Team 302

Design Notebook

Contents

9/24/19 Meeting

Old Business: Today, the group first met with roles already assigned to discuss a basic agenda for the progression of the project. The group also set up meeting times, using half of the days as full group work time, and the other half for one-on-one meetings involving more specific aspects of the project. It was agreed upon that the cortex would be assigned to each group member for a certain portion of the week. This would allow for each member to have their share of time to work on their section of the robot. Each member also took home their specific parts of the robot so that they would be on hand for any one-on-one meetings. The robot kit was brought by Seth and sent home with Member 1.

New Business: Make sure to ask in RFAI about the line color and material, as well as whether or not we are able to use wheels with our robot. The group is also expected to come to the next meeting with ideas for figuring out a walking mechanism for the robot.

(Group met for 1 hour)

10/1/19 Meeting

Old Business: Today, the group met up again with previous work done. The members all watched videos concerning ideas for the walking mechanism of our robot. We began assembling the walking mechanism and trying out different ideas with various gears and leg movements. We built a prototype that utilized a three-leg design, with two legs moving on one rotation, and the third leg moving on the second rotation. The group dropped and picked up three pieces.

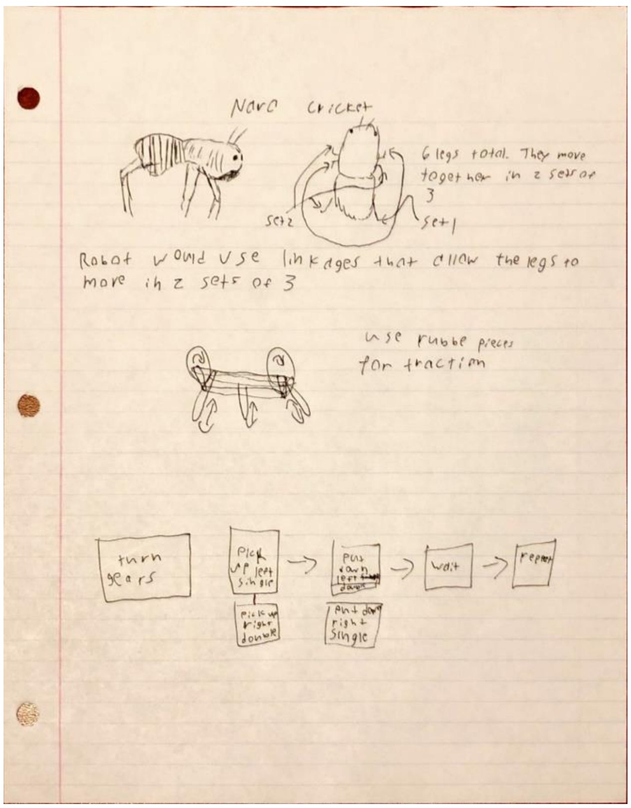
New Business: The group will work toward getting the initial design approved and continuing to assemble and program their specific parts of the robot.

(Group met for 1.5 hours)

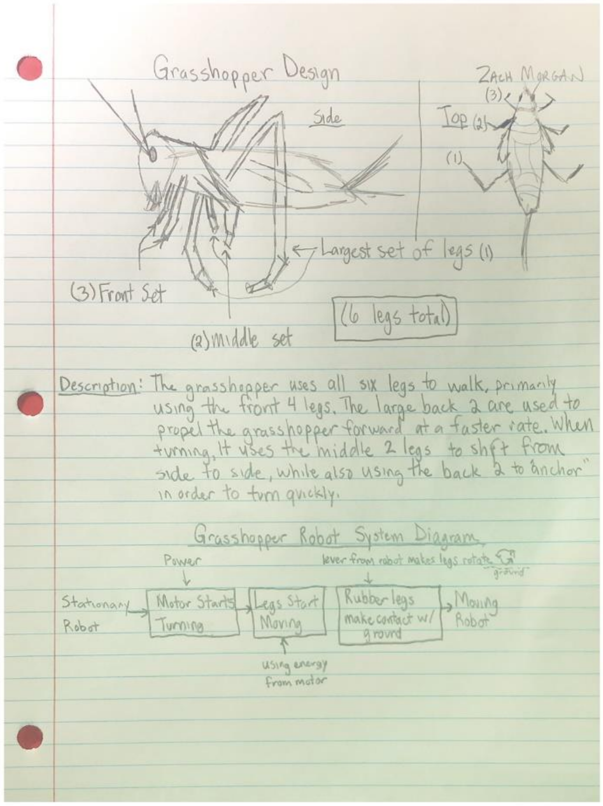
10/6/19 Meeting

Old Business: Today the group met up to review the animal designs that had been discussed. Members drew up diagrams for each animal, including the nara cricket, the ant, and the grasshopper. The designs are shown below:

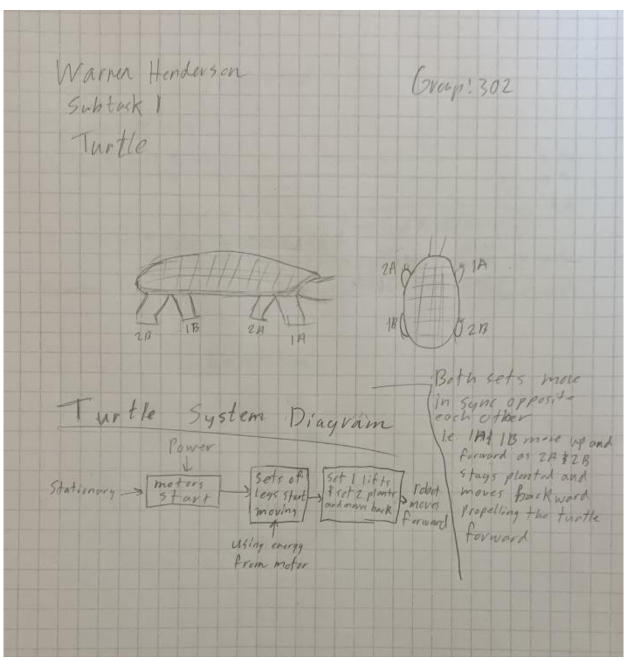
Nara Cricket:



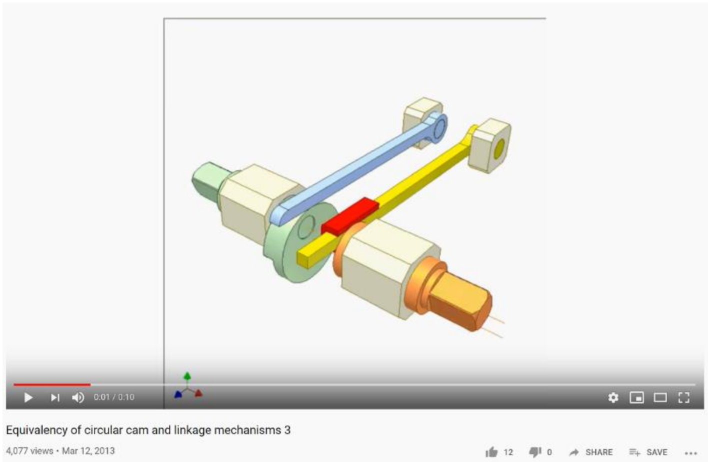
Grasshopper:



Ant:



Screenshot from "Mechanisms" Playlist:



Designs Decision Matrix:

Subtask 1 Decision Matrix			
Criteria	**Nara Cricket**	**Turtle**	**Grasshopper**
Speed	4	1	5
Stableness	4	5	2
Easy to mechanize	3	4	3
Ease of turning	4	4	2
Total:	3.75	3.5	3

In the end the group decided to build based on the nara cricket, and came up with ideas for linkages from the YouTube playlist titled "Mechanisms." Upon finishing the build, the group found the design falling apart. To fix this, supports were added along the outside. Following this, the group tested random lengths and angles in order to calibrate the robot, and added rubber feet to prevent the robot from slipping.

<u>New Business:</u> For the next meeting, the group will continue to work with their parts of the robot, and continue to tweak the current build of the robot.

(Group met for 1 hour)

Design Update 1

We have assembled the robot according to our designs. We have basic programming that allows the robot to walk forward for a set amount of time and turn as well.

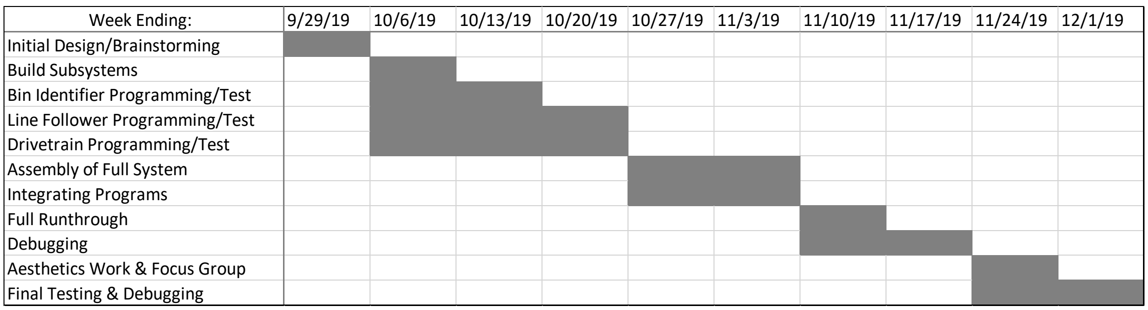
Subtask 1

The team met at TUC to perform in subtask 1. The subtask went well and will be elaborated on in the next meeting minutes.

The main concern was the turning of the robot. The team will work to make a straighter walking robot as well.

10/15/19 Meeting

Old Business: Last meeting, the group met at TUC for the first trial run of the robot that had been assembled. All members were present at the trials, including Member 3's brother, Ryan, who had spectated our work that week. Scores from the trials included were 20 and 18. Along with that, this log document was also shared with the other members of the group.



New Business: For the next meeting, the group hopes to be better with time management, which would also lead to better teamwork. The group looks to up the overall speed of the robot, as well as add sensors to increase the accuracy of the turning in the robot. The robot will be calibrated next time, so it can move in a much straighter line. The group has also brainstormed possibilities for the next subtask. Ideas include having the robot pick stuff up or follow lines, as well as adding mandatory sensors.

(Group met for 45 minutes)

Design Update 2

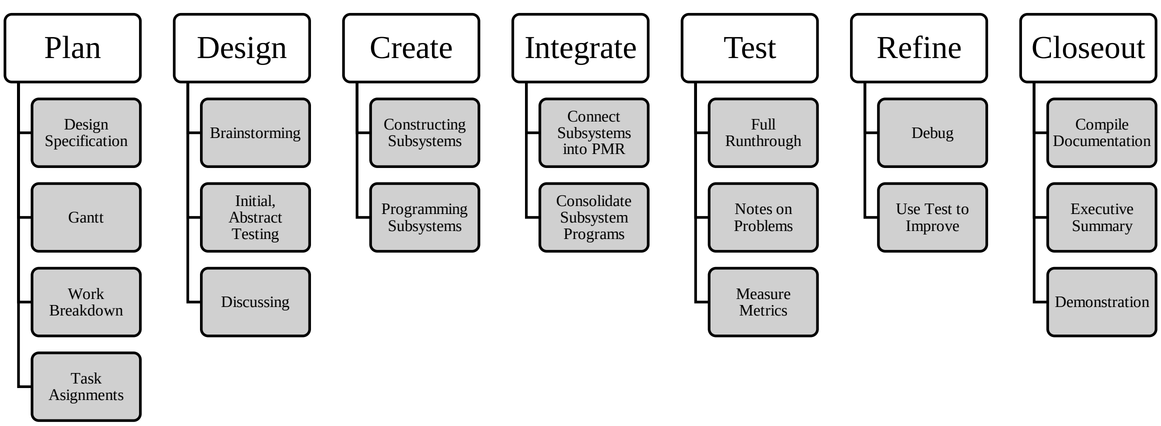
We have moved to a design that uses just one motor for the drivetrain. This means we always walk in a straight line. We will use the other large motor for our arm and we are working on devising something to use for turning with the medium motor.

The arm on the large motor is simply a straight piece with rubber bands on the end. To us the force sensor, we put the arm on a fulcrum that will transfer the weight of the can to an upside-down force sensor.

10/29/19 Meeting

Old Business: For this meeting, we discussed the progress made toward the picking up task for the robot. Seth got an old can from his house to be picked up by the robot. He also gathered weights for the task.

New Business: The group hopes to progress on adjusting the step height of the robot. One task states that the robot must be able to step over obstacles measuring taller than its current step height. The group also hopes to 3-D print parts that we need more copies of. These parts will be applied to adjusting the robot step height, along with many other tasks. The group also looks to add to the aesthetics of the robot via a 3-D printed shell. The group has agreed that this will be the final design meeting as to focus more time on the building and testing of the robot.



(Group met for 30 minutes)

Design Update 3

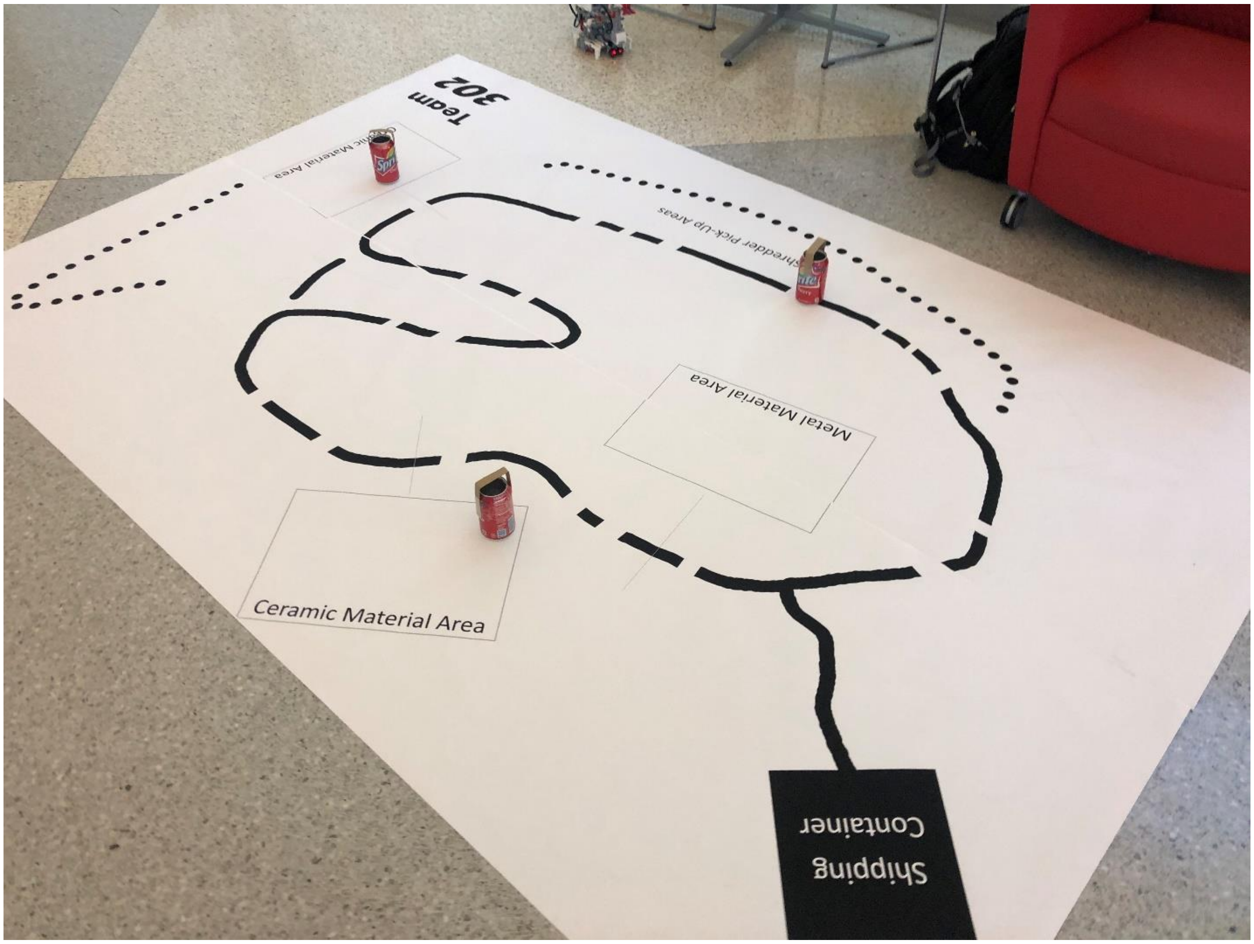
Seth designed and 3D printed many parts: 1) new legs. These legs are almost identical to the lego ones, but they are more compact. This allows us to shrink our robot. 2) a rack for an independent turning system with gears, 3) copies of common gears, 4) linkages to make the robot step higher for the obstacles.

Design Update 4

All of the 3D printed parts were installed. The longer linkages did not work. They made the robot step much to high. We are eliminating them for now and may come back to a different solution. The rack ceased up too often, so we are planning on not turning during the upcoming subtask. The legs worked perfectly. We are finishing up programming and adding the ultrasonic sensor for subtask 2.

Subtask 2

Today, some members of the team filmed the required materials for subtask 2. The robot worked as expected, but we would like to make improvements to the robot. These will be described in the next design update. Seth will edit the video and submit it.




Nutrition Facts
Serv. Size 1 Can
Calories 120
Total Fat 0g 0%
Sodium 65mg 3%
Total Carb. 33g 12%
Sugars 33g
Protein 0g

Design Challenge 2

Old Business: This meeting took place in class today, and the group completed all three tasks of "Design Challenge 2," as listed below.

Task 1:

- The Lego EV3 color/light sensor can be used to measure reflective red light and ambient light from dark shades to much brighter sunlight.
- It makes measurements by shining red light onto the surface. The amount of light reflected back is processed to determine the intensity of light, which is then converted into a numerical value. That numerical value of intensity is used to determine color.
- Specifications include a sample ray of 1kHz.
- The range of values the sensor would provide includes numbers within the range corresponding to the colors of black, white, red, green, blue, yellow, and brown.

The big use of the EV3 light sensor would more than likely be for it to be used as a line following mechanism. Other uses could include detecting obstacles like cans in its path.

- If the environment around the sensor is too bright, the ambient light will skew the results. If the sensor is too far away, then the ray may dissipate before it reflects all the way back to the sensor.
- To prevent these factors from affecting the uses in part B, the sensor should be put closer to the ground.
- Placing the sensor farther from the ground increases the error range in the measurements, and putting it closer makes measurements more accurate.
- If the sensor is not perpendicular with the ground, then the reflected light will not come back to the sensor.

Task 2: From this experiment, we have to learn the limits and functions of the color sensor and we're going to look at only the measurements of Gray and black, and those are the only two colors needed in the project for the line tracking. We're going to look into the accuracy with similar colors, the speed measurements are taken at, and the best orientation and distance from the ground for the sensor. For each color, we're going to take two measurements at varying heights. We will use this data to calculate the accuracy and precision of the sensor in various environments and apply these principles for our final design in project two.

Task 3: After testing, we have found that the color sensor cannot detect gray, however it does detect black very well. It works best when it's 1-3 centimeters from the surface and it does work when it is at an angle, however it works best when it is at a 90 degree angle from the surface. As for speed it is almost instantaneous to the point where we couldn't actually measure a value for how fast it was going in seconds.

Design Update 5

The team has decided to return to the one-large-motor-per-side approach. Although this means the robot does not walk as straight, no effective turning method could be found. Techniques tried include 1) a tail with a rubber band, 2) a spinning wheel (we deemed this as rolling and decided to abandon it), and 3) a motor shifting which side of the robot has the most weight

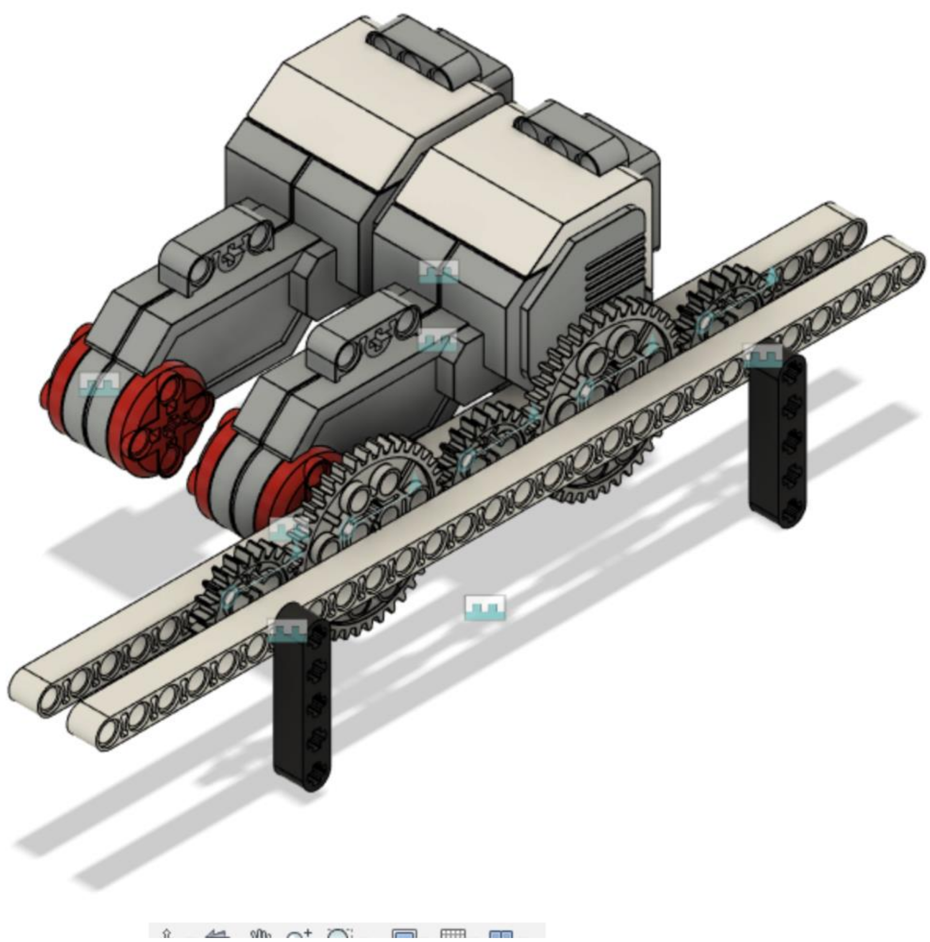
The new design will feature two independent large motors for the drivetrain and use the medium motor (probably with a worm gear) to pick up the can. The brick will also need to be moved to make space for the arm.

The force sensor is very inaccurate, and it will be redesigned as to more accurately measure mass. We are not sure yet how to do this.

Design Update 6

After much testing, a configuration has been reached. It features the brick mounted vertically on the back with the drivetrain being very similar to the subtask 1 bot, just with the 3D printed legs. We have not yet found a solution to the force sensor problem, but we are going to focus on programming for now.

We began using Fusion 360 to CAD all parts and make sure it fit together



Design Update 7

A solution to the out of sync leg problem has been determined. Using proportional control, the program only moves the legs 180 degrees at a time. This means they will always be in sync. We still working on programming and intend on working on the line following very soon.

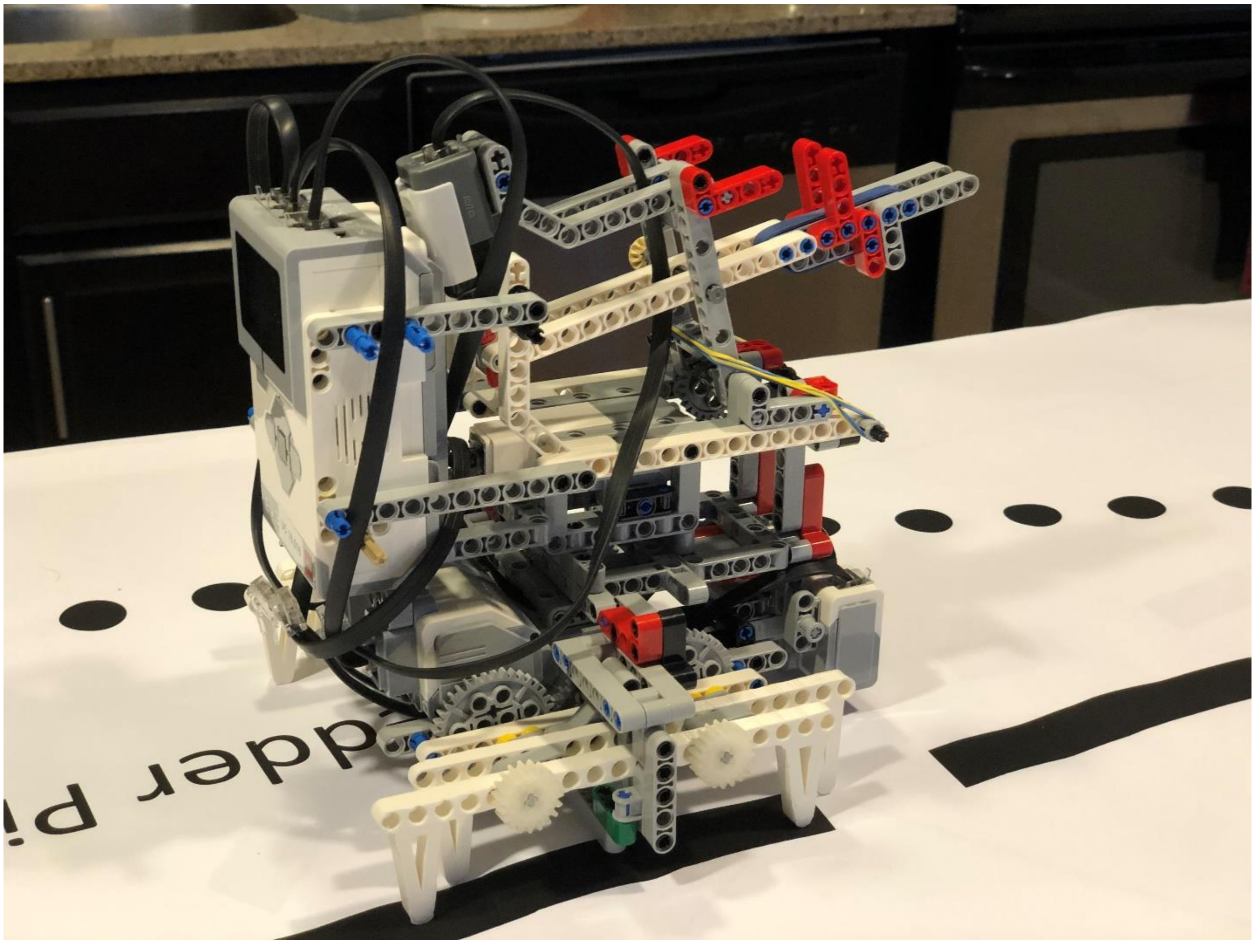
Seth will be taking everything home to work on it for Thanksgiving break.

Design Update 8

Line following has been achieved using two color sensors and backstepping a leg by 180 degrees when a line is detected. The ultrasonic sensor had to be rotated by 90 degrees to accommodate these new sensors.

The only task that we are not confident in for the robot is stepping over the large obstacle. Seth was tasked with determining if there is a way around this.

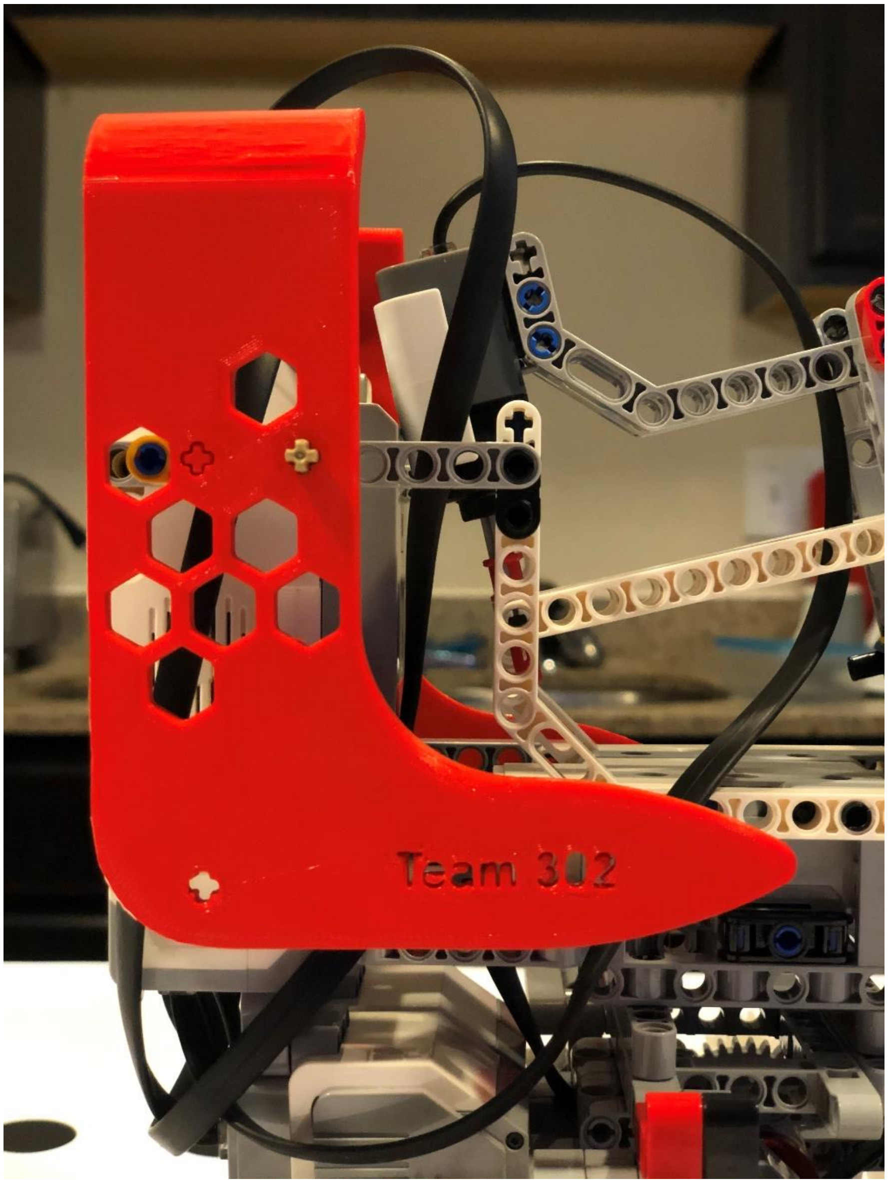
We would also like to add aesthetics to the robot. Seth will design and print these ASAP as the demo is approaching quickly.

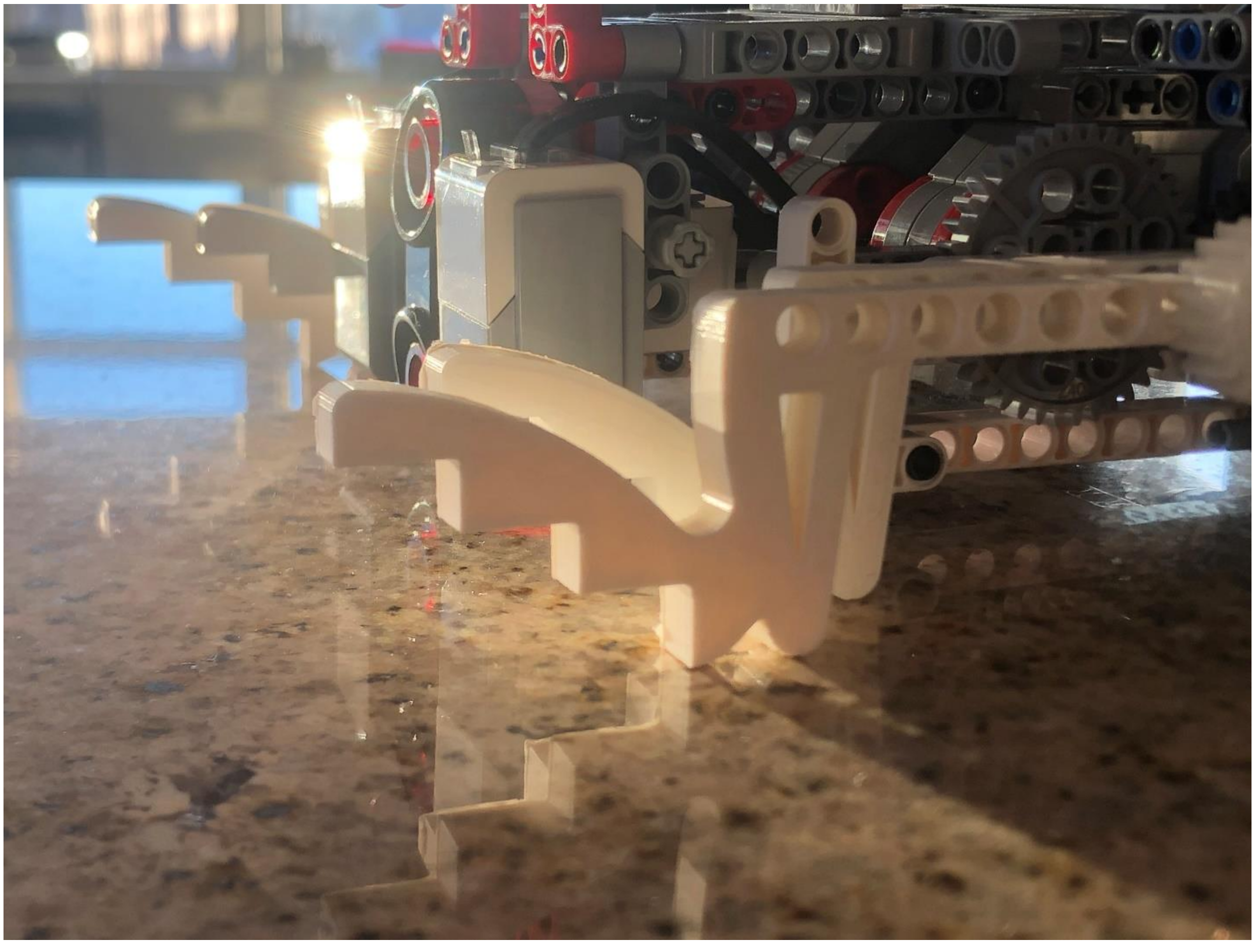


Design Update 9

Seth printed new legs with steps to help the robot go over the obstacles. They were installed but did not work immediate, after adjustments they did. The aesthetics went on well

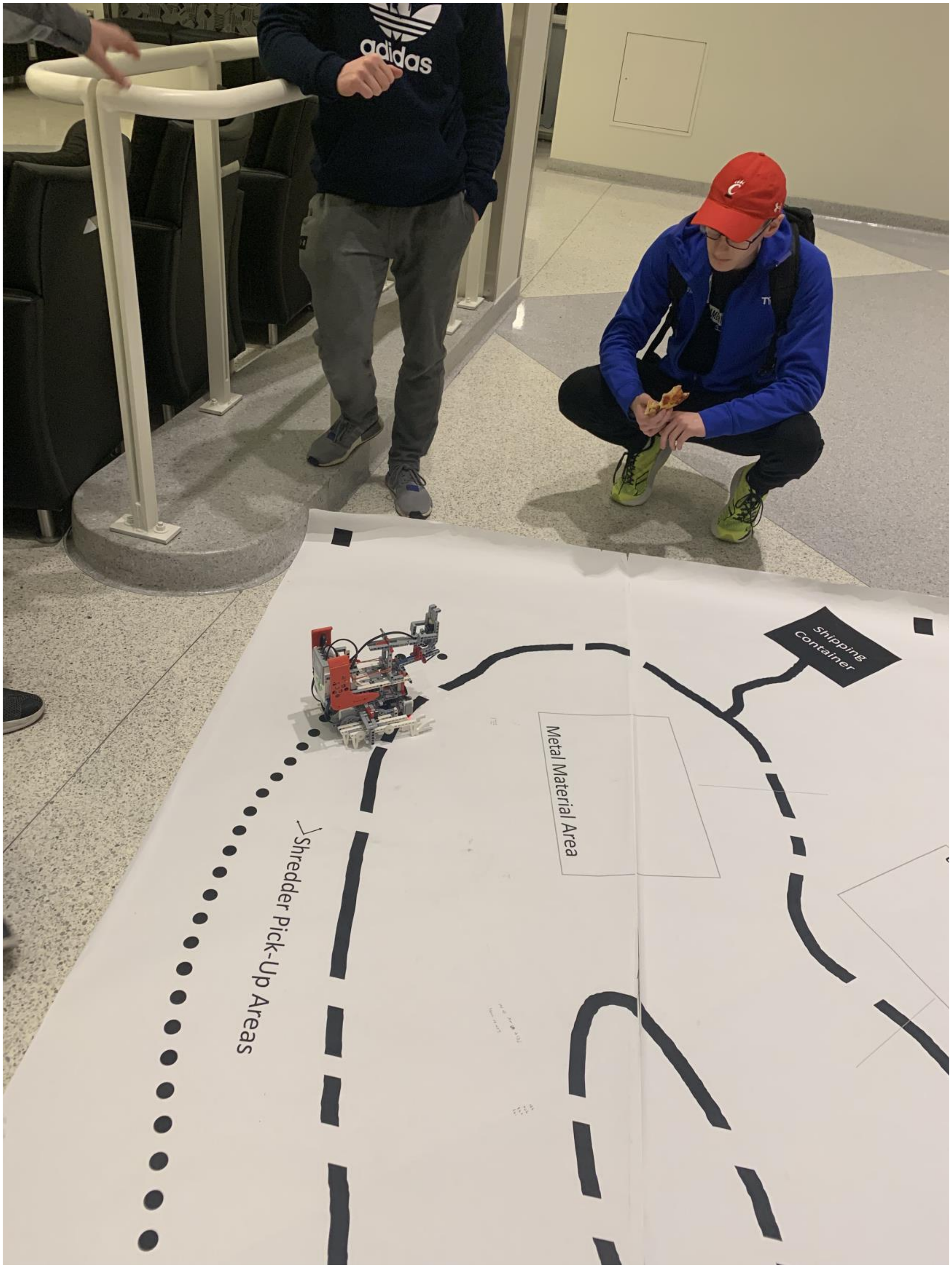
Most of the programming works but we will work to finish it up.

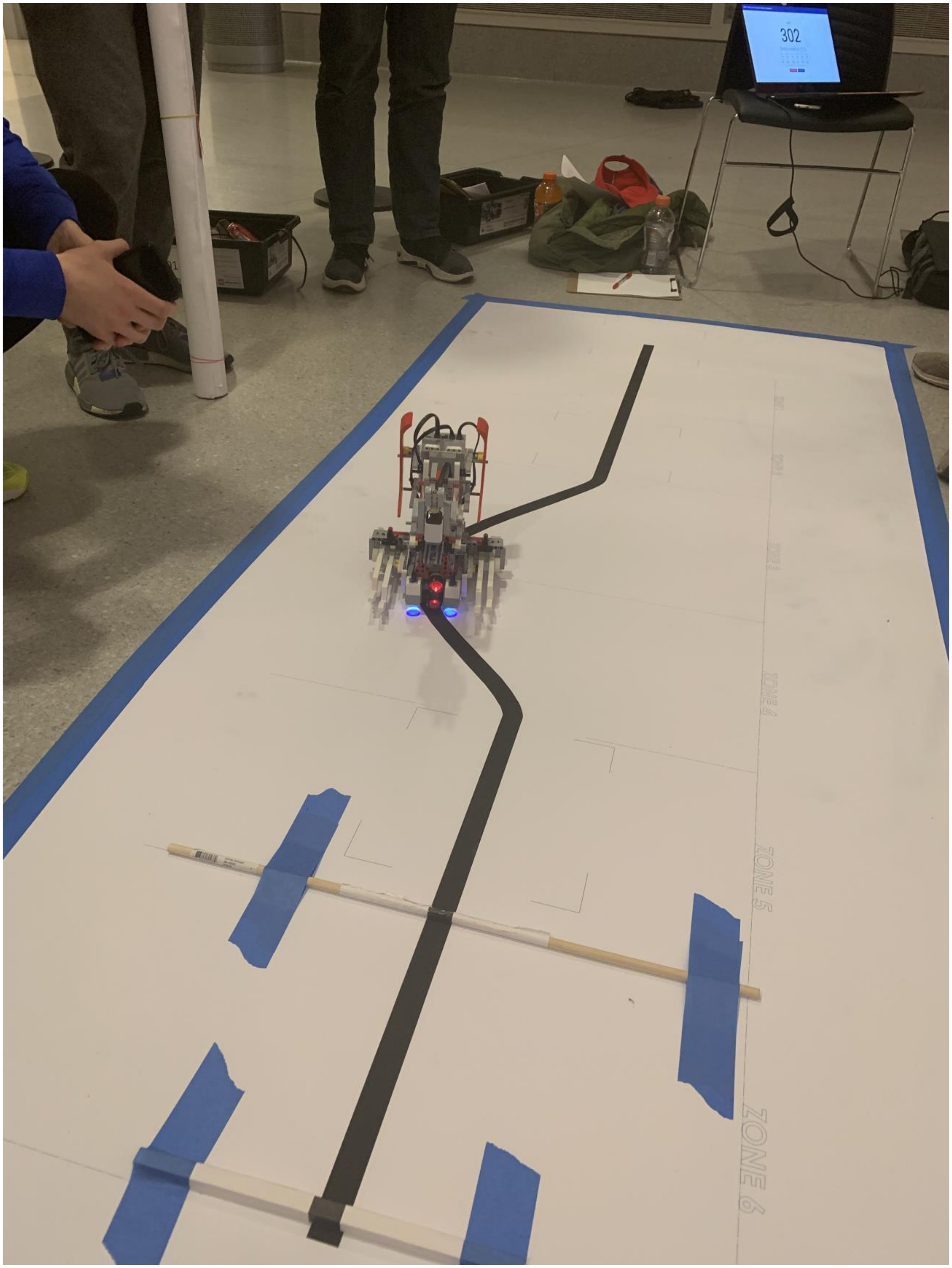

Team 302



Final Demo

The final demo went very well. All members attended. We only lost one point-group for the dotted line task. We all actually had fun and were glad that our hard work paid off. We will soon finish up our documentation and take apart the robot.


adidas
Shipping Container
Metal Material Area
Shredder Pick-Up Areas


302
ZONE 5
ZONE 6

END OF NOTEBOOK