

Senior, 4th year in Robotics Builder,

I enjoy solving problems and want to major in engineering in college. I run in cross country and track and play soccer. My favorite passtimes are reading and eating. My favorite movies are The Princess Bride and Mulan. I speak Spanish.

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Signature Luisa Arrizabalaga Date 2020-07-16

Witnessed And Understood By Camilla Wallbank Date 16-7-20

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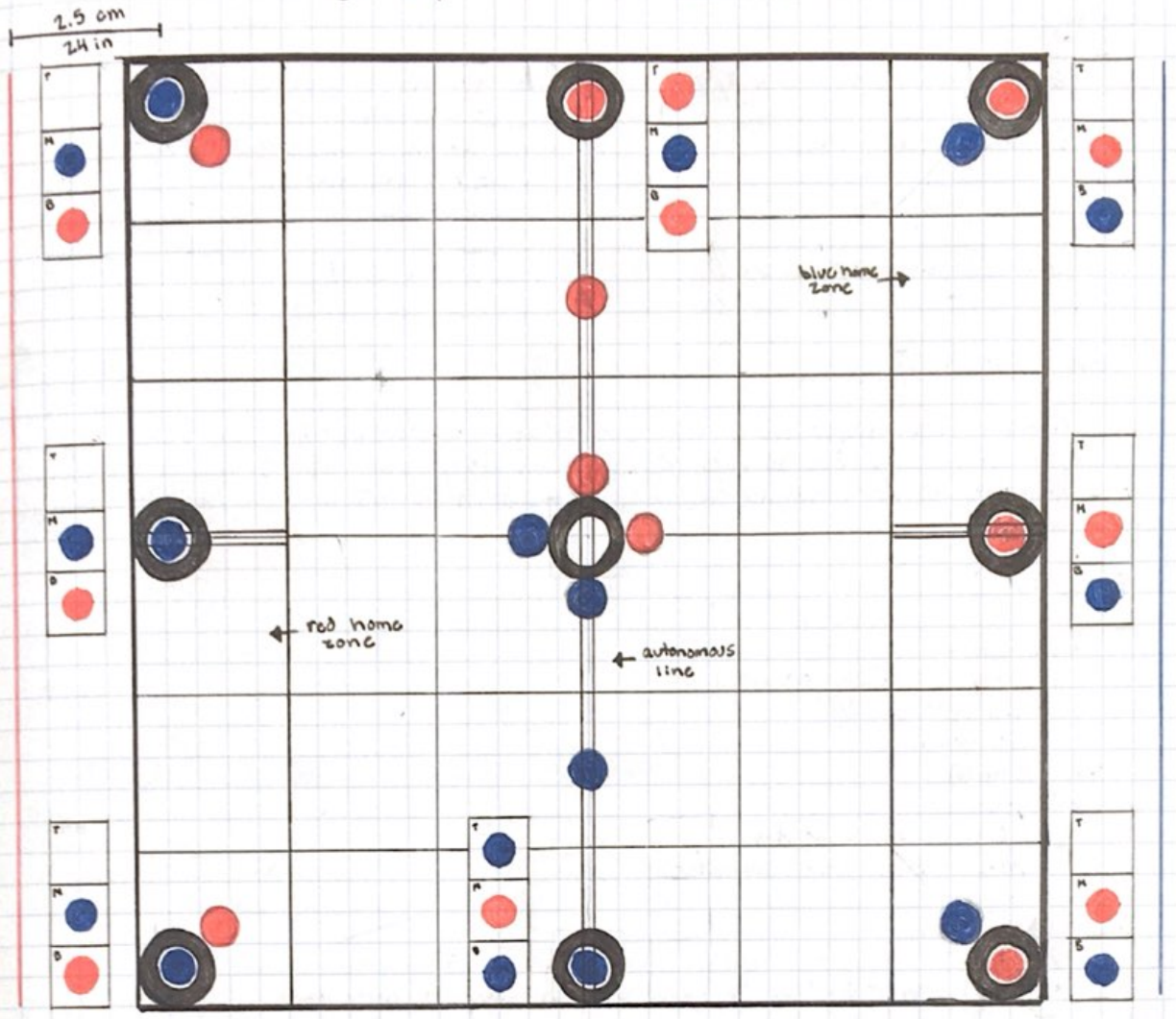
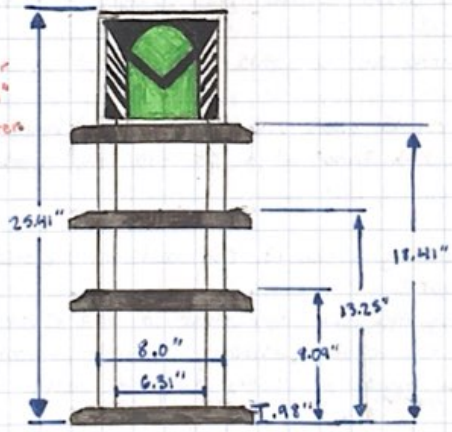
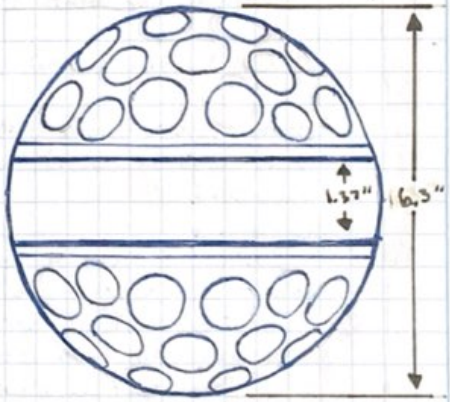
Change Up Game Overview







-LA

continued to page 4

Signature Lulu Arrambalaga Date 2020-07-16

Witnessed And Understood By Cornelia Wallbaum Date 16-7-20

continued from page 3

Scoring

Each ball scored in a goal	1 point for the Alliance corresponding to the ball color
Each connected row	6 points for the Alliance corresponding to the ball color
Autonomous Bonus	6 points
Completed home row in autonomous	1 win point

Game Description

Matches are played on a field set up as illustrated by the figure on the previous page. Two alliances, red and blue, are composed of 2 teams each compete to score points by placing balls in towers and connecting the top row of balls.

Elements

- 32 balls
  - 16 of each color red and blue
  - 6.3 in diameter
  - 168 grams
  - dimpled
- 9 goals
  - 18.41 in to upper rim
  - 10.12 in pipe circle diameter

Game Deffinitions

Alliance home row - The 3 goals in each alliances home zone

Autonomous line - white tape lines across the center of the field

connected row - a row where all 3 goals are owned by the same alliance

Home Zone - Where the robots start the match and defines home row. The home zone is defined by the inner edge of the field perimeter and white tape line

Possession - A robot is possessing a ball if the ball is unscored and any of the following criteria are met
- The robot is carrying the ball such that if the robot changes direction the ball will move with the robot (pushing is not possesion)
- The robot is blocking opposing robots' acces to balls such as a wallbot - LA

continued to page 5

Signature Julia Arruzabalaga Date 2020-07-16

Witnessed And Understood Camilla Wellbaum Date 7-16-20

continued from page 3

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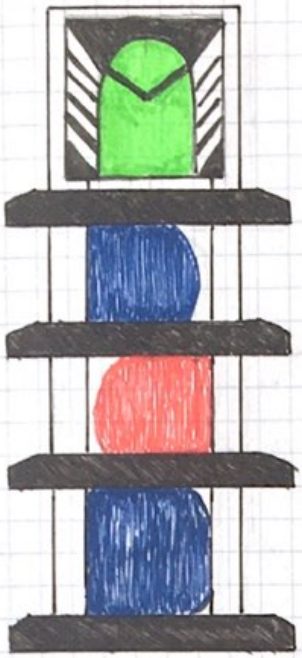
continued to page 5

Signature: Julia Arruzabalaga	Date: 2020-07-16
Witnessed And Understood: Camilla Wellbaum	Date: 7-16-20

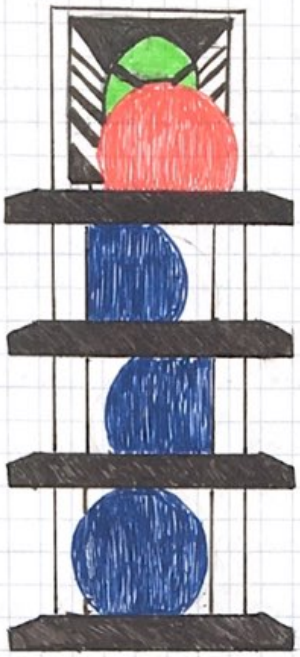
continued from page 4

Game Definitions (cont.)

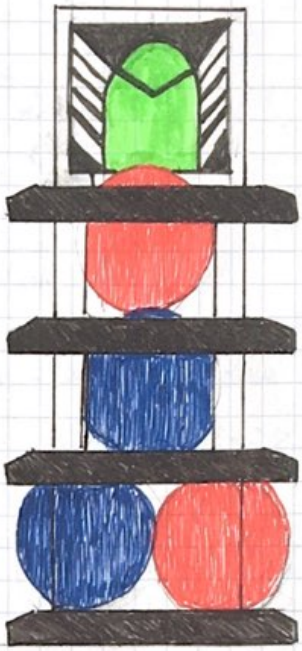
Owned - A goal status. A goal is owned by an alliance if its colored ball is the vertically highest scored ball in that goal.



This goal is owned by the blue alliance because the top ball is blue and completly within the upper edge of the goal.

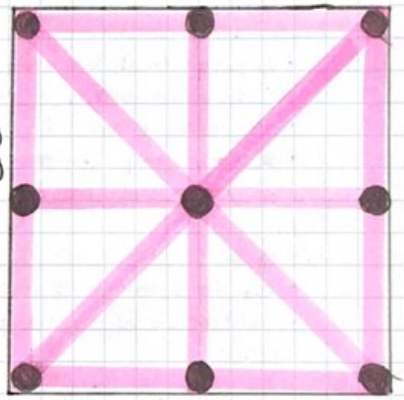


This goal is owned by the blue alliance because the top red ball is not within the upper edge of the goal.



This goal is owned by the blue alliance because the top red ball is not within the upper edge of the goal. The bottom 2 balls are both scored.

Row - 3 goals that make a straight line, There are 8 total including 2 home rows



Scored - A ball status. A ball is scored if is not touching a robot of the same color and meets all of the following criteria

- The ball is fully or partialy within the outer edge of the goal
- The ball is fully below the upper edge of the goal
- The ball is not contacting the foam tile outside the goal

Trapping - A robot status. A robot is ~~trapped if it~~ trapping if it has restricted an opposing robot into a small confined area of the field (about 1 tile) and has not provided an avenue of escape. - LA

continued to page 6

Signature Julia Arredondo Date 2020-07-16

Witnessed And Understood By Camille Wallace Date 7-16-20

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Rules

<G15> No trapping for more than 5 seconds

<SG1> Prior to starting the match the robot must be placed such that it is:

- Contacting its home zone
- not contacting field tiles outside the home zone
- not contacting any balls other than the preload
- not contacting another robot
- contacting 1 preload
  - the preload must be contacting 1 robot
  - the preload must be fully within the field perimeter
  - the preload must not be inside or above a goal

<SG2> Stay on your side during autonomous. Violations of this rule result in one the 6 autonomous points being awarded to the opposing alliance

<SG3> Keep balls on your side during autonomous. Incedental violations that are not match affecting result in a warning

<SG5> Balls may not be descored from the top of a goal

<SG8> Robots may not possess more than 3 balls of the opposing alliances color

Design Statement

Design, build, and compete with a robot that can effectively score and descore balls in the goals of the 2020/2021 game Change Up

Design constraints

- Robots must initialy fit into an 18"x18"x18" cube
- Vex components or look-alike components only
- No more than 8 motors
- Robots may ~~not use more~~ use non-shattering plastic cut from a single 12"x24" sheet up to .07" thick

Strategies

- Be able to score balls and descore balls from all 8 towers
- Control ~~two~~ a diagonal because it prevents opposing alliance from connecting any other rows
- Be able to complete the home row in the autonomous period
- If possible remove opposing colored balls from towers and replace with our alliances color -LA

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Signature Luis Arrizabalaga Date 2020-07-16

Witnessed And Understood By Camilla Wallevik Date 16-7-20

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Brainstorming

Chassis:

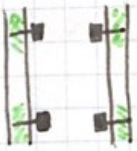
Chassis criteria:
- must not be larger than 18x18
- must be able to move the robot around the field
- must have space for the intakes and balls

Omniwheels

Pros:
- easy to drive and program
- only requieres 2 motors
- axels from last year are the right length

Cons:
- less mobility
- requieres chain which can break
- The 2 sides need to be wider to fit the chain

Mecanum wheels



Pros:
- sides of chassis are narrower
- can move side to side
- doesn't use chain

Cons:
- needs 4 motors
- harder to program + drive
- less intuitive

	Omniwheels	Mecanum wheels
Speed	8 less motors= less speed	10 more motors= more speed
Range of motion	8 always has to turn	10 can move side to side
# of motors	10 only 2 motors	7 uses 4 motors
space for intake	10 motors not infront	6 motors in the way
Total	36	33

We decided to use omniwheels for our chassis with 2 motors in the back. This means we will have space in the front for a ball and intakes. The omniwheel design also only uses 2 motors which gives us more motors to use in the intakes and outake.

We decided that the chassis should be about 25 holes long so we would have space in front of the chassis for roller intakes. We want there to be around 15 holes in the center of the robot so the balls will have space to fit comfortaby along with our outake system. If needed we will put anti-tip wheels on the back, but we will need to test the design to see if anti-tip wheels are necessary. We think we will have a bar on the back connecting the two sides and maybe another bar slightly closer to the front of the robot depending on weather or not we have the space. -LA

continued to page 10

Signature Lilia Arreondelaga Date 2020-07-16

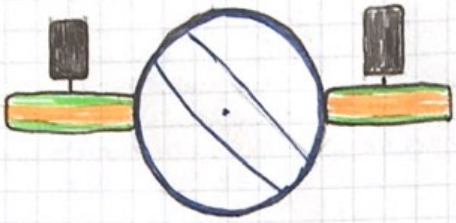
Witnessed And Understood By Camille Wallace Date 7-16-20

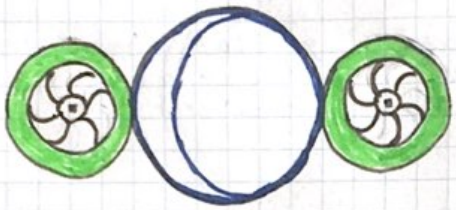
continued from page 9

Intakes:

Criteria:
- cannot stick out further than 18"
- Must be able to pick balls up easily without them "running away"
- Must be able to descore balls from the goals

Wheels w/ rubber bands



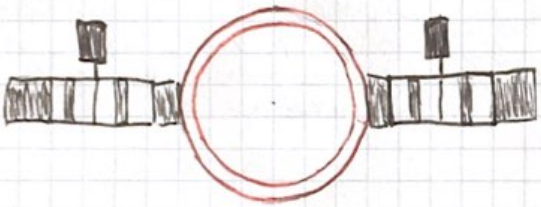


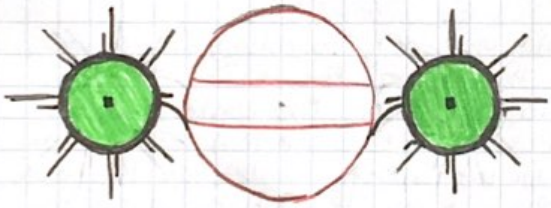
- two wheels apx. 4" diameter are placed with the diameter of the ball between them
- They are both powered by a motor sitting on top of them
- The wheels are wrapped with rubber bands to increase grip

Pros:
- no chain to break
- no flaps to fall off
- more precise

Cons:
- needs to be lined up perfectly
- harder to pick up balls coming from one side

Sprockets w/ tread and flaps





- 2 medium sized sprockets wrapped in tread and flaps are placed slightly more than the diameter of the ball apart
- each one is powered by a motor

Pros:
- Does not need to be as precise
- easier to pick up from an angle

Cons:
- relies on chain + flaps which could break
- not quite as much power when ball is between sprockets. -LA

continued to page 11

Signature Erika Arroyabalenga Date 2020-07-16

Witnessed And Understood By Camille Williams Date 7-16-20

continued from page 10

Intakes (cont.)

	wheels	sprockets
Ability to pick up balls	5 must be very precise	8 has a bit of leeway
maintence required	9 rubber bands	6 chain/ flaps
ability to descore	6 hard to get it right	7 flaps help remove balls
size	8 same size	8 same size
Total	28	29

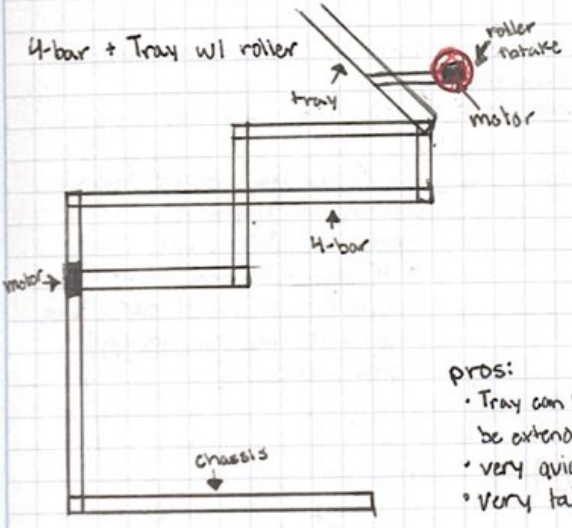
We chose the sprockets and tread with flaps because we think they will be better at picking up balls, especially if the robot is not aproaching head on. They will probably be better at descoring too because of their superior grip. The only major weakness of this design is its reliance on chain and flaps which could break during the competition. However, because the chain is only around one sprocket it is fairly unlikely to break. While the wheels could provide more power due to the direct contact, power is unnessary when intaking the balls.

We decided to use 24 tooth sprockets. We used this size because we think it will let the tread / flaps to be the right distance apart to have the ball fit comfortably between them. We will attach them to the chassis by placing a c-chanel above the front of the chassis with standoffs. We will put an axel throug the chassis, then the sprocket, then the top c-chanel, then into a motor. We will use the largest size of flaps to have the greatest contact with the ball and to increase our chances of picking the ball up.

Outake system:

Criteria:
- must be able to lift balls up to the top of the tower
- must have room to descore balls
- must start under 18 in high
- should be able to hold at least 3 balls

4-bar + Tray w/ roller



This design uses a 4 bar with a tray at the end. The 4 bar will keep the tray at the same angle and lift it to the height of the tower. There will be a roller made of 2 sprockets with rubber bands. This roller will keep the balls in as the tray is lifted and shoot them into the goals.

pros:
- Tray can hold 3 balls or be extended to hold more
- very quick at scoring
- very tall -LA

cons:
- lots of points of failure with a four bar
- might be hard to build

continued to page 12

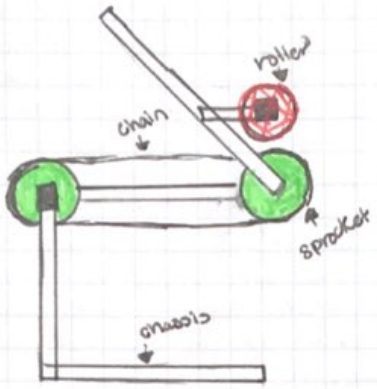
Signature Lilia Arrambalaga Date 2020-07-16

Witnessed And Understood Camille Wallbank Date 7-16-20

continued from page 11

- Outtake system (cont.)

Sprocket system + tray w/ roller

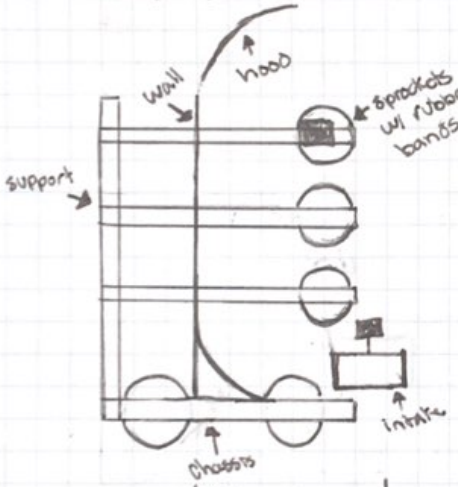


This design uses a system of sprockets and chain to keep the tray level. The motor on the arm raises the middle c-channel and the tray while the sprockets keep the tray at the same angle. The tray and roller are the same as from the previous design

pros:
- tray can hold 3 or more balls
- can quickly score
- fewer metal pieces

cons:
- chain/sprocket system might be hard to implement
- chain could break
- not as that tall

Roller tower w/ hood



This design uses a tower design to raise the ball up, then has a hood to shoot the ball. The balls ar raised by 3 pairs of sprockets interlaced with rubber bands. The back of the tower is a wide c-channel wrapped in mesh.

pros:
- simple design
- balls will stay in easily
- descoring can be done easily while scoring

cons
- might be overshoot, scoring needs more precision
- rubber bands break easily
- needs a mechanism to flip the hood up

	4 bar w/ tray	sprockets w/ tray	roller tower
ease of scoring	10 very fast + simple	10 very fast + simple	6 must be very precise
ease of descoring	8 use the intakes	7 use the intakes	9 very simple
simplicity of design	6 lots of moving parts	7 sprocket system	8 hood must flip up
maintnence required	8 lots of rubber bands	8 chain + rubber bands	6 lots of rubber bands
total	32	33	29

We chose the sprocket design because we think it will be easier to score than the tower design. We also think it is better than the 4 bar design because it has less moving metal pieces.

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Signature: Julia Annisabrasaya
Witnessed And Understood By: Camille Wallbank
Date: 2020-07-16
Date: 7-16-20

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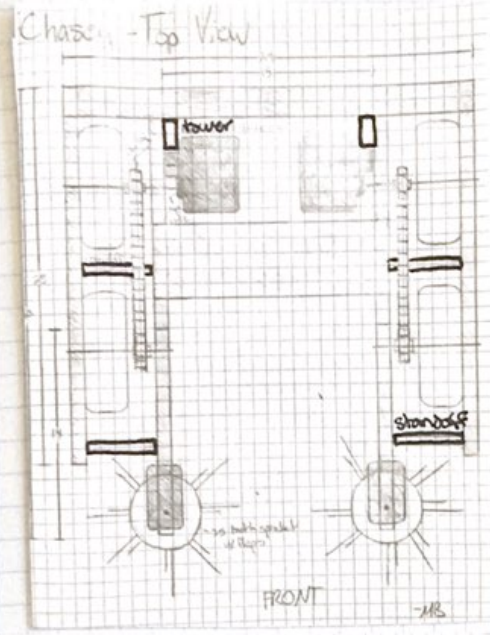
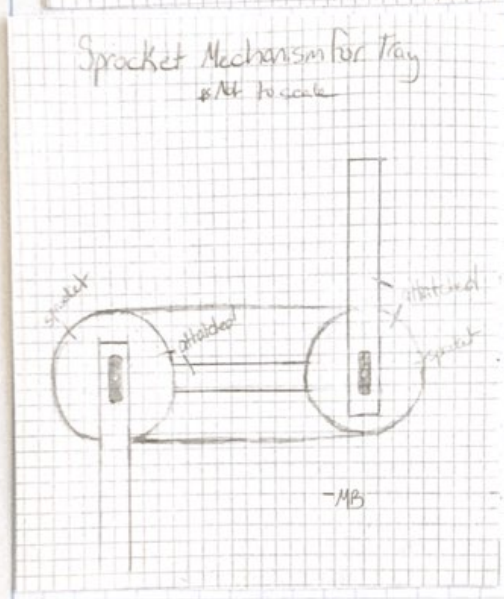
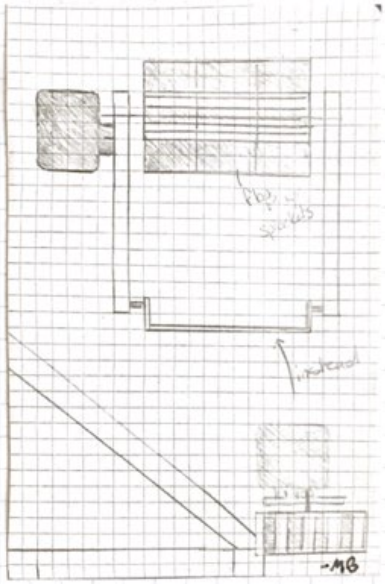
Our Robot will use a 2 motor chassis with the motors in the back connected to front wheel with sprockets and chain.

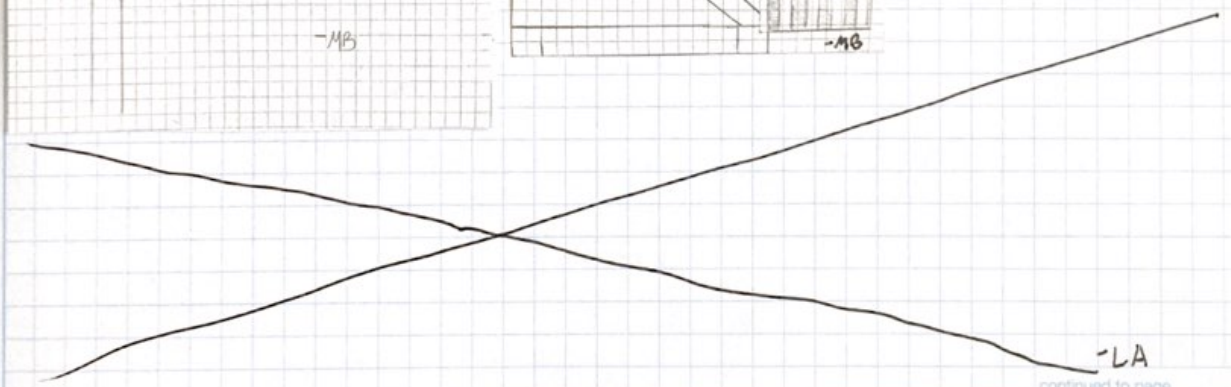


The front of the chassis will have 2 sprockets wrapped in tread and flaps. We will connect the 2 sides with a bar that goes all the way accross from outside to outside. They will also be attached with a wide c channel that goes from the inside to the other inside. We will place the towers inside the chassis next to the back bar. The two wheels will have to be fairly close together to give the intakes space. The sprockets connecting the wheels will ~~have~~ be on the inside to allow the intakes to have any space it requires. Each side of the chassis will be connected with standoffs. We will use 24 tooth sprockets to be the right distance to pick up the ball.





The arm will use a system of sprockets to keep the tray level. The roller on the tray will be powered on ones side and will keep the ball in when the tray is raised. We will probably use 2 L chanels connected with c chanels to make the tray probably around 35 holes each to hold as many balls as possible



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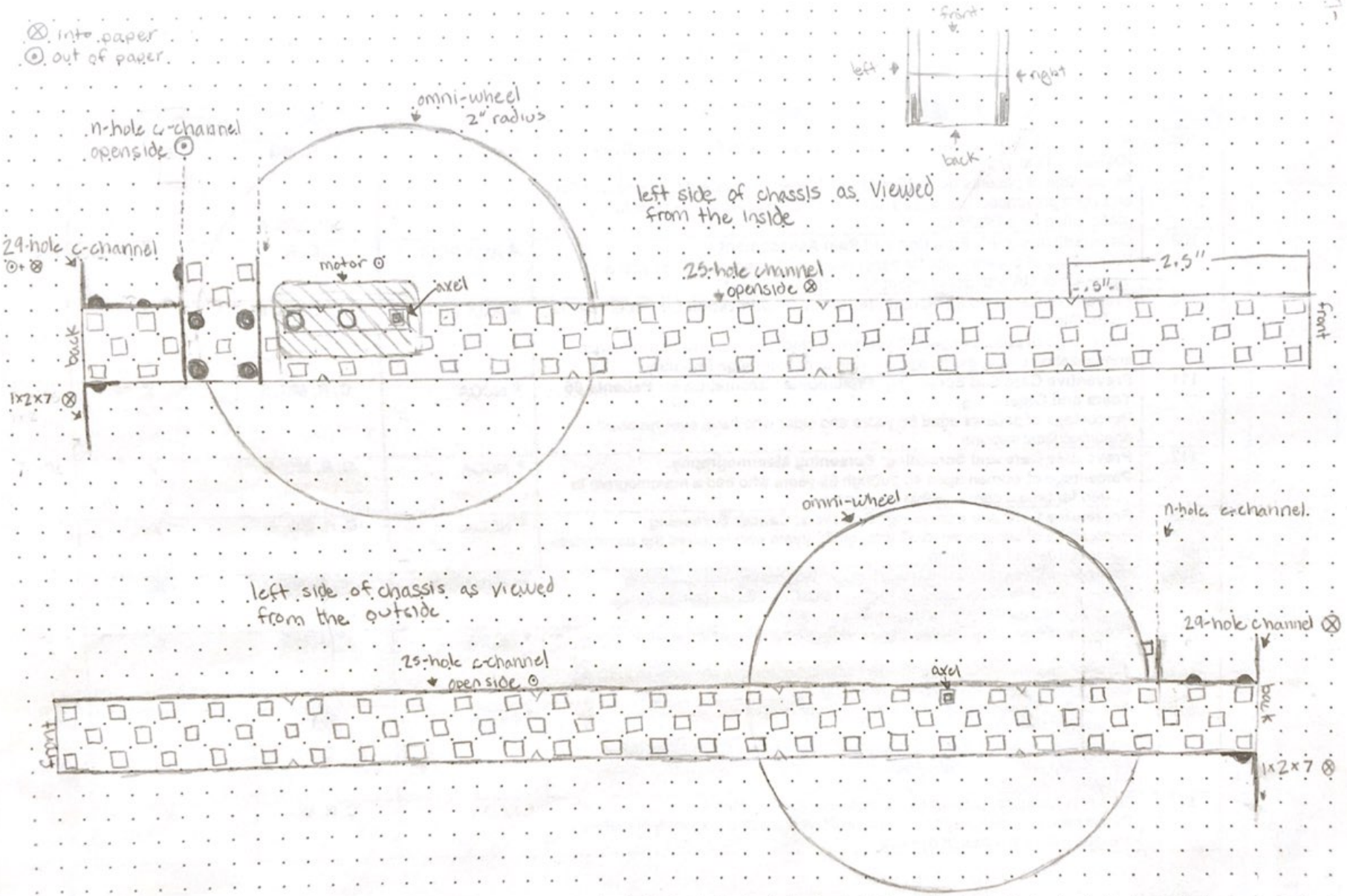
Signature	Julia Arrizabalaga	Date	2020-07-16	
Witnessed And Understood	Camilla Wellmark	Date	7-16-20	PROPRIETARY INFORMATION


⊗ into paper
⊙ out of paper
front
left
right
back
omni-wheel
2" radius
n-hole c-channel
openside ⊙
left side of chassis as viewed
from the inside
29-hole c-channel
⊙+⊗
motor ⊙
axel
25-hole channel
openside ⊗
2.5"
.5"
back
front
1x2x7 ⊗
omni-wheel
n-hole c-channel.
left side of chassis as viewed
from the outside
29-hole channel ⊗
25-hole c-channel
openside ⊙
axel
back
front
1x2x7 ⊗

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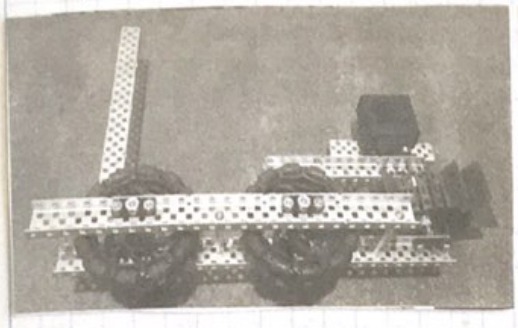
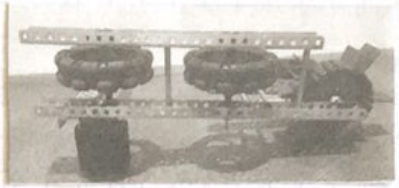
July 23 Daily Entry

Goals: start work on chassis and intakes

Building: We worked on the chassis and built the 2 halves and intakes.





We used 25 hole long pieces and followed the plan on the previous page. We attached the pieces for the tower even though we dont have any of the arm mechanism built. -LA

July 27 Daily Entry:

Goals: · connect the chassis
· start work on tray + arms

Building: We started building the tray with the 35 hole long L chanels but we did not work on the tray roller. We also started work on the arm mechanism. As shown to the right, we built a prototype to test that the principal for the mechanism was sound. We were unable to connect the 2 sides of the chassis because we did not have c-chancls of the right length.

September 3 Daily Entry

Goals: · create schedule
· connect chassis

Building: We cut the connecting piece. The wide c-chanel in the middle is 19 holes long. The thin c chanel in the back is 31 holes long. We also attached the arm to the tower. We did not connect the tray but did look to see what it will look like finished. While the ~~tower~~ tray would get tall enough, it was not close enough to the tower to allow the ball to enter the tower. To build the arms we drilled holes in the towers so we could put a high strength axel all the way through. We used 24 tooth sprockets to connect to the arms. We used 2 motors, one on each side to ~~at~~ give the arm more power to lift

continued to page 16

Signature: Julia Arrisabalaga Date: 2020-09-03 ~~2020-09-3~~

Witnessed And Understood By: Mia Terashe Date: 09-03/2020

continued from page 15

September 3 cont

Building: Because we used high strength axels that cannot be cut we had to add a sort of box onto the tower to move one of the motors the out more so it would be the right distance from the other motor to allow the axel to to fit perfectly the 2 motors.

Testing: We tested the chassis with the rollers to ensure every thing works before we add more pieces to the robot. It drives well and can intake a ball fairly well.

Brainstorming: To allow the tray to get closer to the tower, we think we will move the motor on top of the intake further back on the chassis and use a sprocket to connect the motor to the intake. We think This will allow us to move further into the goal and the intakes will be able to enter the goal without the hinderance of the motor on top

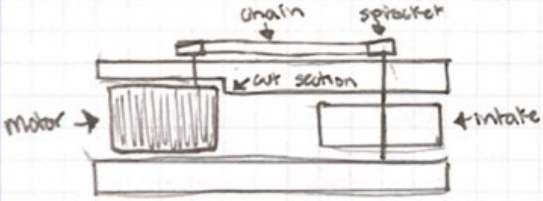
Schedule: We want to be able to have a working robot with an autonomous by october 30

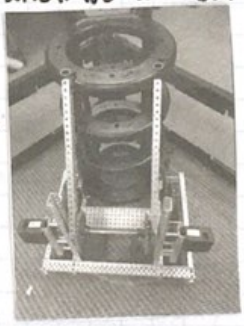
- Week 1 (sept 2-3): Chassis done, tested, and working
- Week 2 (sept 9-10): Brainstorm ammo and be half done with lift
- Week 3 (sept 16-17): Done with lift and tray
- Week 4 (sept 23-24): completed robot
- Week 5 (sept 30 ~~oct~~ oct 1): Test robot and complete any needed repairs
- Week 6 (oct 7-8): Start testing autonomous
- Week 7 (oct 14-15): continue testing
- Week 8 (oct 21-22): continue testing
- Week 9 (oct 28-29): Finish autonomous and robot - LA

September 9 Daily Entry

Goals: Fix intakes

Building: We moved the motors to the bottom of the piece of metal, but had to cut the c channel it is attached to to allow it to fit between the chassis and c channel. We also started attaching the tray





Testing: We tested the new intake design and it works to allow the robot to get much closer to the goal and lets it get close enough to put balls in the tower. -LA

continued to page

Signature: Lidia Arrizabalaga Date: 2020-09-09

Witnessed And Understood By: Mr Nicole Date: 09-09-2020

continued from page

September 10

Goals: · Attach arms.

Building: We tried attaching the arms but had issues because the 2 sprockets were not aligned so we could not put the chain on them. This means we have to make the 2 towers further appart so we can have the sprockets aligned while keeping the distance between the 2 sides of the tray constant. We moved the towers from the very inside of the chassis to the other side of the inside channel, or between the parts of the half of the chassis, where the wheel is. Then, we put the sprocket on the other side of the arm, between the arm and tower to allow the sprockets to be aligned. -LA

September 16:

Goals: · Finish the arms

Building: We finished connecting the arms and trays together with the sprockets.

Testing: After connecting all the arm components, we tested the arm. However, as the arm raised the sprockets did not keep the angle between the tray and the vertical constant as we had intended, but instead kept the angle between the arm and the tray constant.

After testing our current design, we tried to build a new working prototype of the sprocket mechanism to see how it worked. We were able to get the design to work, but the placement of sprockets in the working model was not compatable with our current robots design. There was not enough space between the tray and the chassis to fit the sprocket.

We I programed code for the robot to test, code is included on page 18. -LA

continued to page 18

Signature	Julia Buenaventura	Date	2020-09-16	
Witnessed And Understood By	Mr Brake	Date	09-0-2020	PROPRIETARY INFORMATION

continued from page 17

September 16 code

```
void opcontrol() {
pros::Controller master(pros::E_CONTROLLER_MASTER);
pros::Motor rightintake(3,E_MOTOR_GEARSET_18,true);
pros::Motor leftintake(10);
pros::Motor tower(9,E_MOTOR_GEARSET_06);
pros::Motor roller(11);
std::shared_ptr<okapi::OdomChassisController> chassis =
        okapi::ChassisControllerBuilder()
                .withMotors(-6, 7) // Left: 14, 16 | Right: 15, 17
                .withDimensions(okapi::AbstractMotor::gearset::green, {{4.125_in, 12.75_in}, okapi::imev5GreenTPR}) // Drop Center Wheels:
4.32in
                .withMaxVelocity(175)
//              .withSensors(ADIEncoder('A', 'B', true), ADIEncoder('C', 'D')) // Left Tracking Pod: 'A', 'B' | Right Tracking Pod: 'C', 'D'
                .withOdometry()
                .buildOdometry();
std::shared_ptr<okapi::AsyncMotionProfileController> profileController =
        okapi::AsyncMotionProfileControllerBuilder()
                .withLimits({
                        1, // Maximum linear velocity of the Chassis in m/s
                        2.0, // Maximum linear acceleration of the Chassis in m/s/s
                        10.0 // Maximum linear jerk of the Chassis in m/s/s/s
                })
                .withOutput(chassis)
                .buildMotionProfileController();
        while (true) {
                lcd::print(0, "%d %d %d", (lcd::read_buttons() & LCD_BTN_LEFT) >> 2,
                        (lcd::read_buttons() & LCD_BTN_CENTER) >> 1,
                        (lcd::read_buttons() & LCD_BTN_RIGHT) >> 0);

                chassis->getModel()->tank(master.get_analog(ANALOG_RIGHT_Y),

        master.get_analog(ANALOG_LEFT_Y));

                        if (master.get_digital(DIGITAL_R1)){
                                rightintake.move_velocity(mv);
                                leftintake.move_velocity(mv);
                        }
                        else if (master.get_digital(DIGITAL_R2)){
                                rightintake.move_velocity(-mv);
                                leftintake.move_velocity(-mv);
                        }
                        else{
                                rightintake.move_velocity(0);
                                leftintake.move_velocity(0);
                        }

                        if (master.get_digital(DIGITAL_L1)){
                                tower.move_velocity(mv);
                        }
                        else if (master.get_digital(DIGITAL_L2)){
                                tower.move_velocity(-mv);
                        }
                        else {
                                tower.move_velocity(0);
                        }

                        if (master.get_digital(DIGITAL_UP)){
                                roller.move_velocity(mv);
                        }
                        else if (master.get_digital(DIGITAL_DOWN)){
                                roller.move_velocity(-mv);
                        }
                        else {
                                roller.move_velocity(0);
                        }
                        delay(20);
        }
}
```

motor declarations

I used the okapi library for chassis control

programs tank drive

runs the intakes

moves the arm

moves the rollers

continued to page

Signature Julia Quintabalega Date 2020-09-16

Witnessed And Understood By Mia Madel Date 09-16-2020

continued from page

November 7

Crown Point

Qualifacation

Q6	2567M 7701H	33	7	46311H 7701E	loss
Q17	574B 4981B	7	51	1233E 7701E	Win
Q27	7701E 12336	4	69	4082B 587X	loss
Q32	2849A 1233D	20	22	12337 7701E	Win
Q41	587Y 7701E	18	12	1233W 586A	Win
Q49	5866 7701E	52	9	46311B 46311A	Win

Round of 16

R16 3-1	7701E 2567K	24 →	17	587X 46311B	Win

Quarterfinals

QF 2-1	7701E 2567K	9 →	16	12337 4981B	loss

7701E

Rank: 8 WP: 10 AP: 24 SP: 59
4-2-0 OPR: 23.1 DPR: 5.6 CCWM: 21.6

Overall I think we did very well durring this competition, we won 2/3 of our qualifing matches and won the auton in almost all our matches. The 2 or 1 point auton we had was very consistent in getting 1 point and that is all was usualy needed. We had a very good skills score for our first time doing skills with 93 points. By disrupting the blue rows in skills, it can be very easy to gain a good ammount of points. We had a programing skils score of 13 wich was also very good considering we had very little auton skills practice. We had a good judges interview and we won the excelence award. The main thing we need to change after this is our hood release mechanism because while it works, it is very particular and needs to be set just right or it wont work. We also have to replace our wheels because I discovered that all our wheels are very striped allowing them to turn freely on the axel. I suspect this is what was causing drifting durring our last match in the quarterfinals. -LA

continued to page

Signature Lilia Arrazabalaga Date 2020-11-7

Witnessed And Understood By Kaitlyn Tesche Date 2020-11-7