Project 4

Team 297

Charlie Bush (Project Manager), Nekruz Ashrapov (Programmer), Philip Clark (Tester), Braden Burger (Builder)

Contents:

Meeting #1

Meeting Agenda / Minutes	Project/team: Project 4 Team 297

Date/time: 2/10/23 3:30-7:30	Note taker: Philip Clark

Present: All team members

Agenda:

Create a design specification for the beginning of project 4.

Review Gantt Chart

Tasks behind schedule

Task	Why behind	Plan to get up to date

□ Tasks added to chart

Foreseeable issues that will prevent success □ No □ Yes

Decisions made:

The only decision made were for the design specifications and when our next meeting should be.

Important information shared:

How to create a well put together design specification.

Ideas we want to remember:

Do not fall behind on any of the tasks.

Team member	Hours on project since last meeting (hrs)	Total hours on project (hrs)
Nekruz Ashrapov	4	4
Philip Clark	4	4
Charlie Bush	4	4

Design Specifications

Meeting #2

Meeting Agenda / Minutes	Project/team: Project 4 Team 297

Date/time:2/15/23 10:00 A.M-2:00 P.M	Note taker: Philip Clark

Present: All team members

Agenda:

Construction of the robot and starting the code to go with the first subtask.

Review Gantt Chart

Tasks behind schedule

Task	Why behind	Plan to get up to date
Code	We delayed the building of the robot, which stopped the code from being made.	Work on the easy parts of the code to speed up the coding process.

□ Tasks added to chart

Foreseeable issues that will prevent success □ No □ Yes

Decisions made:

We decided on the construction of our robot for now and the beginning of the code.

Important information shared:

We all shared our thoughts on what the robot should be able to do and look like in order to achieve the first subtask.

Ideas we want to remember:

The code might take long, so it is important to check in with the coder for any issues.

Team member	Hours on project since last meeting (hrs)	Total hours on project (hrs)
Philip Clark	4	8
Charlie Bush	4	8
Nekruz Ashrapov	4	8

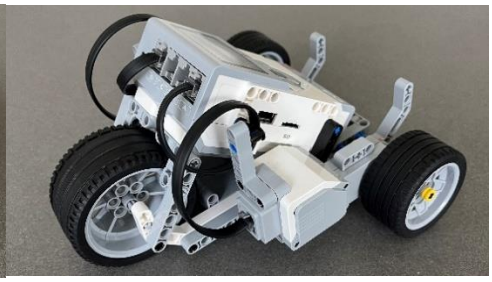
Ideate and Prototype

First Concept for Subtask 1:

- This initial concept for our subtask 1 design was to have one wheel in the back and two in the front. This was a bad idea however, because it left the robot unable to turn.

Second Concept for Subtask 1:

- This design is similar to the last one, but the back wheel is larger, and the structure was stable. This design didn't last long though because it had the same issues as the previous design of not turning. This required a complete redesign.

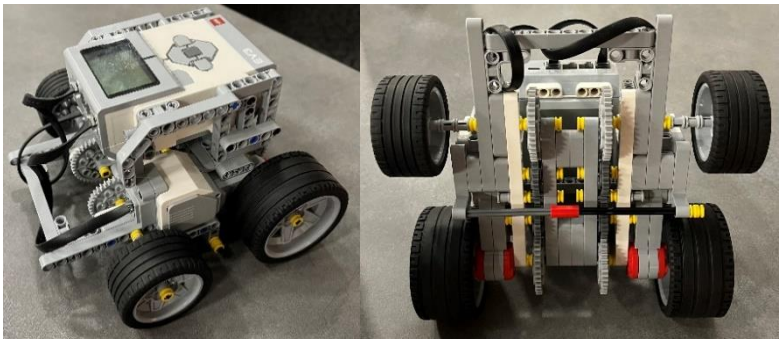


Third Concept for Subtask 1:

- This redesign was a big upgrade from the last, with an addition of a fourth wheel and the ability to turn. The issue with this design however was the fact that the tires were causing too much friction, making it very hard to turn.

Final Concept for Subtask 1:

- This concept ended up being the final concept we used for Subtask 1. If we were given more time, we could've come up with a better design, but the time was a constraint. This design is very similar to the previous one, except for the wheels are a bit wider in order to get slightly easier turns. We also made the front wheel a bit shorter to allow for more room next to the motors.



Code for Subtask 1

```
def subtask1A():
    gyro.reset_angle(0)
    for i in range(lap):
        gyroForward(distAnce,speed)
        gyroForward(0,speed*-1)
    robot.stop()
    rightMotor.brake()
    leftMotor.brake()

subtask1A()
```

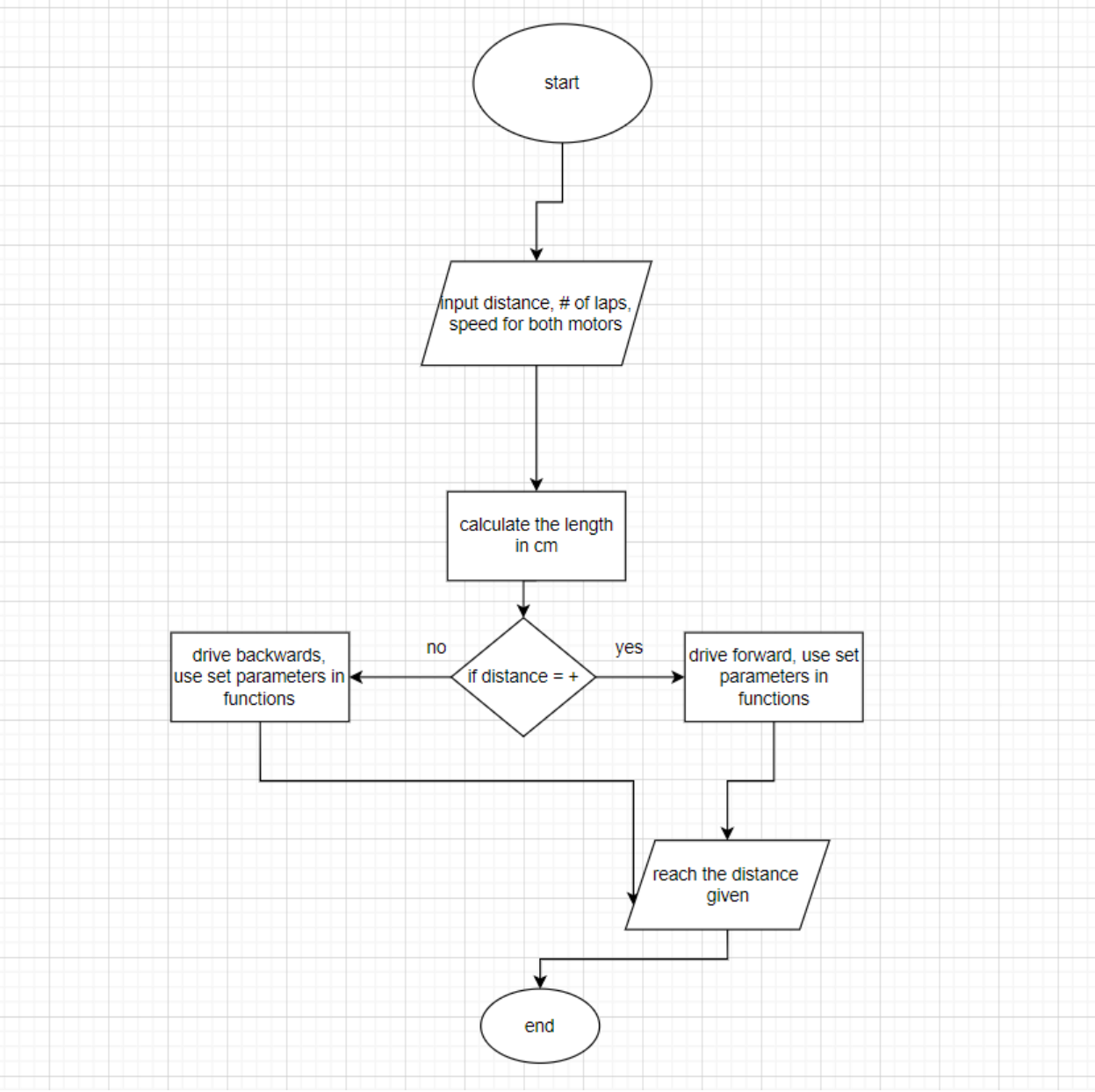
```python
ev3 = EV3Brick()


rightMotor = Motor(Port.C)
leftMotor = Motor(Port.B)
gyro = GyroSensor(Port.S3)
ultrasonic_sensor = UltrasonicSensor(Port.S2)
robot = DriveBase(leftMotor, rightMotor)



distAnce = 60 #cm
lap = 1
speed = 200 #mm/s


distAnce = (17.136*distAnce)-20.00



#straight function
def gyroForward(dist,speed1):
    if dist > 0:
        while robot.distance() < dist:
            accuracy = (0 - (gyro.angle()* 10))
            robot.drive(speed1, accuracy)
            angle = gyro.angle()


    else:
        while robot.distance() > 2:
            accuracy = (0 - (gyro.angle()* 10))
            robot.drive(speed1, accuracy)
            angle = gyro.angle()


    robot.stop()
    robot.reset_angle(0)
```

We started testing with different codes and we came to our final code which was this concept. This code was able to have the robot walk forward and turn around while keeping it in line. We wanted to make the turning as easy as possible without a gyro sensor, so we decided to have one motor run backwards while the other one ran forwards. We timed this up to figure out how to turn it around exactly 180 degrees. We tested it out with a gyro sensor to see if it would work with our robot, but we were unable to get the gyro sensor to work exactly how we wanted too.

Our robot ran the codes well even when higher numbers were inputted for it to walk back and forth many times.

The code uses variables that will work for Subtask 1, but we will not be able to do that for the final presentation. We know we will need to get the gyro sensor running at the final presentation because we will not be able to input constants into our code. We will also need the ultrasonic sensor working which we have begun testing for.

Flow Diagram for Subtask 1



This flow diagram goes through the code we used for Subtask 1. The first step was to input the correct distance we were going to use. Then we needed to convert this to centimeters in order for the code to run correctly. We would then determine if the number input was positive or

negative, which would tell us whether the robot would be walking backwards or forwards. Once it figures out which way it walks, the robot will then walk to the distance it will be given.

Meeting #3

Meeting Agenda / Minutes	Project/team: Project 4 Team 297

Date/time: 2/20/23 5:00-7:00 P.M	Note taker: Philip Clark

Present: All members

Agenda:

Test the robot to see if it works with our new code and prepare for subtask 1.

Review Gantt Chart

Tasks behind schedule

Task	Why behind	Plan to get up to date

□ Tasks added to chart

Foreseeable issues that will prevent success □ No □ Yes

Decisions made:

The code was finished alone, so we were able to test the robot during the meeting.

Important information shared:

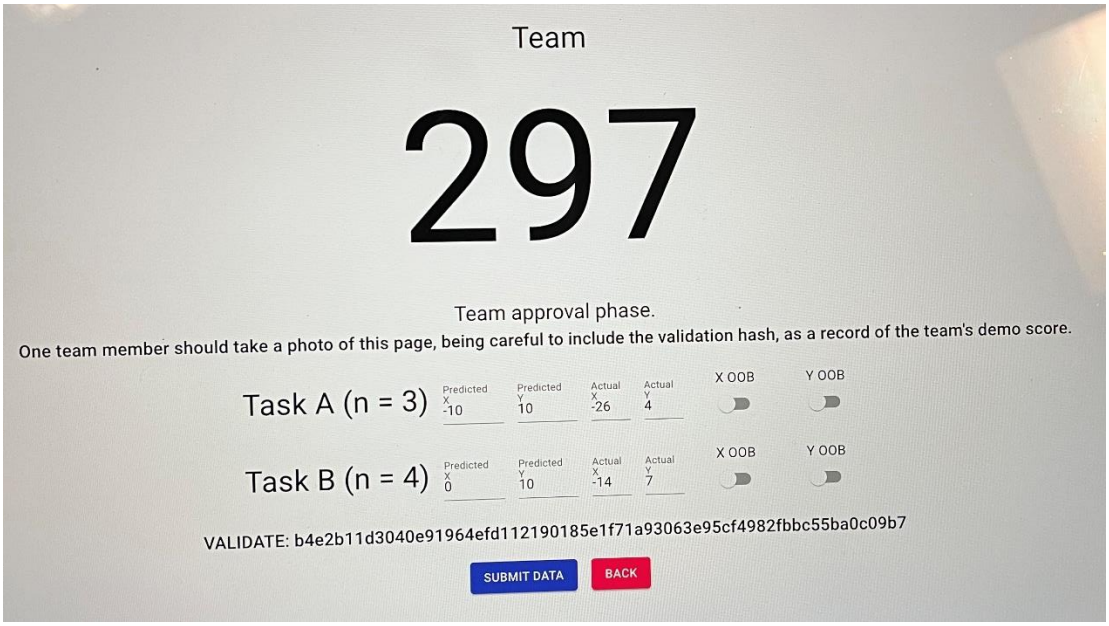
The robot ran well with the code, and we believe it will be ready for subtask 1.

Ideas we want to remember:

We want to try to test the robot earlier for future subtasks.

Team member	Hours on project since last meeting (hrs)	Total hours on project (hrs)
Philip Clark	8	10
Nekruz Ashrapov	8	10
Charlie Bush	8	10

Subtask 1: Results



- This was our score for subtask 1 . For the first test, we estimated an error of 10 cm to the left and 10 cm above the center. When we ran the test, the robot did great at going the distance required, but on the way back, the robot deviated from its original path quite a bit as it deviated 26 cm to the left and 4 cm above the center. For the second task, we expected our robot to perform better with 0 deviation left or right but a 10 cm deviation upward. When we ran the test the robot naturally went slightly right and this caused the robot deviate from the center line, when it went to turn, it turned exactly 180, but since it was now off center, it started to go off course. Our robot ended with an error of 14 cm to the left and 7 cm above the target. We are

content with the results of the subtask. We did not expect the error to be as much as it was, but it was able to help us see what we needed to fix with our code and our robot.

Meeting #4

Meeting Agenda / Minutes	Project/team: Project 4 Team 297

Date/time: 3/3/2023 3:30-4:30	Note taker: Philip Clark

Present: All team members

Agenda:

Go over the next steps for Project 4. Start getting ready for the mid-project review.

Review Gantt Chart

Tasks behind schedule

Task	Why behind	Plan to get up to date

□ Tasks added to chart

Foreseeable issues that will prevent success ☐ No □ Yes

Decisions made:

Made Decisions on who will do what part leading up to the mid-project review. Also worked on some of the tests for the review. Add Braden to the group.

Important information shared:

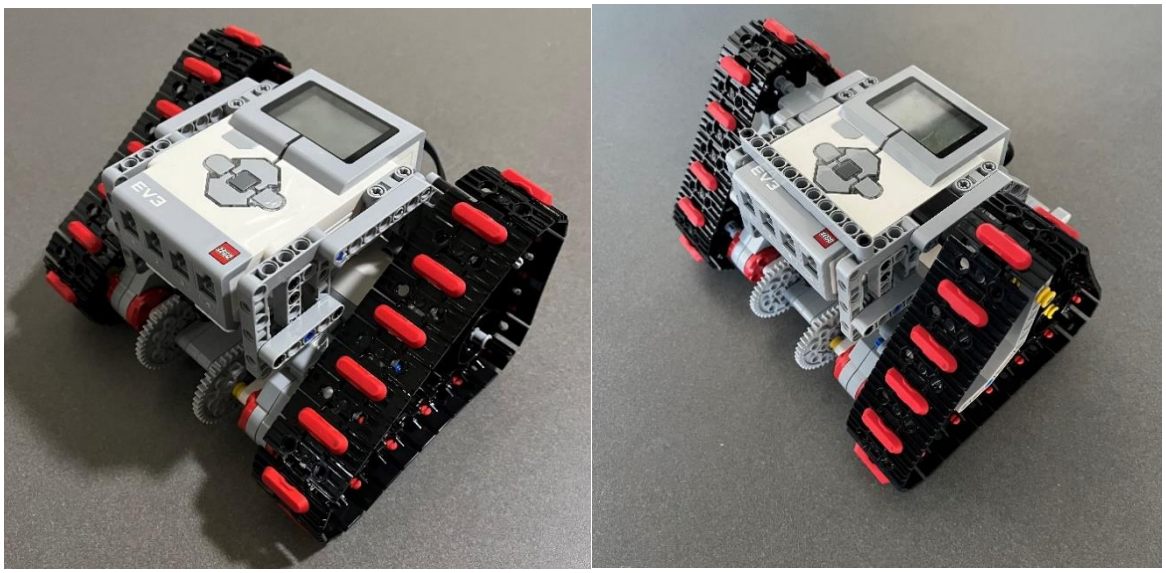
Everyone learned what tasks they should be working on for the next parts of the project.

Ideas we want to remember:

Always let the group know when you are struggling on a task.

Team member	Hours on project since last meeting (hrs)	Total hours on project (hrs)
Philip Clark	10	11
Charlie Bush	10	11
Braden Burger	0	1
Nekruz Ashrapov	10	11

Post subtask 1 redesign:



This is our next redesign of our robot. We changed the wheels for tank treads because we think that it will help our movement and turning. One slight problem with this design is that there is a decent amount of tension on the axel of the treads.

Meeting #5

Meeting Agenda / Minutes	Project/team: Project 4 Team 297

Date/time: 3/7/2023 7:00-9:00	Note taker: Philip Clark

Present: All members

Agenda:

Test our robot from the Locomotion excel file for the mid-project review

Review Gantt Chart

Tasks behind schedule

Task	Why behind	Plan to get up to date

☐ Tasks added to chart

Foreseeable issues that will prevent success ☐ No ☐ Yes

Decisions made:

We decided to find the best way to get our robot to the exact distances in the locomotion file. We used our calculations from all of our expected distances compared to our actual distances.

Important information shared:

We shared important information on what will make our robot move in the correct x and y directions.

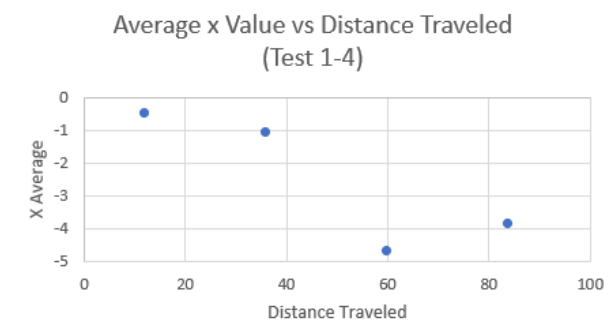
Ideas we want to remember:

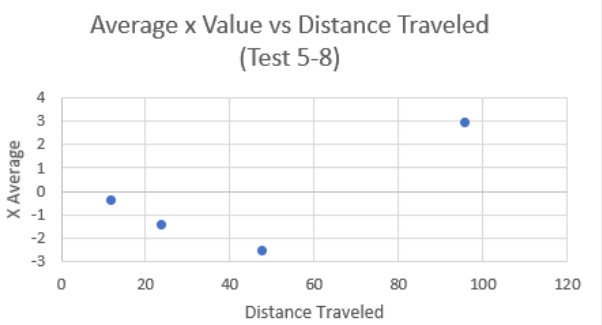
The robot may not always move in the direction at the exact same length every single time.

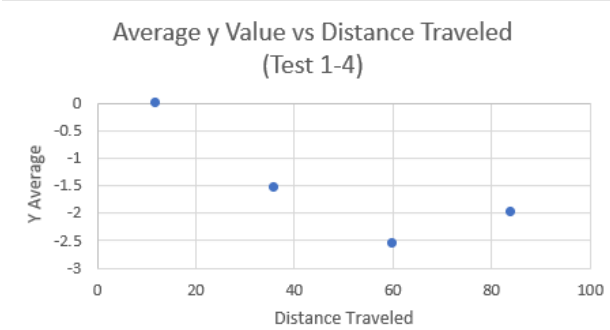
Team member	Hours on project since last meeting (hrs)	Total hours on project (hrs)
Philip Clark	11	13
Charlie Bush	11	13
Braden Burger	1	3
Nekruz Ashrapov	11	13

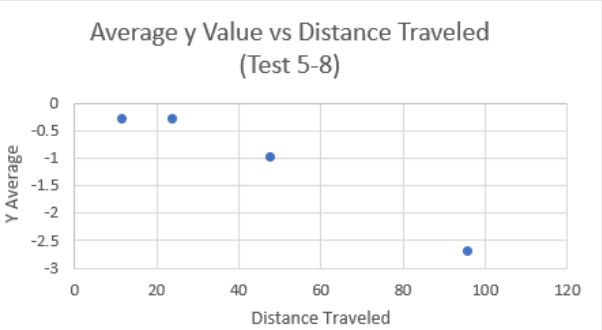
Mid-Point Test Results:

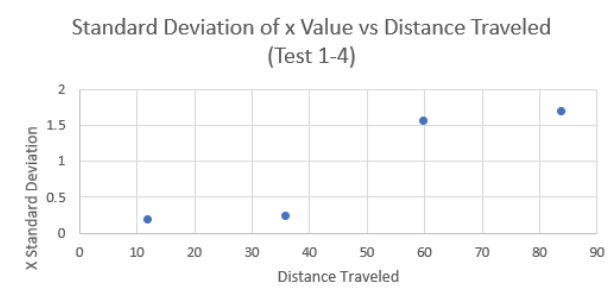
Test	Distance away from expected - x	Distance away from expected - y	Test Averages		Test Standard Deviations	
1	-0.5	0	X Value:		X Value:	
1	-0.25	0		-0.5		0.176776695
1	-0.75	0	Y Value:		Y Value:	
1	-0.5	0		0		0
1	-0.5	0				
2	-1	-2.25	X Value:		X Value:	
2	-1	-1		-1.1		0.223606798
2	-1	-1.5	Y Value:		Y Value:	
2	-1	-1		-1.55		0.570087713
2	-1.5	-2				
3	-2	-5	X Value:		X Value:	
3	-4.75	-2		-4.7		1.555233101
3	-5.5	-1.5	Y Value:		Y Value:	
3	-5.75	-2		-2.55		1.396424004
3	-5.5	-2.25				
4	-5.25	-2.5	X Value:		X Value:	
4	-6	-2		-3.85		1.691892432
4	-3	-2	Y Value:		Y Value:	
4	-3	-2		-2		0.353553391
4	-2	-1.5				
5	-0.5	-0.5	X Value:		X Value:	
5	-0.5	-0.5		-0.45		0.447213595
5	-0.5	0	Y Value:		Y Value:	
5	-1	-0.5		-0.3		0.273861279
5	0.25	0				
6	-2.5	0.25	X Value:		X Value:	
6	-1.5	-0.25		-1.45		0.670820393
6	-1	-0.25	Y Value:		Y Value:	
6	-0.75	-0.25		-0.3		0.447213595
6	-1.5	-1				
7	1	-0.5	X Value:		X Value:	
7	-4.5	-1		-2.6		2.162174831
7	-4	-1.5	Y Value:		Y Value:	
7	-3	-1		-1		0.353553391
7	-2.5	-1				
8	2.5	-2.5	X Value:		X Value:	
8	6.5	-4		2.88		4.962056025
8	4.5	-2.5	Y Value:		Y Value:	
8	6.4	-2		-2.7		0.758287544
8	-5.5	-2.5				

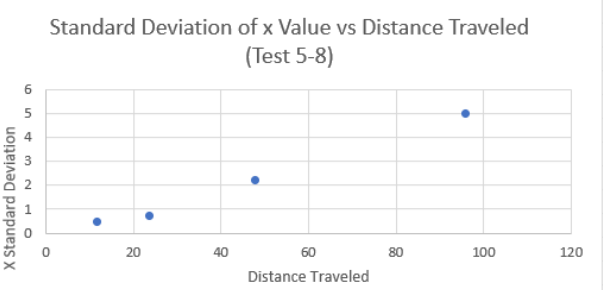

Average x Value vs Distance Traveled
(Test 1-4)
X Average
Distance Traveled

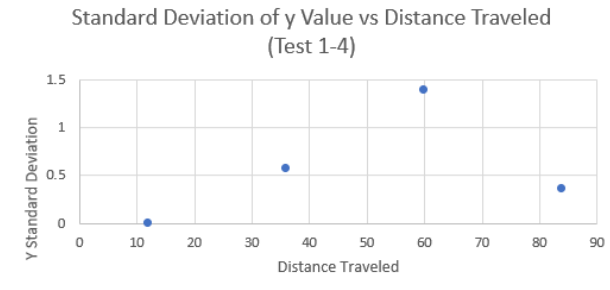

Average x Value vs Distance Traveled
(Test 5-8)
X Average
Distance Traveled

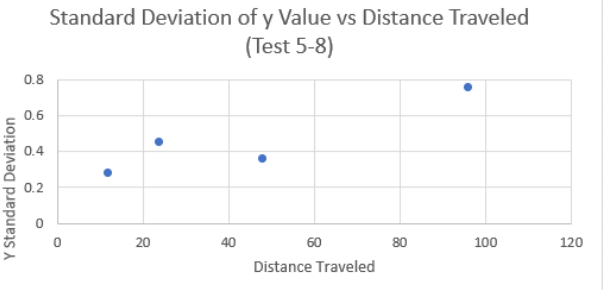

Average y Value vs Distance Traveled
(Test 1-4)
Y Average
Distance Traveled


Average y Value vs Distance Traveled
(Test 5-8)
Y Average
Distance Traveled


Standard Deviation of x Value vs Distance Traveled
(Test 1-4)
X Standard Deviation
Distance Traveled


Standard Deviation of x Value vs Distance Traveled
(Test 5-8)
X Standard Deviation
Distance Traveled


Standard Deviation of y Value vs Distance Traveled
(Test 1-4)
Y Standard Deviation
Distance Traveled


Standard Deviation of y Value vs Distance Traveled
(Test 5-8)
Y Standard Deviation
Distance Traveled

Summary:

When we tested tests 1 through 4, we discovered that our robot still favored the left side. For the first test, our robot deviated left an average of .5 in. Our robot was very good at going the desired distance, achieving a deviation of 0 in the y direction. For our second test, our robot still favored the left side achieving a deviation of 1 in to the left and a deviation of 1 below the desired mark. Tests 3 and 4 show a similar trend with a deviation left of 5.5 and 4 respectively and a deviation down of about 1.75 for both.

When we ran tests 5 through 8, we were pleasantly surprised at the data we got from the tests. Test 5 saw a deviation left of only .5 in and .25 in down. Test 6 saw a deviation left of 1.5 in and 1 in down. Test 7 saw a slightly higher deviation of 3.5 in left and 1.25 in down. Test 8 saw an even bigger deviation of -5 in the x direction and -2.5 in the y direction.

We think that the increase in average deviation during our tests is from the increasing distance our robot had to travel. This was especially evident in test 7 and 8 as the robot had to turn 90 degrees and then travel 96 in in a straight line. Even though we had tweaked our robot to lessen its tendency to turn right, this great distance the robot had to travel soon showed that it still deviated left significantly.

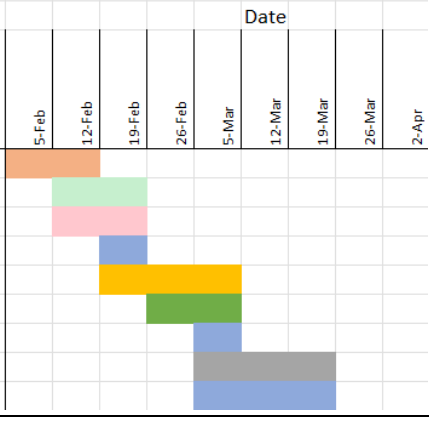
This testing has shown our group that while our robot is good, there are still some major improvements to make. One of the biggest improvements we see is to reduce the turning left. This can be done by splitting the motors in the code into their own driving bases which would allow us to increase the left motors power or speed by a factor that would keep it consistent with the right motor. We also think that adding the gyro sensor and a while loop that senses if the angle is greater than 2, then the motors will reduce the speed in one which will redirect our robot back to a straighter path. This would help our robot to not turn left and would help reduce the

errors in its movement. This mid-point test has shown us that there is a lot more we need to improve on for our robot if we are to have a successful and functional robot.

GANTT Chart

Project Name: Project 4
Project Team: 297

Task ID	Task	Start	finish	Responsible	% Complete
1	Design Specifications	8-Feb	12-Feb	Nekruz, Philip	100
2	Develop Robot Design for Subtask 1	12-Feb	20-Feb	Charlie	100
3	Develop Python Code for Subtask 1	12-Feb	20-Feb	Nekruz	100
4	Subtask 1	20-Feb	20-Feb	Team	100
5	Redesign Robot Locomotion	20-Feb	6-Mar	Charlie, Braden	100
6	Develop Code for Midpoint Testing	26-Feb	6-Mar	Charlie, Nekruz	100
7	Test Robot for Locomotion	7-Mar	7-Mar	Team	100
8	Develop Lifting Mechanism for Box	5-Mar	20-Mar	Braden	15
9	Develop Barcode Scanner	5-Mar	20-Mar	Team	0



Meeting #6

Meeting Agenda / Minutes

Project/team: Project 4 Team 297

Date/time: 3/30/2023 7:00-9:00

Note taker: Philip Clark

Present: All members

Agenda:

Check on our progress for the final demo.

Review Gantt Chart

Tasks behind schedule

Task	Why behind	Plan to get up to date

☐ Tasks added to chart

Foreseeable issues that will prevent success ☐ No ☐ Yes

Decisions made:

We decided what type of device we wanted to use to pick up the box with. We also worked on the coding to scan for the barcode.

Important information shared:

We shared important information on what will fix any issues we have with the robot

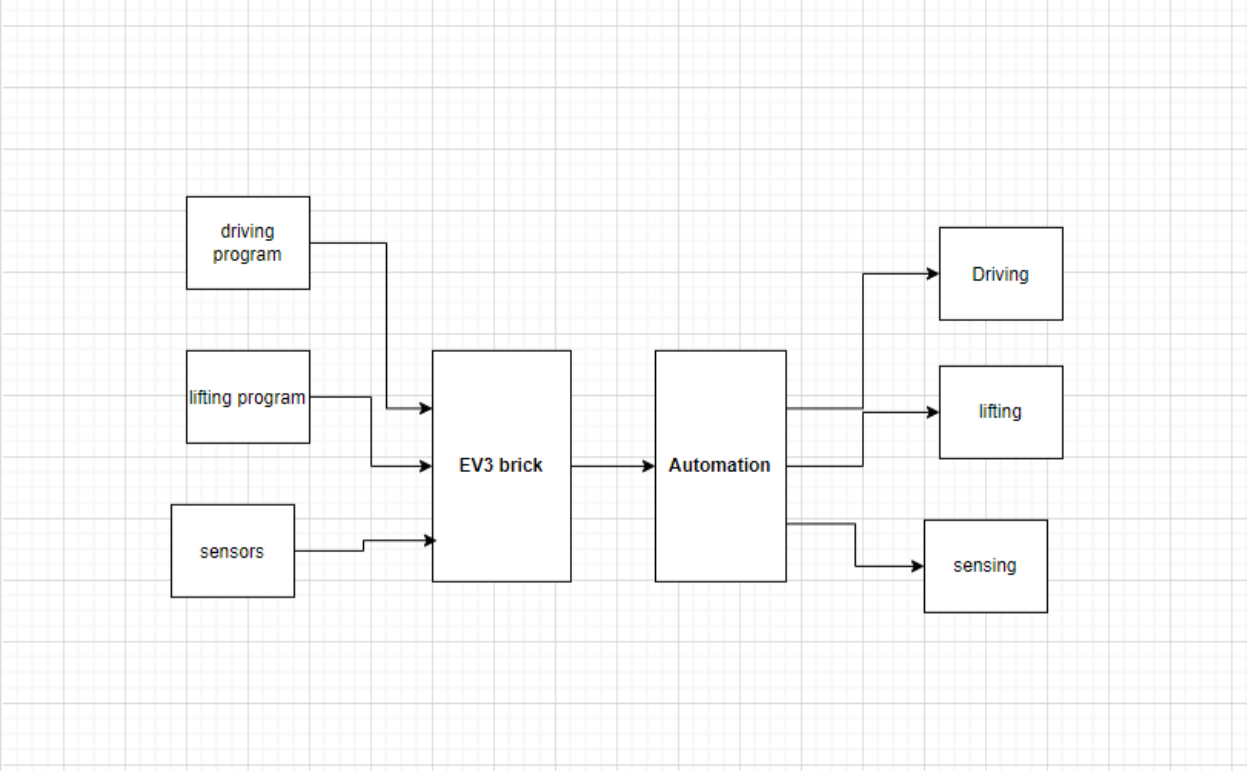
Ideas we want to remember:

The robot needs to be able to detect the angle with the gyro sensor.

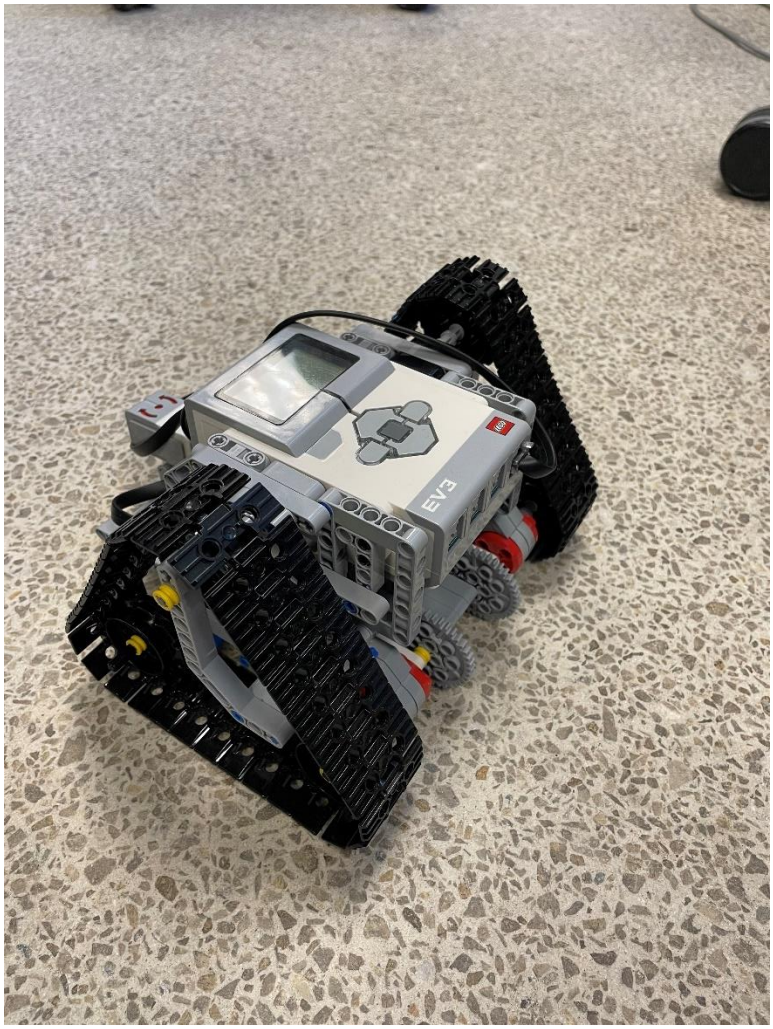
Team member	Hours on project since last meeting (hrs)	Total hours on project (hrs)
Philip Clark	13	15
Charlie Bush	13	15

Braden Burger	3	5
Nekruz Ashrapov	13	15

Flowchart for Final Demo



Robot Redesign



After we had completed further testing, we decided to remove the red grips as they caused problems>

Changes:

- Removed red tracks
- Fixed gyro sensor

Meeting #7

Meeting Agenda / Minutes | Project/team: Project 4 Team 297

Date/time: 4/4/2023 7:00-9:00 | Note taker: Philip Clark

Present: All members

Agenda:

Created the code for the claw and tested other codes.

Review Gantt Chart

Tasks behind schedule

Task	Why behind	Plan to get up to date

☐ Tasks added to chart

Foreseeable issues that will prevent success ☐ No ☐ Yes

Decisions made:

We decided which arm would be the best from all of the ones we created. We then figured out what code would work best with.

Important information shared:

We shared ideas on the code. We decided which one would be the simplest and easiest for the robot.

Ideas we want to remember:

The robot needs to be able to pick up the box from a certain distance.

Team member	Hours on project since last meeting (hrs)	Total hours on project (hrs)
Philip Clark	15	17
Charlie Bush	15	17
Braden Burger	5	7
Nekruz Ashrapov	15	17

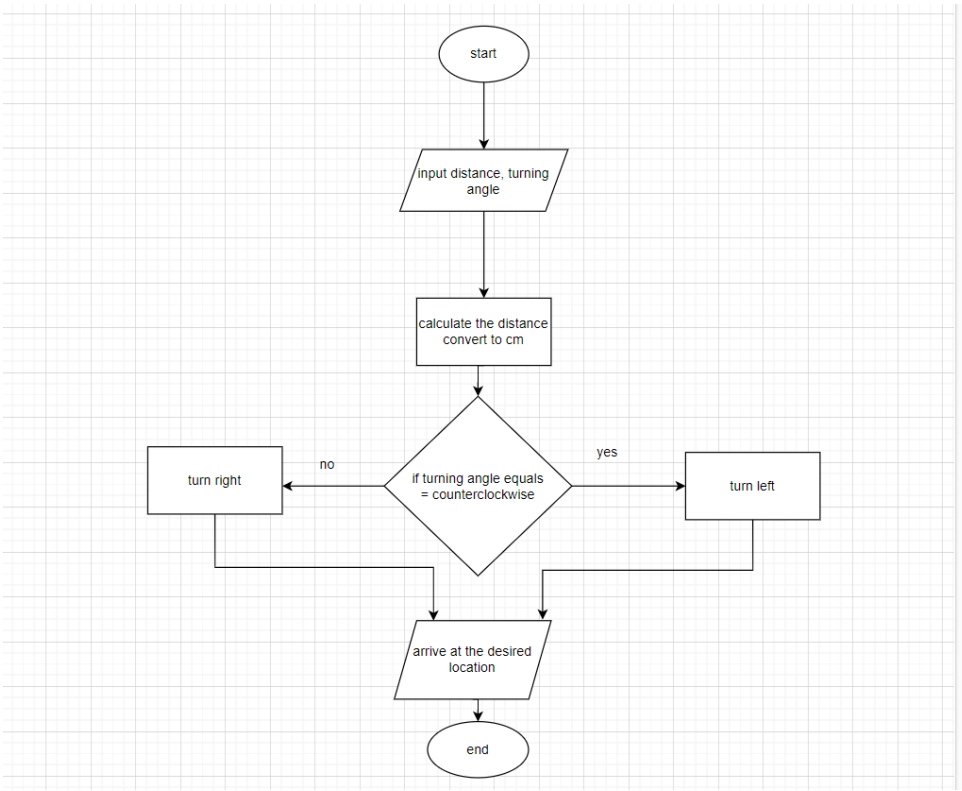
Final Robot Redesign

Changes:

- **Added ultrasonic sensor to sense distance from box**
- **Added color sensor to read barcode.**
- **Re-wrote coded and improved structure**

Subtask1

```
def subtask1():
    g=12
    g=g*2.54+15.24
    gyro.reset_angle(0)
    gyroDrive(118, 200)
    gyroTurn(90, 200, 'counterclockwise')


    gyro.reset_angle(0)
    gyro.reset_angle(0)
    gyroDrive(g+155,200)
    wait(5000)



    gyroTurn(90, 200, 'clockwise')

    gyro.reset_angle(0)
    gyro.reset_angle(0)
```



This is our code and flow chart for subtask1. We have our robot going the distance required, turning and stopping at requested distance, and then continuing to the final position.

Meeting #8

Meeting Agenda / Minutes | Project/team: Project 4 Team 297

Date: 4/11/2023 7:00 PM-4/12/23 7:00 AM (All-nighter) | Note taker: Philip Clark

Present: All members

Agenda:

Test our final code and make sure all subtasks are being completed successfully.

Review Gantt Chart

Tasks behind schedule

Task	Why behind	Plan to get up to date

☐ Tasks added to chart

Foreseeable issues that will prevent success ☐ No ☐ Yes

Decisions made:

We made decisions on what our final code and design would be for the robot.

Important information shared:

We shared what ideas would help the robot run best with the inputs that are added in.

Ideas we want to remember:

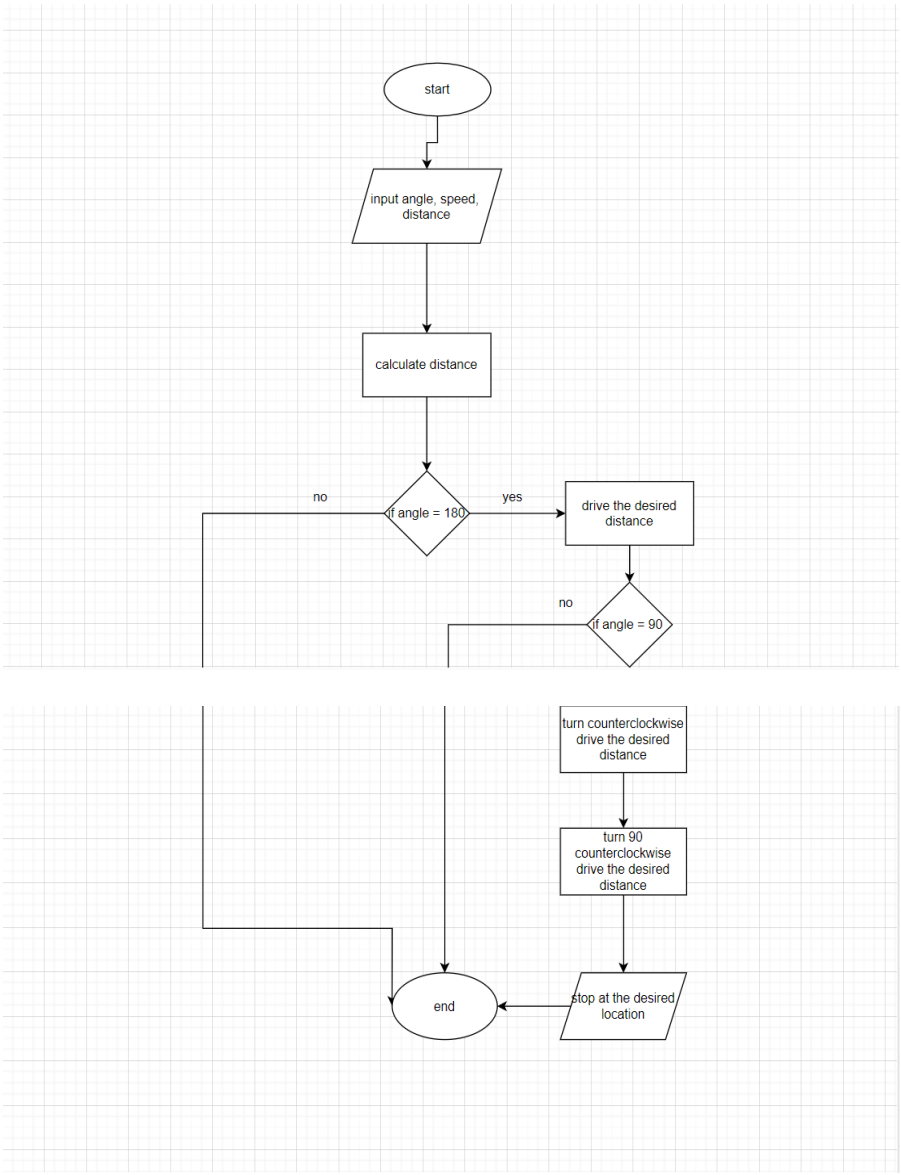
The robot needs to be a certain distance from the box to detect the bar code.

Team member	Hours on project since last meeting (hrs)	Total hours on project (hrs)
Philip Clark	17	21
Charlie Bush	17	29
Braden Burger	7	19
Nekruz Ashrapov	17	29

Subtask2

```
def subtask2():
    gyroTurn(175,200,'clockwise')
    gyro.reset_angle(0)
    gyroDrive(45.72, 200)

    gyroTurn(89, 200, 'clockwise')
    g=12
    g=g*2.54+15.24

    gyro.reset_angle(0)
    gyro.reset_angle(0)
    gyroDrive(g+45.72,200)




    gyroDrive((232.2-g)+(45.72+15.24),200)
    gyroTurn(88, 200, 'clockwise')

    gyro.reset_angle(0)
    gyro.reset_angle(0)

    gyroDrive((232.2-g)+((15.24+45.72))+45.72,200)
```

This is our code for subtask2.

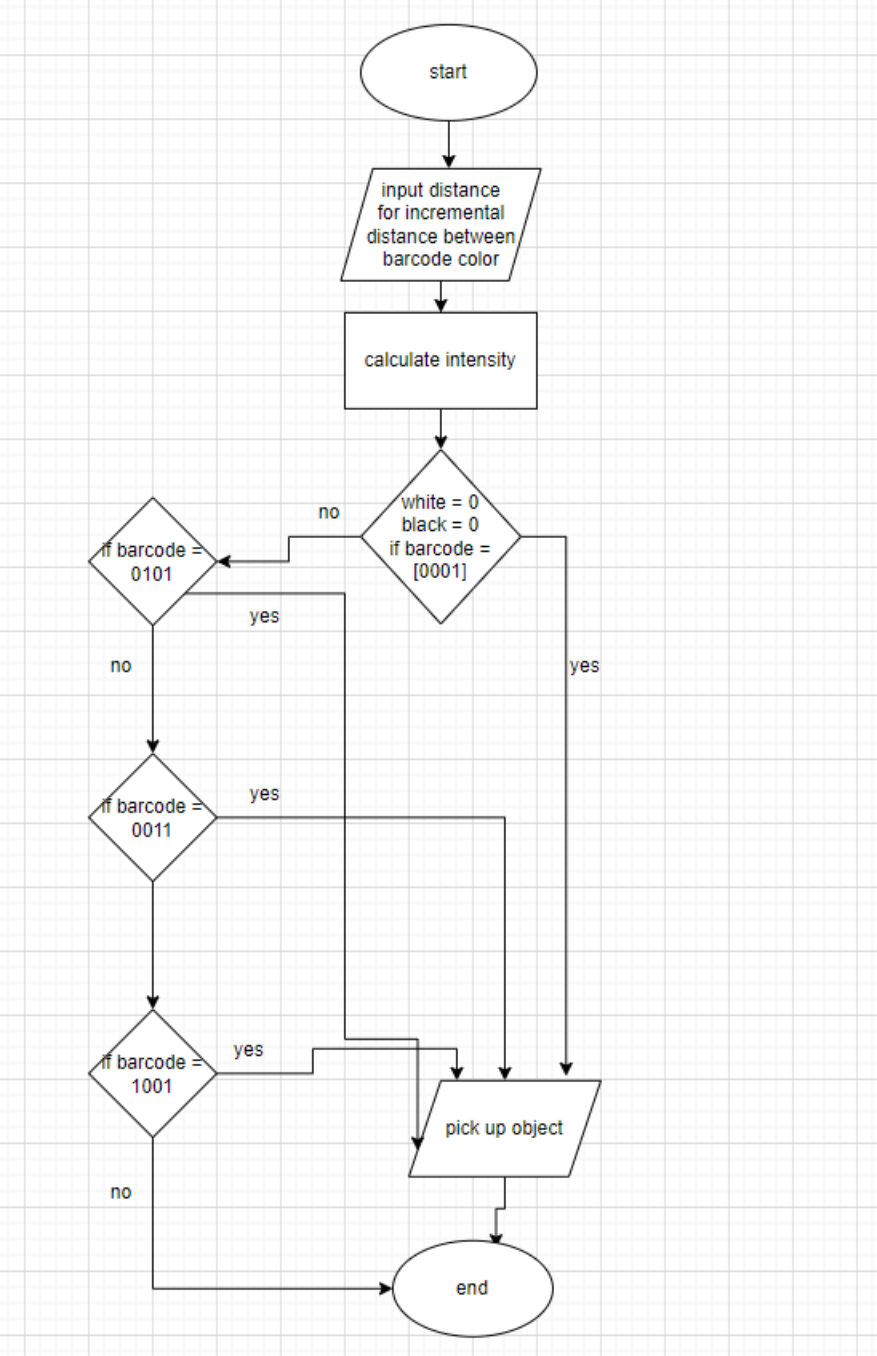


This is the flowchart for subtask 2.

Subtask3

```
def scan():
    barcode = [0, 0, 0, 0]
    intensity = [0, 0, 0, 0]


    for i in range(4):
        intensity[i] = color_sensor.reflection()
        if intensity[i] > 65:
            barcode[i] = 0
        else:
            barcode[i] = 1
        wait(100)
        robot.straight(1.27)


    if barcode == [0,0,0,1]:
        print("Box type 1")
    elif barcode == [0,1,0,1]:
        print("Box type 2")
    elif barcode == [0,0,1,1]:
        print("Box type 3")
    elif barcode == [1,0,0,1]:
        print("Box type 4")
    else:
        print("No box")
```

This is the code for Subtask 3.



This is the flowchart for Task 3 and 4.

Subtask4

```
179
180 def subtask4():
181
182     gyroTurn(90 , 200 ,'counterclockwise')
183     gyro.reset_angle(0)
184     gyroDrive(20,200)
185     wait(500)
186     gyroTurn(175,200,'clockwise')
187     gyro.reset_angle(0)
188     gyroDrive(35,200)
189     wait(500)
190     clawdown()
191     gyroDrive(45,200)
192     wait(500)
193     clawup()
194
195
196     gyroTurn(180,200,'clockwise')
197     gyro.reset_angle(0)
198     gyroDrive(65,200)
199
200     gyroTurn(89,200,'counterclockwise')
201     gyro.reset_angle(0)
202     wait(200)
203     gyroDrive(123.42,200)
204     wait(200)
205     clawdown2()
```

This is our code for subtask4. This has the gyro turning away from the box, doing a 180 turn, picking up the box, turning again, and then traveling to the destination.

Meeting #9

Meeting Agenda / Minutes	Project/team: Project 4 Team 297
Date/time: 4/12/2023 4:30-9:30	Note taker: Philip Clark
Present: All members	

Agenda:

Change final problems before the demo at 9:30.

Review Gantt Chart

Tasks behind schedule

Task	Why behind	Plan to get up to date

☐ Tasks added to chart

Foreseeable issues that will prevent success ☐ No ☐ Yes

Decisions made:

We decided that some of the codes may not work with every input, so they need to be changed to a code that will work with every input.

Important information shared:

We shared important information that will keep the robot from not going off course from a different type of input.

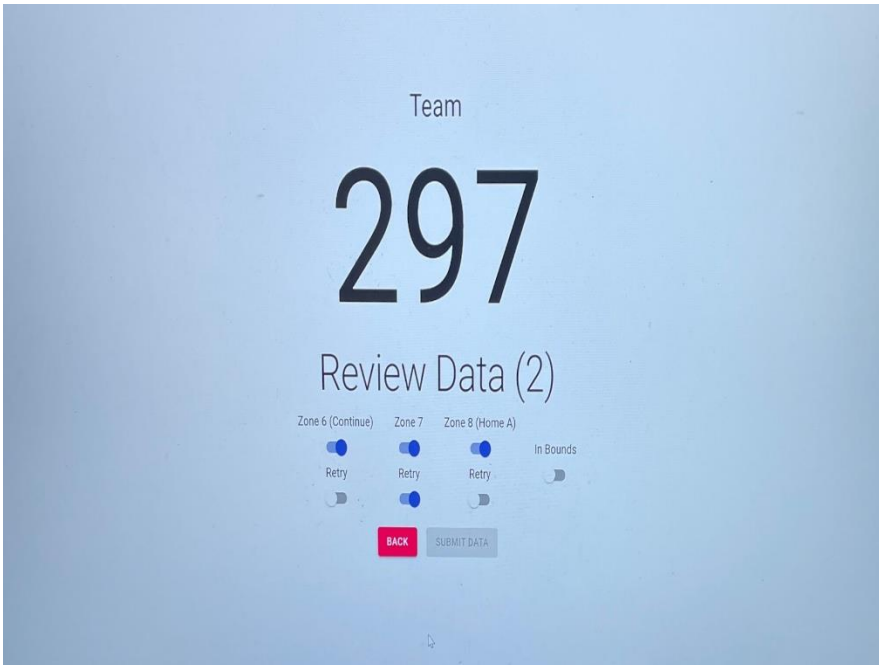
Ideas we want to remember:

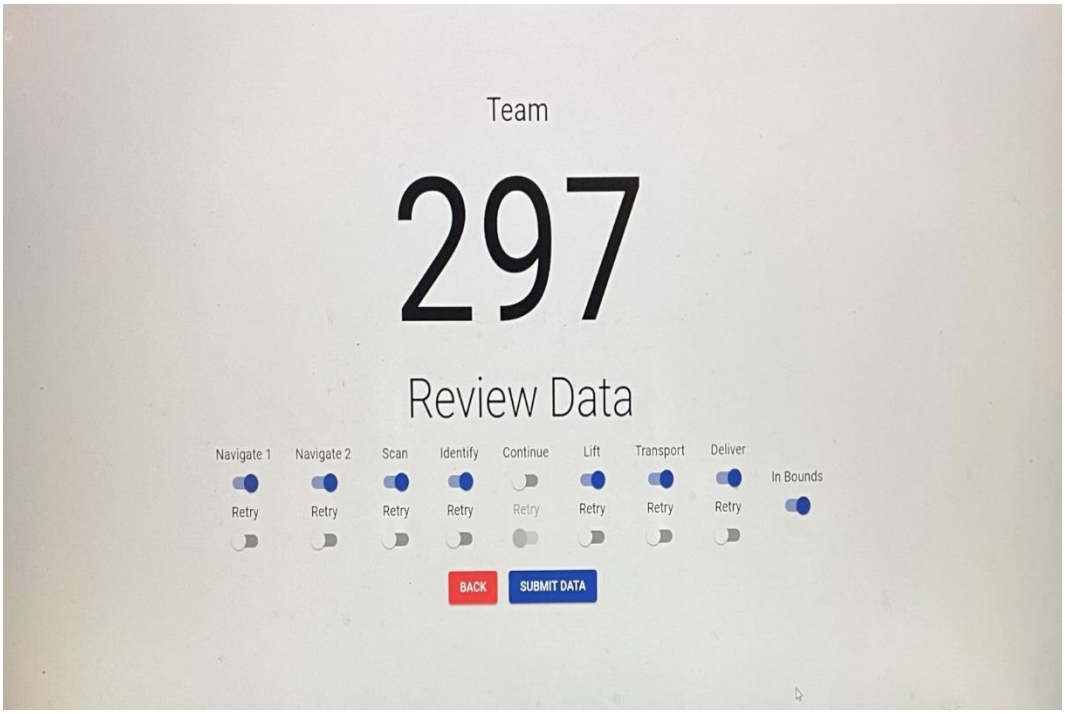
The robot should work with every input, but a code should fix it if it doesn't.

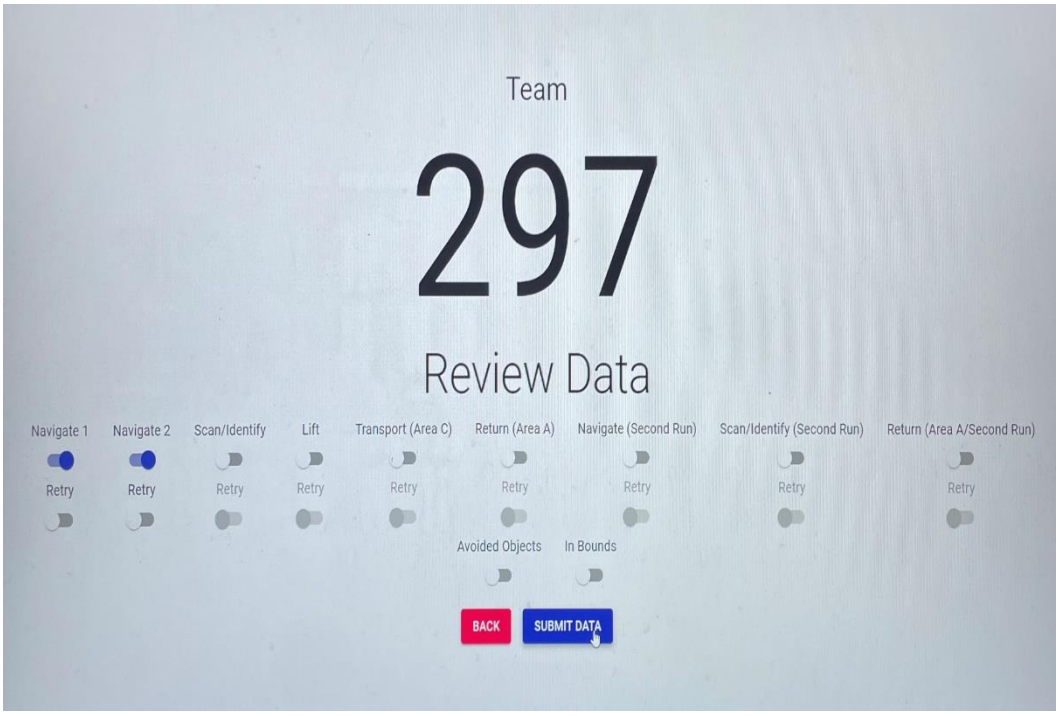
Team member	Hours on project since last meeting (hrs)	Total hours on project (hrs)
Philip Clark	21	26
Charlie Bush	29	34
Braden Burger	19	24
Nekruz Ashrapov	29	34

PMR Results


ENED 1120 Project 4 Final Demo (Station 5 Subtask A)
Team
297
Review Data
Zone 1
Zone 2
Zone 3 (Stop)
Zone 4
Zone 5 (Home B)
In Bounds
Retry
Retry
Retry
Retry
Retry
BACK
SUBMIT DATA


Team
297
Review Data (2)
Zone 6 (Continue)
Zone 7
Zone 8 (Home A)
In Bounds
Retry
Retry
Retry
BACK
SUBMIT DATA


Team
297
Review Data
Navigate 1
Navigate 2
Scan
Identify
Continue
Lift
Transport
Deliver
In Bounds
Retry
BACK
SUBMIT DATA


Team
297
Review Data
Navigate 1
Navigate 2
Scan/Identify
Lift
Transport (Area C)
Return (Area A)
Navigate (Second Run)
Scan/Identify (Second Run)
Return (Area A/Second Run)
Retry
Avoided Objects
In Bounds
BACK
SUBMIT DATA

We are happy with how PMR testing went. We are happy that we were one of the few groups that made it to the final test. We were pleased with how we did on the subtasks, however we wished we had spent more time on building code for the final as the code we had did not fully work when we got to the final test.

Meeting #10

Meeting Agenda / Minutes | Project/team: Project 4 Team 297

Date/time: 4/18/2023 7:00-9:00 | Note taker: Philip Clark

Present: All members

Agenda:

Review the Design Notebook to make sure it is ready to be turned in.

Review Gantt Chart

Tasks behind schedule

Task	Why behind	Plan to get up to date

☐ Tasks added to chart

Foreseeable issues that will prevent success ☐ No ☐ Yes

Decisions made:

Decisions on what will be placed in the final Design Notebook submission.

Important information shared:

We shared what other items should be added into the final Design Notebook

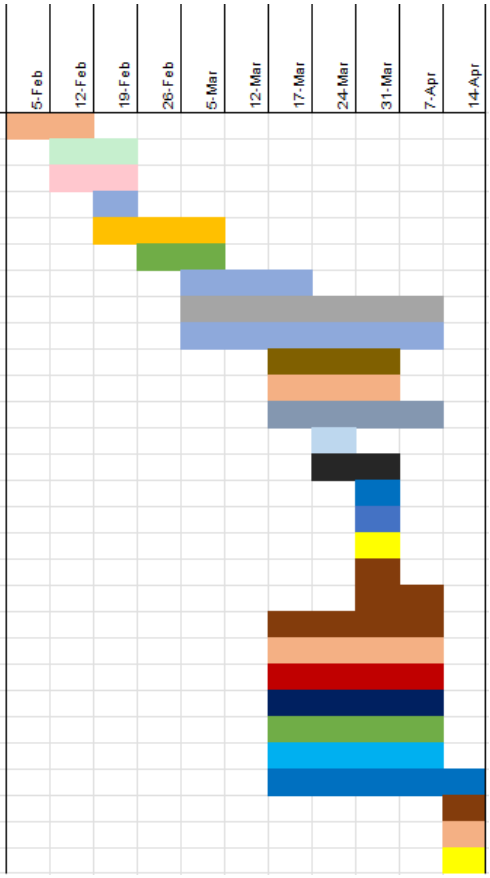
Ideas we want to remember:

The Design Notebook should be thorough but organized neatly with the right amount of information.

Team member	Hours on project since last meeting (hrs)	Total hours on project (hrs)
Philip Clark	26	28
Charlie Bush	34	36
Braden Burger	24	26
Nekruz Ashrapov	34	36

Updated Gantt Chart

Task ID	Task	Start	finish	Responsible	% Complete
1	Design Specifications	8-Feb	12-Feb	Nekruz, Philip	100
2	Develop Robot Design for Subtask 1	12-Feb	20-Feb	Charlie	100
3	Develop Python Code for Subtask 1	12-Feb	20-Feb	Nekruz	100
4	Subtask 1	20-Feb	20-Feb	Team	100
5	Redesign Robot Locomotion	20-Feb	6-Mar	Charlie, Braden	100
6	Develop Code for Midpoint Testing	26-Feb	6-Mar	Charlie, Nekruz	100
7	Test Robot for Locomotion	7-Mar	17-Mar	Team	100
8	Develop Lifting Mechanism for Box	5-Mar	12-Apr	Braden	100
9	Develop Barcode Scanner	5-Mar	12-Apr	Team	100
10	Develop and Improve Gyro Sensor Code	17-Mar	2-Apr	Nekruz, Braden	100
11	Develop and Improve Ultrasonic Sensor Code	17-Mar	4-Apr	Nekruz, Braden	100
12	Develop and Improve Color Sensor Code	17-Mar	8-Apr	Nekruz, Braden	100
13	Create Lift Arm	25-Mar	26-Mar	Charlie	100
14	Develop and Improve Lift Arm Code	30-Mar	6-Apr	Nekruz, Braden	100
15	Record Video	2-Apr	2-Apr	Team	100
16	Edit and Turn in Video	2-Apr	4-Apr	Nekruz	100
17	Create Support for Arm	2-Apr	2-Apr	Charlie	100
18	Test Finished Codes	2-Apr	2-Apr	Team	100
19	Final Robot Design Check	2-Apr	12-Apr	Charlie, Braden	100
20	Overview of Subtask 1 Code	20-Mar	12-Apr	Team	100
21	Overview of Subtask 2 Code	22-Mar	8-Apr	Team	100
22	Overview of Subtask 3 Code	22-Mar	8-Apr	Team	100
23	Overview of Subtask 4 Code	24-Mar	8-Apr	Team	100
24	(Final) Robot Code Check	20-Mar	12-Apr	Braden, Nekruz	100
25	(Final) Robot Test	20-Mar	12-Apr	Team	100
26	Complete Robot Overview	24-Mar	18-Apr	Team	100
27	Dismantle Robot	18-Apr	18-Apr	Charlie	100
28	Lego Inventory	18-Apr	18-Apr	Charlie	100
29	Finish Design Notebook	18-Apr	18-Apr	Team	100



Future Improvements

We would like to have a dedicated code for the final as we just used each subtask together with bridging code. Having a set final code would allow us to get even more points on the PMR tests.

We would also like to have reliable motors and sensors as one of our motors had stopped working and our gyro sensor would sometimes fail, which was not good for our robot.

The final thing we would like to improve on is the barcode scanner as it worked but was very unreliable. Reinforcing this code would help improve the reliability of the scanner for commercial use.