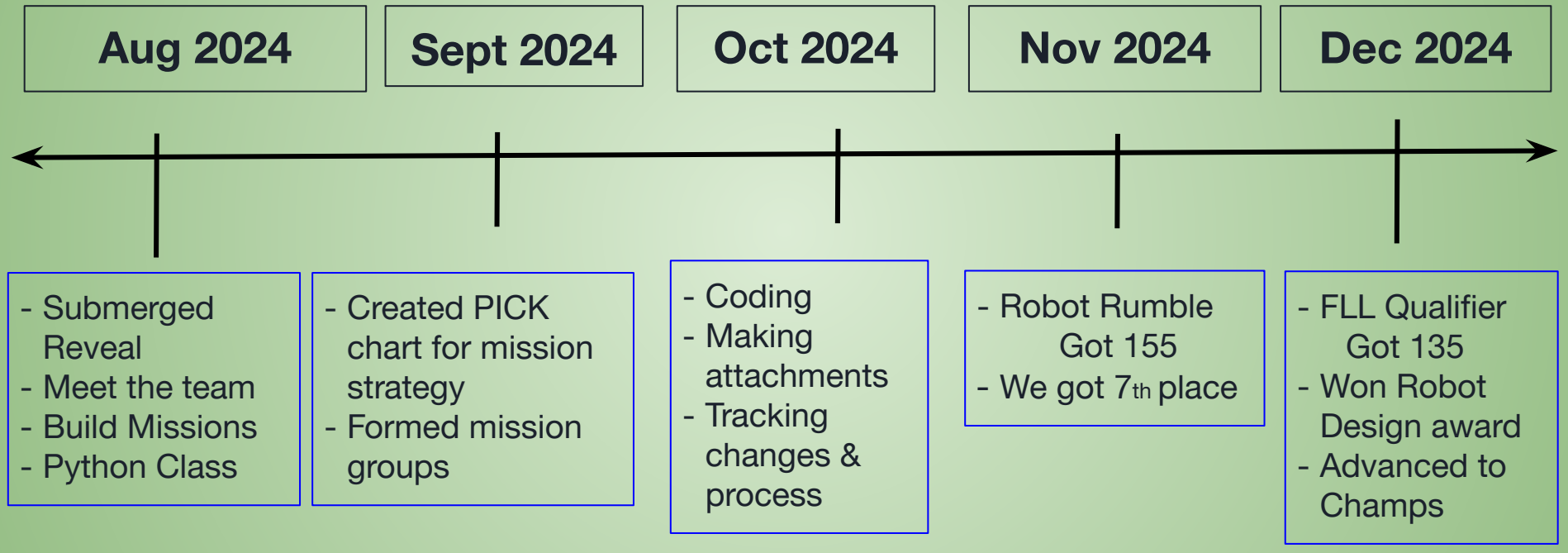
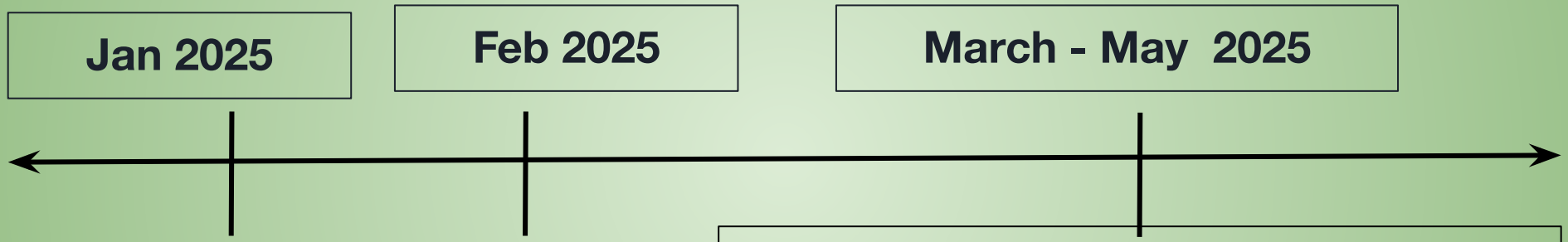
CAPTIBYTES

#3249

Robot Design Timeline



Robot Design Timeline



- Improved attachments & jigs
- Improved code
- Strategies for more consistent runs
- Outreach - FLL Explore Expo

- February 8 FLL Championship
- Teaching Shen tech classes to code

Upcoming….

- STEM night at Karigon Elementary - 3/20/25
- FRC tournament at MVP arena - 3/28 & 29/25
- Shen Science Health and Discovery Night - 4/ 25/25
- Shatekon Elementary STEAM Night - 5/20/25

Meet Our Bot

OUR BOT Gary!

Spike Prime Hub

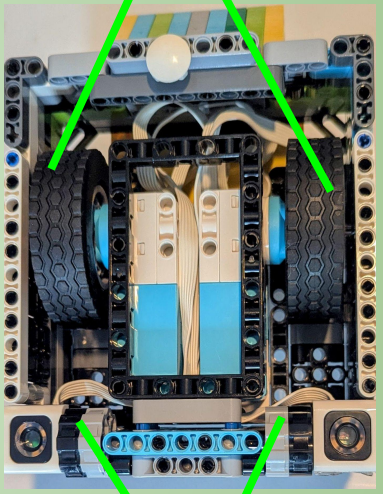
Attachment motors (medium size)

Flat Frame (for easy alignment)

Used Python to code missions,

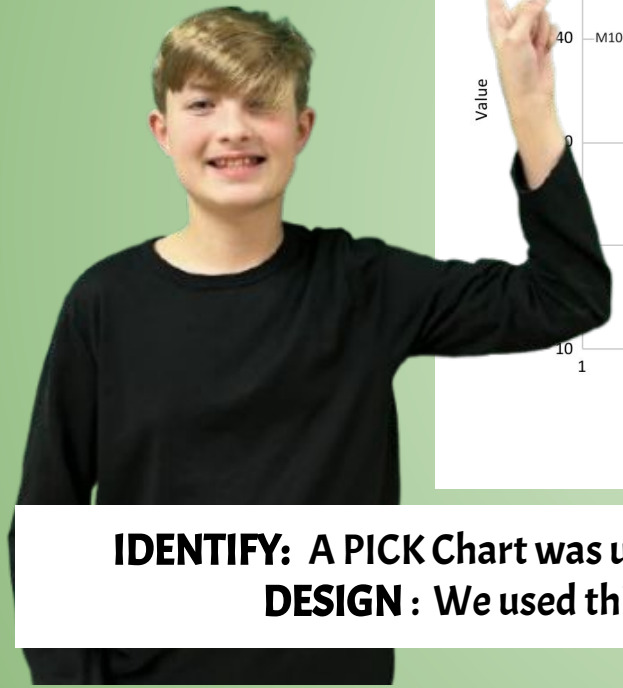
Small bevel Gears for drop in attachments

Drive Train: Wheels rubber)



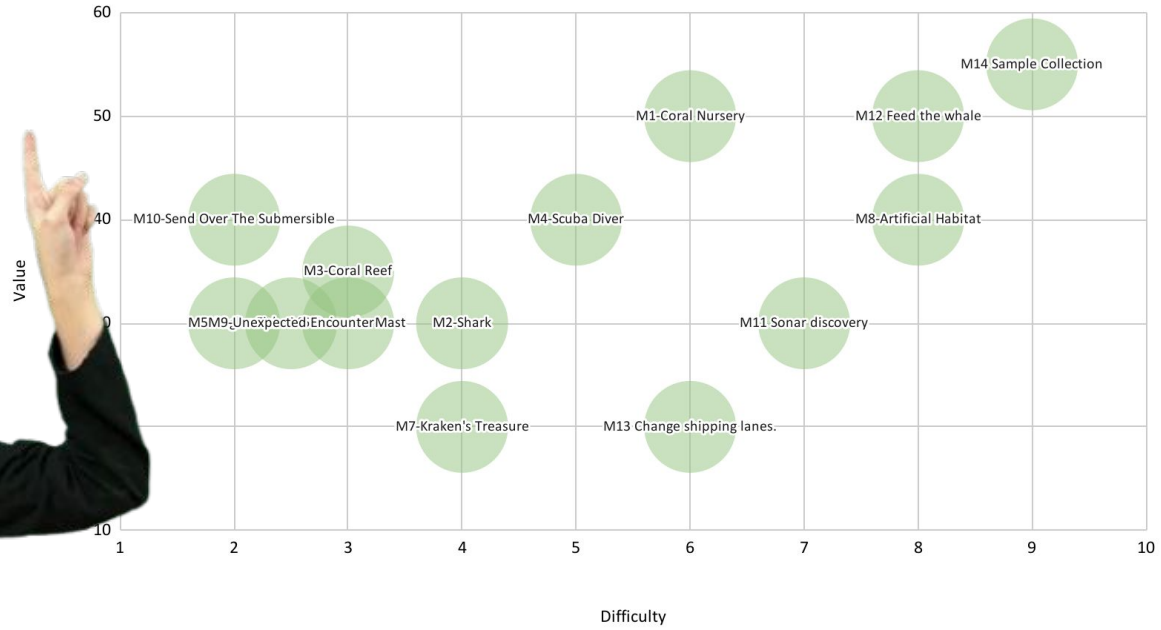
Black smooth wheel rims (no tread) for easy glide movement

Implement	Challenge
Possible	Kill



PICK CHART: Value vs. Difficulty

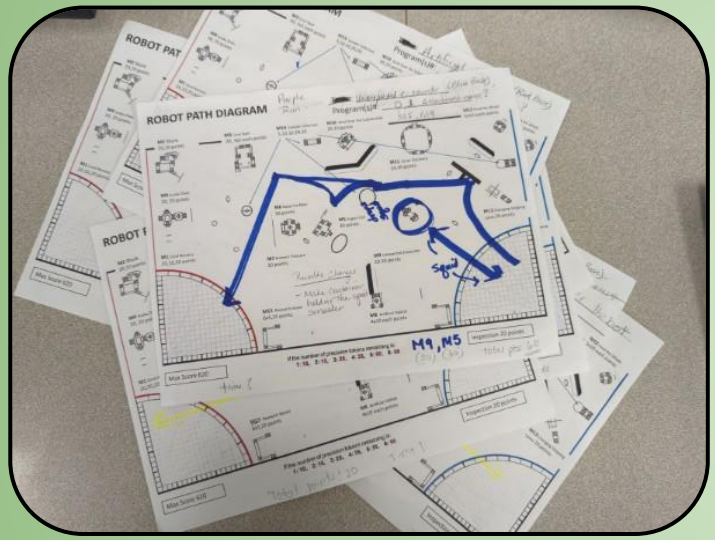
PICK Chart



IDENTIFY: A PICK Chart was used to initially identify missions based on point value, and difficulty.

DESIGN : We used this data to group our missions for team members to work on.

Pseudo Code & Robot Path Diagram



We write pseudocode to help figure out how to code but doing it in a way of writing it out to say what it does.

Blue Base PseudoCode

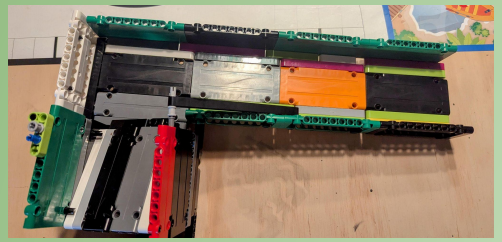
1. Robot leaves base then goes straight and pushes into the "Unexpected Encounter" and picks up the Octopus.
2. The robot then quickly backs up into the blue base with the octopus and then the code is switched
3. Attach the new attachment for picking up all the samples and add the octopus to the green part of the attachment, then the robot will head out to drop the octopus off in its area
4. Then it will try and do "Angler Fish"
5. After all the krill and coral are collected it will head to the red base and then will be switched to the code for red base

Red Base PseudoCode

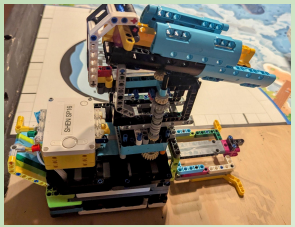
1. Robot leaves base then stops and turns, goes forward a bit then uses attachment and lifts up the yellow bars of "Raise the Mast" with a lot of power inorder to raise it.
2. We then back up into the "Coral Nursery" and make sure it pushes the thing back with an angled piece on the back of the robot.
3. We have the robot go forward a bit then turn and go straight then stop in front of the "Coral Reef" and then have a hammer-like attachment slam down into the yellow bar in the back to flip the coral up.
4. The robot then backs up and turns and goes forward with the same hammer-like attachment and slams down into the "Shark" or just have a small slope on the front/back to move into or push the yellow tab down to lift up the shark.
5. Then we have the robot back up and turn then go back to home base (red base)

Attachments for Champs

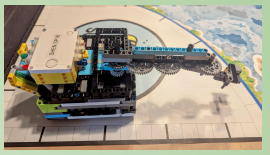
The Water Slide



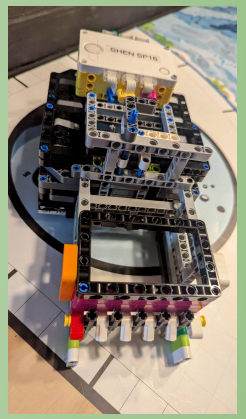
Breakfast



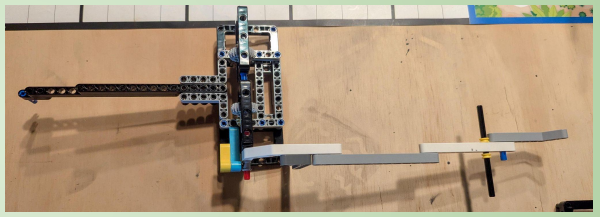
Spinny



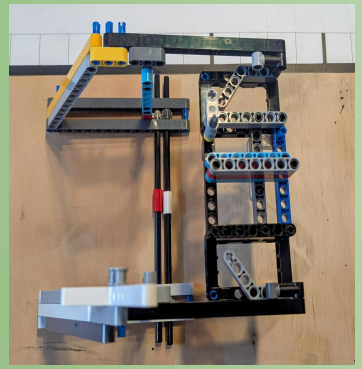
The Kriller 3.0



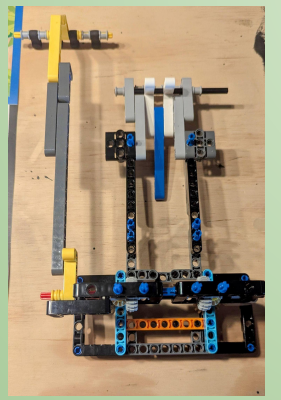
Gonzo



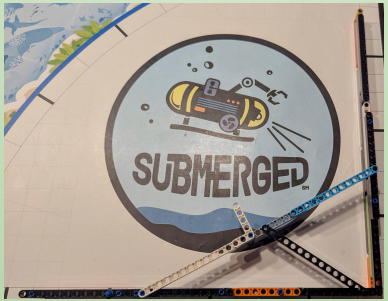
Pythagoras



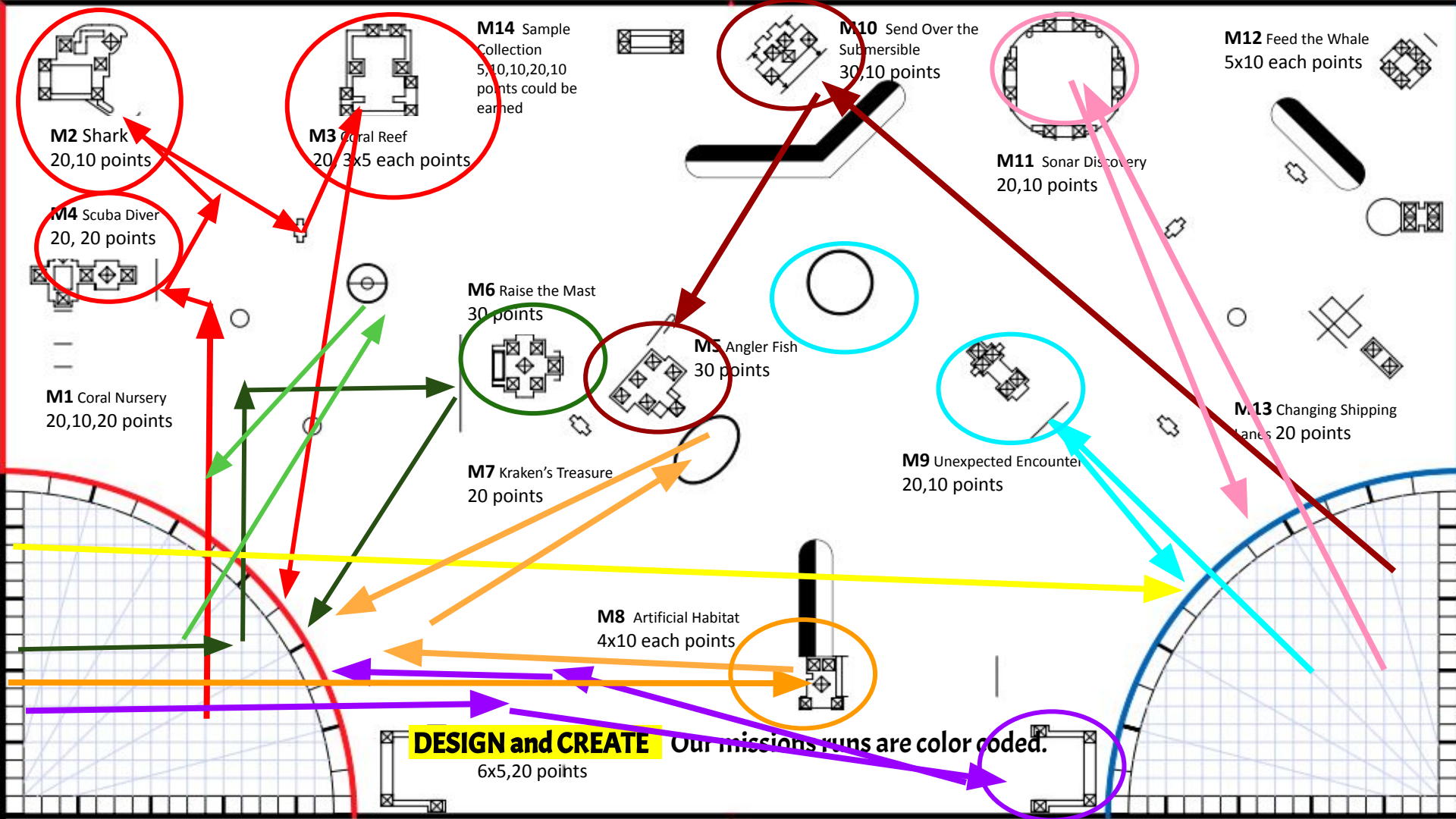
Crab Hook



The Anglers “jigs”



The useless stick


M2 Shark
20,10 points
M3 Coral Reef
20, 3x5 each points
M14 Sample Collection
5,10,10,20,10 points could be earned
M10 Send Over the Submersible
30,10 points
M12 Feed the Whale
5x10 each points
M11 Sonar Discovery
20,10 points
M4 Scuba Diver
20, 20 points
M6 Raise the Mast
30 points
M5 Angler Fish
30 points
M1 Coral Nursery
20,10,20 points
M7 Kraken's Treasure
20 points
M9 Unexpected Encounter
20,10 points
M13 Changing Shipping Lanes 20 points
M8 Artificial Habitat
4x10 each points
DESIGN and CREATE
6x5,20 points
Our missions runs are color coded.

Hard at Work!

Run Colors	Missions	Points - Max	Points - likely
Red	M1 (corals buds), M2 (shark), M3 (coral reef), M4 (diver)	80	80
Dark Green	M6- Raise the Mast	30	30
Green	M2 - Shark habitat	10	10
Orange	M8 - (Artificial Habitat) (M14Trident)	70	50
Purple	M15 - Research Vessel	20	20
Light Red	M9- Unexpected Encounter	30	20
Cyan	M11 Sonar	30	30
Brown	M10 (submersible), M5 (angler fish)	60	60
Pink	M12 Feed the whale	30	0
Precision tokens		50	35
Inspection		20	20
	Total	**430**	**355**

Rumble - 155
Qualifier - 135
Champs - 355

Library of Reusable Code – Examples

```
_run_until = lambda: sensor("color",ports[4],0)
await forward(50,run_until=_run_until)

await turn(360,True)



_run_until = lambda: sensor("color",ports[5],7)
await turn(360,True,run_until=_run_until)

await forward(33,True)
```

First example: The first line sets up a function that will check the sensor in port 5 for the color black. The next line tells the bot to move forward for 50cm or until the function passed is detected as true. This line does not stop the motors.

Second example: This line tells the robot to turn 360° right and stop the motors after it turns.

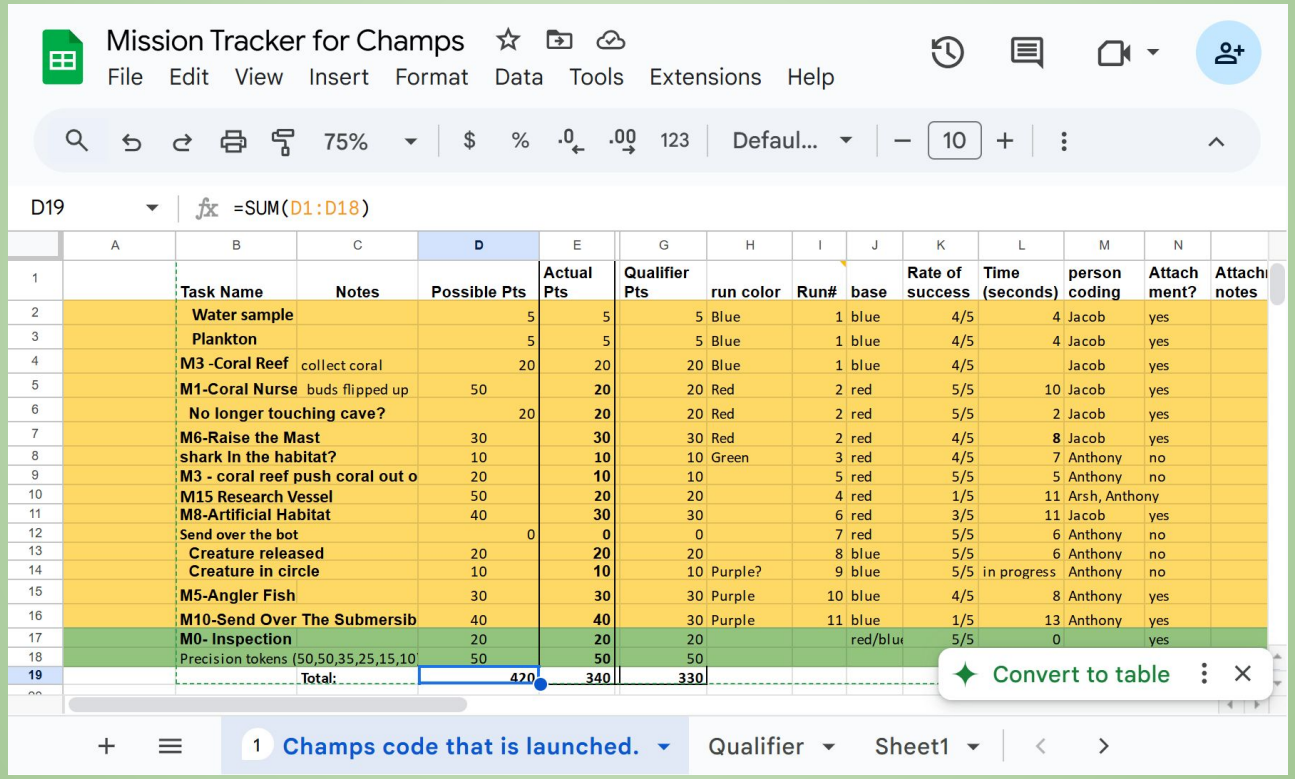
Third example: This line sets up a function that will check the sensor in port 6 for the color yellow. The next line tells the bot to turn 360° or until the function passed is true and stop the motors after it turns.

Fourth example: This line tells the bot to move forward 33cm and stop at the end

Red Run Code

```
from hub import light_matrix, port
import runloop
import motor_pair
import motor

import math

# Library code:
motor_pair.pair(motor_pair.PAIR_1,port.C,port.F)
motor_pair.pair(motor_pair.PAIR_2,port.B,port.D)

#Takes distance in centimeters (cm)
async def forward(dist,v):
    d = 5.5     #Diameter of one wheel
    degrees = int(dist*(360.0/(math.pi*d)))
    print(degrees)

    await motor_pair.move_for_degrees(motor_pair.PAIR_1,degrees,0,velocity=v)

#Takes angle of turn (theta)
# Parameters: theta = degrees to turn
async def turn(theta):
    r = 8     #Radius of turning (using one wheel)
    d = 5.5     #Diameter of one wheel
    dist = (2*math.pi*r)*(theta/360.0)
    degrees = int(dist*(360.0/(math.pi*d)))
    print(dist)
    print(degrees)

    if (dist < 0):
        motor.stop(port.F,stop=1)
        await motor.run_for_degrees(port.C,degrees,360)

    elif (dist > 0):
        motor.stop(port.C,stop=1)
        await motor.run_for_degrees(port.F,degrees,360)

# Start of actual run code:
async def main():
    await forward(55,1000) # leaves red base
    motor.run_for_degrees(port.B,260, 720) # start of-
_CORAL-NURSERY_ and grab the _SCUBA-DIVER_
    motor.run_for_degrees(port.D,-260, 720)
    await runloop.sleep_ms(750)
    await turn(-90)
    await forward(-13,1000)
    motor.run_for_degrees(port.B,-70, 720)
    motor.run_for_degrees(port.D,70, 720)
    await forward(10,1000) # end of _CORAL-NURSERY_ and
grab- the _SCUBA-DIVER_
    await turn(-40) # start of _SHARK_
    await forward(-25,1000)
    await forward(5,1000) # end of _SHARK_
    await turn(90) # start of _CORAL-REEF_ and the end of-
_CORAL-REEF_
    await forward(-5,1000)
    await turn(30)
    await forward(-70,1000) # returns to red base

runloop.run(main())
```

Design & Iteration – Mission tracker



Mission Tracker for Champs

File Edit View Insert Format Data Tools Extensions Help

D19 =SUM(D1:D18)

	Task Name	Notes	Possible Pts	Actual Pts	Qualifier Pts	run color	Run#	base	Rate of success	Time (seconds)	person coding	Attachment?	Attachi notes
2	Water sample		5	5	5	Blue	1	blue	4/5	4	Jacob	yes	
3	Plankton		5	5	5	Blue	1	blue	4/5	4	Jacob	yes	
4	M3 -Coral Reef	collect coral	20	20	20	Blue	1	blue	4/5		Jacob	yes	
5	M1-Coral Nurse	buds flipped up	50	20	20	Red	2	red	5/5	10	Jacob	yes	
6	No longer touching cave?		20	20	20	Red	2	red	5/5	2	Jacob	yes	
7	M6-Raise the Mast		30	30	30	Red	2	red	4/5	8	Jacob	yes	
8	shark In the habitat?		10	10	10	Green	3	red	4/5	7	Anthony	no	
9	M3 - coral reef push coral out o		20	10	10		5	red	5/5	5	Anthony	no	
10	M15 Research Vessel		50	20	20		4	red	1/5	11	Arsh, Anthony		
11	M8-Artificial Habitat		40	30	30		6	red	3/5	11	Jacob	yes	
12	Send over the bot		0	0	0		7	red	5/5	6	Anthony	no	
13	Creature released		20	20	20		8	blue	5/5	6	Anthony	no	
14	Creature in circle		10	10	10	Purple?	9	blue	5/5	in progress	Anthony	no	
15	M5-Angler Fish		30	30	30	Purple	10	blue	4/5	8	Anthony	yes	
16	M10-Send Over The Submersib		40	40	30	Purple	11	blue	1/5	13	Anthony	yes	
17	M0- Inspection		20	20	20			red/blue	5/5	0		yes	
18	Precision tokens (50,50,35,25,15,10		50	50	50								
19		Total:	420	340	330								

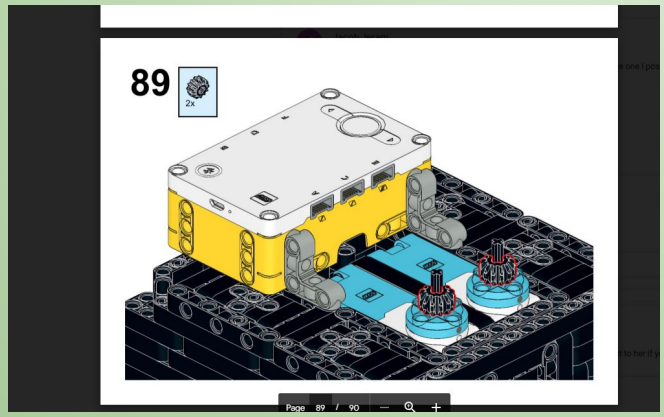
Convert to table

1 Champs code that is launched. Qualifier Sheet1

DESIGN & ITERATE: Robot Design Strategies

- New members built a backup using bricklink so that they were familiar with its design
- After the qualifier we added rubber tires and a beam to reduce wobble

Bricklink



DESIGN & ITERATE: Coding Strategies

- Attended summer class to learn python
- Veteran members taught newer members python
- Created a boilerplate of reusable code to make coding more efficient
- Commented out code so that others understand and can edit it

Big challenges along the way & how we solved them

Problems….

1. Trouble coding the gyro
2. Inconsistent runs
3. Not knowing the true battery level

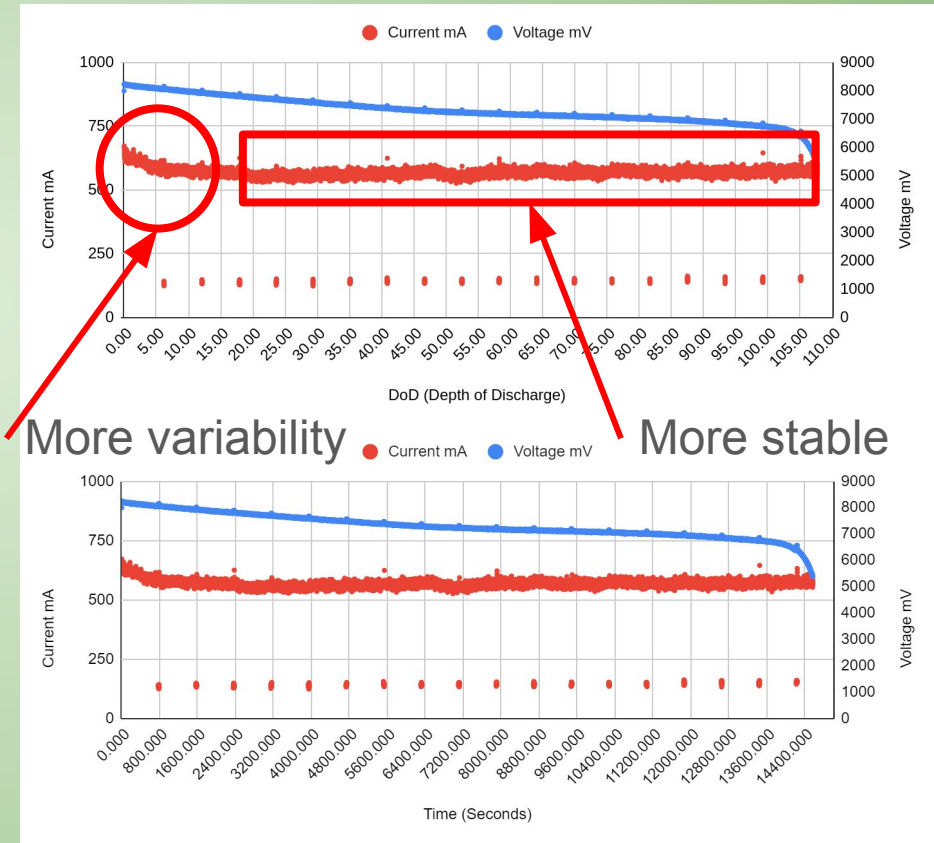
Solutions….

1. Learned that it worked best when battery at about 90% charged
2. Created jigs, practiced more, reconfigured attachments, made changes to base bot and code
3. Wrote a script in python to print out after each run. Also have new procedures for charging batteries.

Battery Analytics

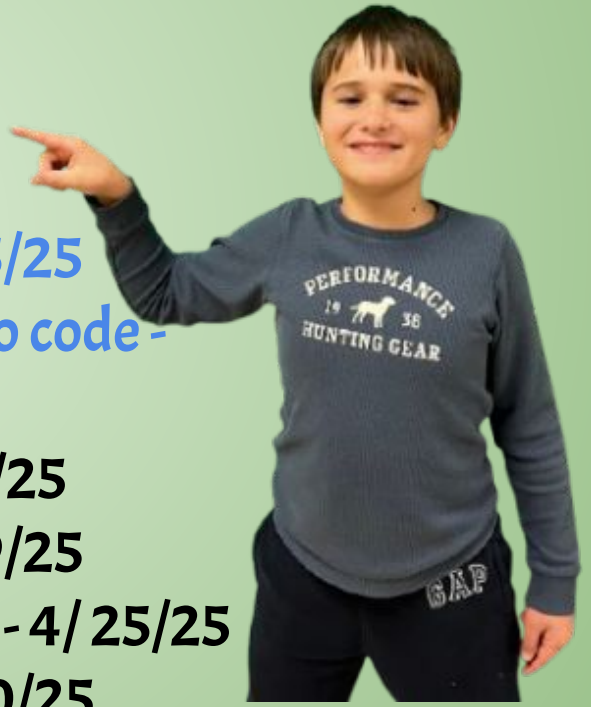
- Bot had inconsistent behavior at the qualifier.
- Thought it might be an issue with the battery, made a script to gather battery data.
- Realized that the battery current is much more variable when the bot is fully charged than when at ~90% SOC.

We now run the bot down to 90% before coding/running to ensure stability.



COMMUNICATE: IMPACT/Outreach

- Sharing code with Github and Bricklink on our website
- Shen FLL Robot Rumble - 11/16/24
- Teaching club kids to code - weekly
- Hosted FLL Explore Expo (33 teams) - 1/25/25
- Teaching SHEN 6th grade tech students to code - Feb. 2025
- STEM night at Karigon Elementary - 3/20/25
- FRC tournament at MVP arena - 3/28 & 29/25
- Shen Science Health and Discovery Night - 4/ 25/25
- Shatekon Elementary STEAM Night - 5/20/25



QR Code for our Code

GitHub

Thankyou!

Questions?