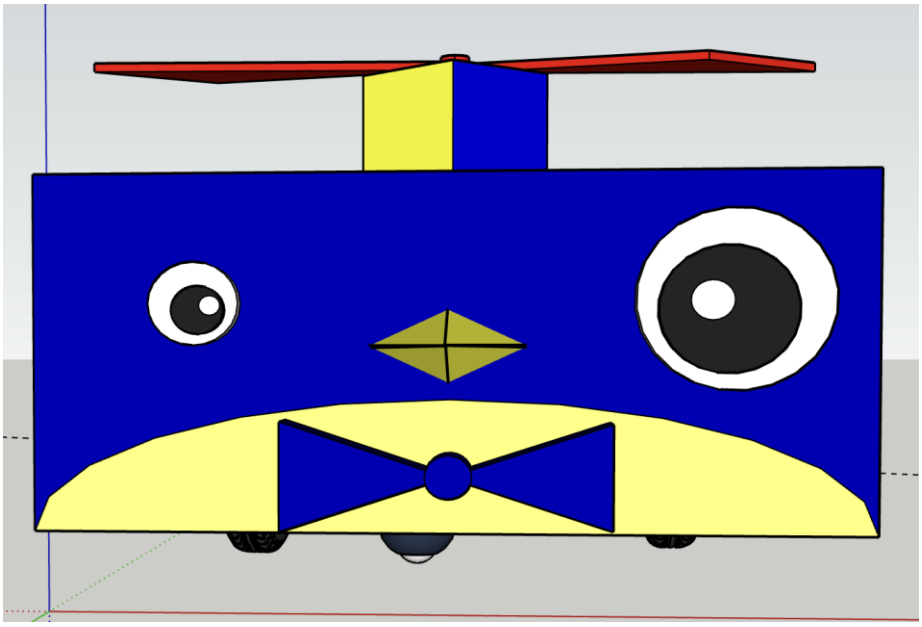

Line Follower Robot

Olivia Chan

Due Date: June 13, 2023

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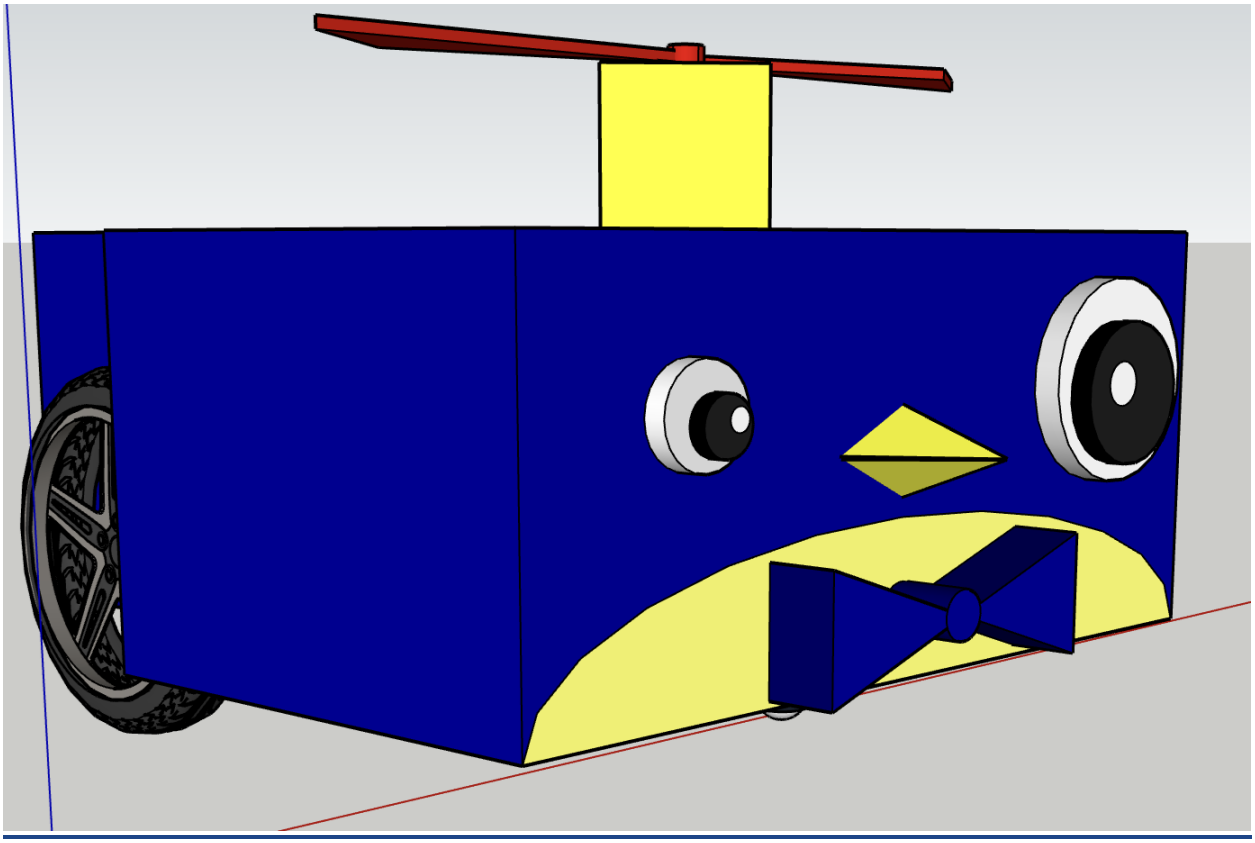
INTRODUCTION:

This project aims to create the iCar, a robotic car designed to navigate through a maze of straight lines with 90 and 45-degree intersections. This robot implements the Arduino circuit. The pathway is made up of black electrical tape, and the car follows these lines closely. The car will go straight, turn left, or right depending on where the black line is relative to the car. The black lines are detected with LDRs placed at the front of the robot. The car is programmed with the C++ language, which allows the robot to move according to the input read from the LDRs. A team of three Grade 12 students — Olivia Chan, Radha Kotra, and Lois Zan created this robot to simulate working on a computer engineering project and to learn how to utilize important engineering skills, such as circuitry design, coding, computer-aided design, and model construction. A 3D design software, SketchUp, was used to design the layout of the robot system.



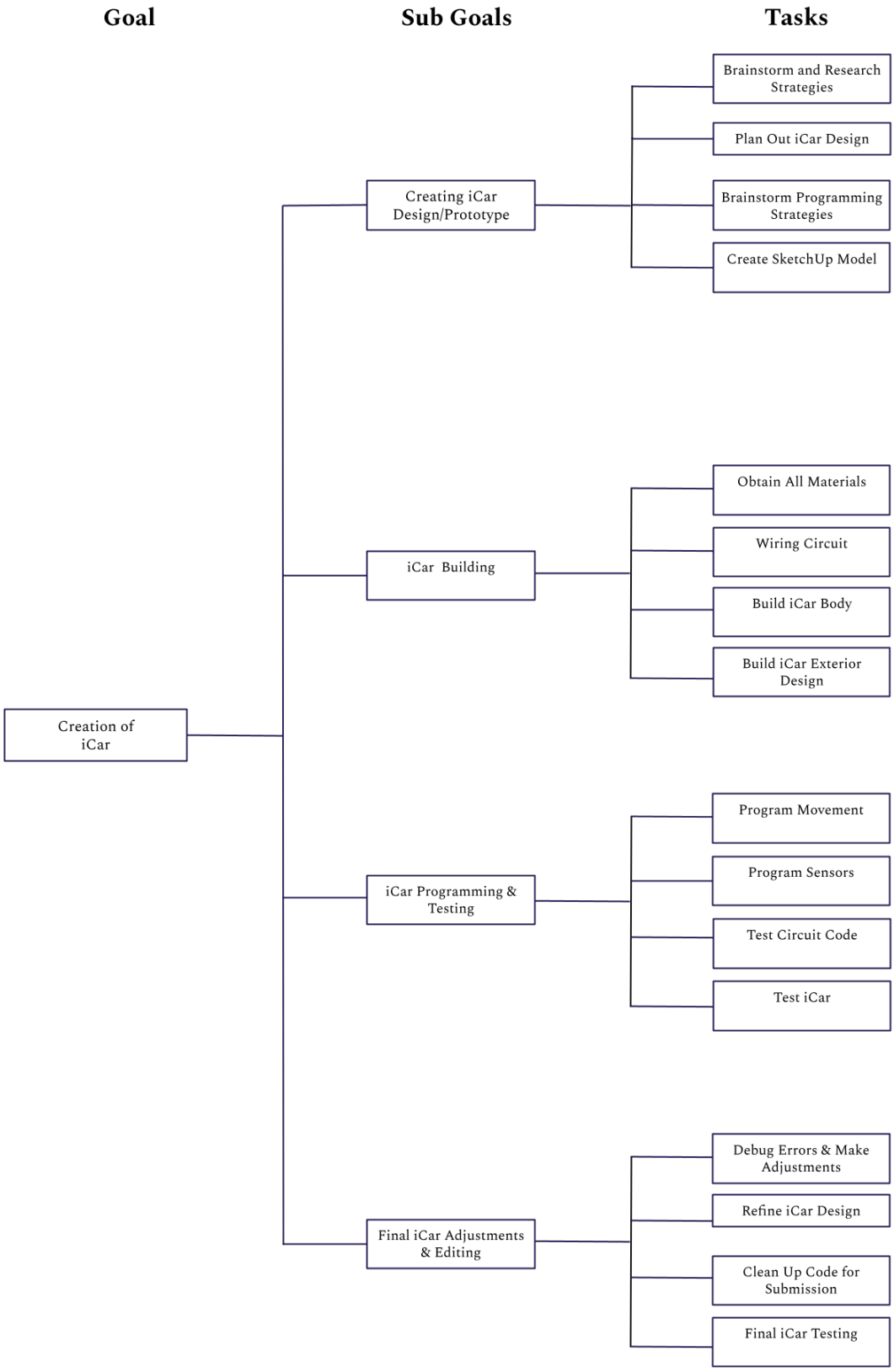
MASTER SCHEDULE

Function: To Build a Competitive iCar Robot that has the ability to navigate through a maze of straight lines with 90 and 45-degree intersections.

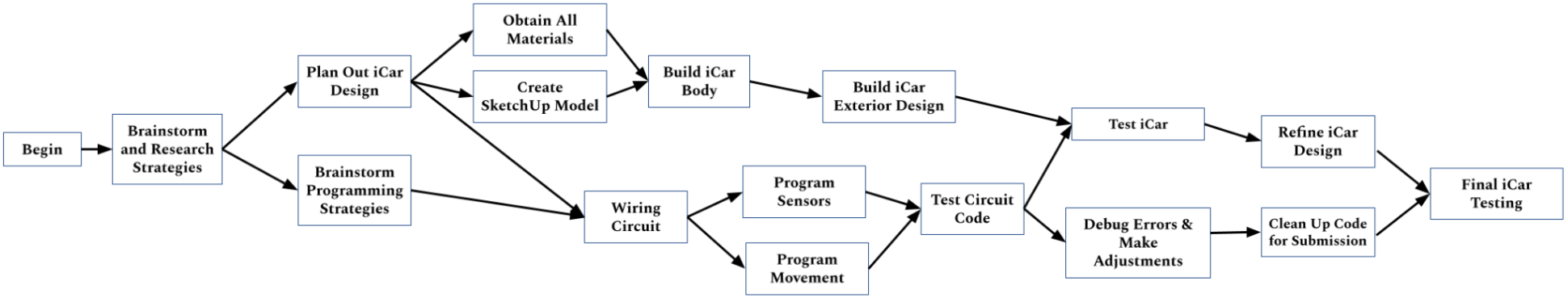
Expected Start Date: April 24, 2023 **Expected End Date:** June 13, 2023

Materials
1 Arduino Uno Rev3 Board
Electrical Wires
2 Wheels
1 Tamiya Gearbox
1 Steel Ball Bearing Wheel
1 7.4 V Lithium Polymer Rechargeable Battery
1 Breadboard
1 L298P Motor Driver Shield
2 LEDs
3 Ultrasonic Sensors
Clipboard (Base)
Paper of various colours (Exterior)
2 Googly Eyes (Exterior)
Yellow sponge (Exterior)
Yellow foam paper (Exterior)

PLANNING ORGANIZER

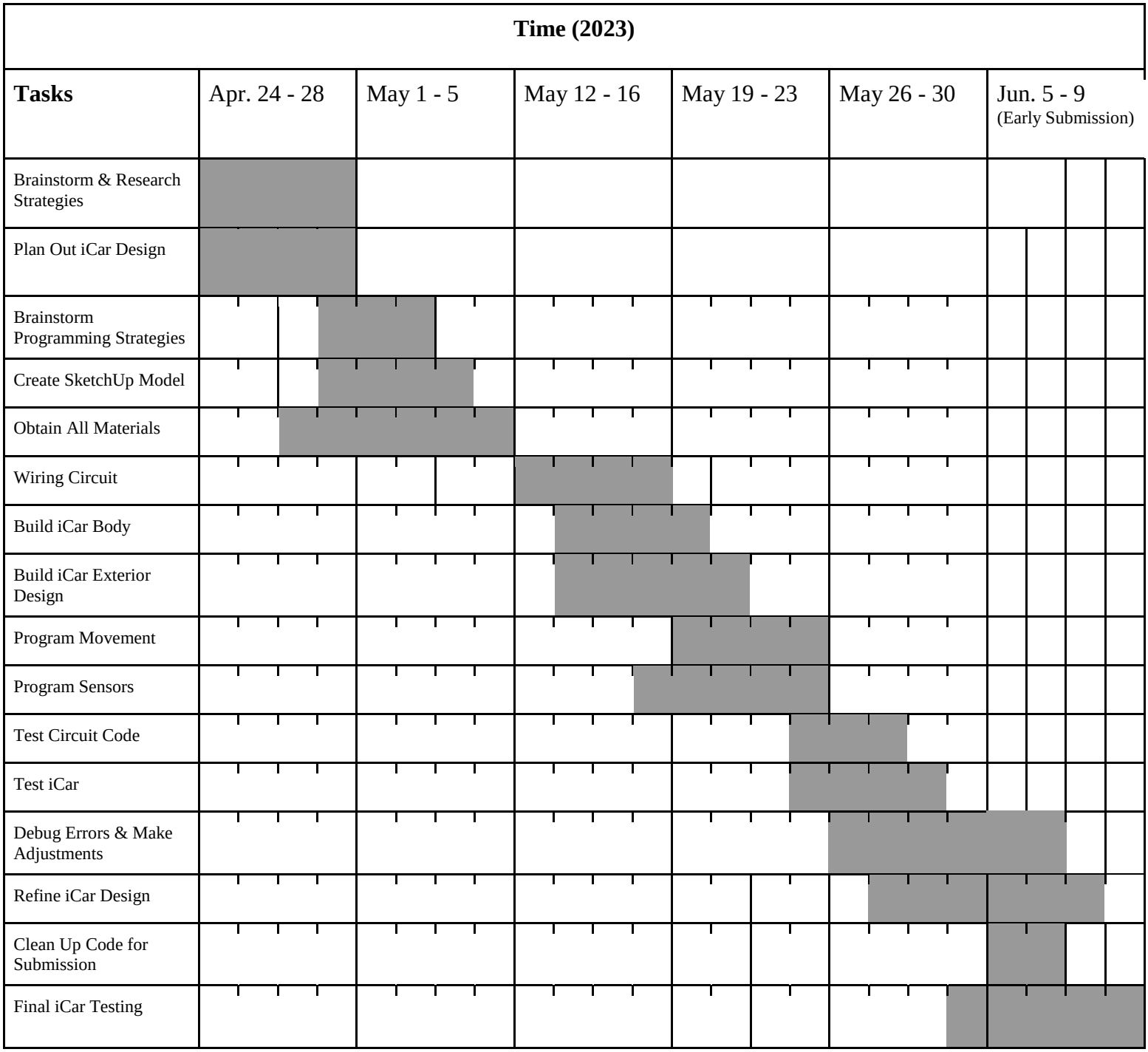


PERT Chart


Begin
Brainstorm and Research Strategies
Plan Out iCar Design
Brainstorm Programming Strategies
Obtain All Materials
Create SketchUp Model
Wiring Circuit
Build iCar Body
Program Sensors
Program Movement
Build iCar Exterior Design
Test Circuit Code
Test iCar
Debug Errors & Make Adjustments
Refine iCar Design
Clean Up Code for Submission
Final iCar Testing

Olivia Chan

GANNT Chart



Weekly Log

Date		Task	Things to be finished		Remarks
From	To		Expected	Actual	
Apr. 24	Apr. 28	Brainstorm & Research Strategies	Research 5 strategies	As Expected	
		Plan Out iCar Design	Brainstorm 3 designs	2 designs brainstormed	Need more time for discussion and research
May 1	May 5	Brainstorm Programming Strategies	Brainstorm 3 strategies	As Expected	
		Create SketchUp Model	Finish interior + exterior model	As Expected	
		Obtain All Materials	Obtain motor shield, batteries, motors, clipboards, & paper	Obtained batteries and motor shield	Still need to obtain a battery & a motor shield
May 12	May 16	Wiring Circuit	Solder wires + parts, connect circuit components together	As Expected	
May 19	May 23	Build iCar Body	Cut clipboard & assemble components together	As Expected	
		Build iCar Exterior Design	Decorate and create the exterior	Not completed	Will be finished after programming.
		Program Movement	Program robot to move smoothly and accurately	Robot follows the line but veers off track occasionally	Had movement issues, fixed by moving LDR positioning closer to the wheels
		Program Sensors	Program robot to detect black line with its sensors	As Expected	
May 26	May 30	Test Circuit Code	Integrate movement and sensor code	As Expected	
		Test iCar	Test movement on black line and timing efficiency	Robot follows the whole path, but over the time limit	Movement is jerky + needs accuracy. Timing is too slow for the last 2 challenges + needs refining.
June 5	June 9	Debug Errors & Make Adjustments	Fix code errors + robot as needed	As Expected	
		Refine iCar Design	Make final changes to the physical bot and code.	As Expected	
		Clean Up Code for Submission	Check code structure for organization, add comments	As Expected	
		Final iCar Testing	Test iCar at least 10 times without failure	Bot completes the entire path a bit over time.	Robot does not consistently perform the last 2 challenges under the time limit.

EVALUATION

Did your project meet your expectations? (min. 2 expectations)

1. The robot was able to trace through the entire maze consistently without going off course or using any hardcode, at a relatively high speed. We were able to meet this goal. In addition, the completed physical robot does resemble our initial designs. The interior design is compact, and the exterior design fits accurately with the other components. Also, the code is comprehensive and structured in a logical way.
2. The car was able to trace one T-intersection in 40 seconds, and one T-intersection and cross-intersection in 50 seconds. Although (at the time of writing), the car still couldn't complete the entire maze within 1 minute and 30 seconds, we were able to increase the robot's speed quite a bit from the initial speed. Originally, it took about 3 and a half minutes to complete the entire maze, whereas now it only takes about 2 minutes.

What would you do differently next time for improvement? (min. 2 areas)

1. Asking for help earlier on instead of always trying to find the solution independently. There were a few issues that we ran into that had simple solutions, but took a while to solve just because we did not have the experience to know what was causing the problem or how to fix it. Asking others earlier on would have helped speed up the solution process. And we did not realize that the refining process would take longer than expected. In comparison to other robots, the building and coding process is around the same, but the refining process is more difficult and quite time-consuming. Since getting the robot to work under the time limit is challenging, previous mechanisms that we might have used had to be refined or completely changed in an effort to decrease the total path time. If the early issues were solved quickly, this would have left more time for the final refinement and adjustment process. It would also have allowed us to complete the robot on the early submission date, but unfortunately, we were unable to accomplish that.
2. Working on communication and checking in on each other a bit more often. It is really important for everyone in the group to know what everyone else is doing even if the work is being split up. This comes in handy when one person has finished their piece but another person needs help because their time can be allocated more efficiently to the work that needs to be done. Although we did create the plan for all the tasks beforehand, we did not really allocate them to specific people. This led to a lot of wasted time when one person was working on something, but the other group members did not know what task they should be working on. Because we did not allocate tasks, members would be too focused on their own tasks to know what other members should be doing at that time. Overall, doing more planning at the start would have allowed us to utilize class time more effectively.