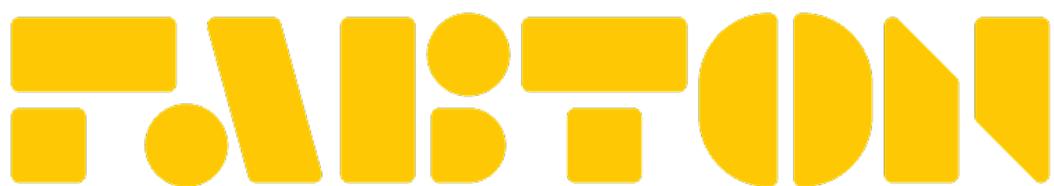


Fabton 2025

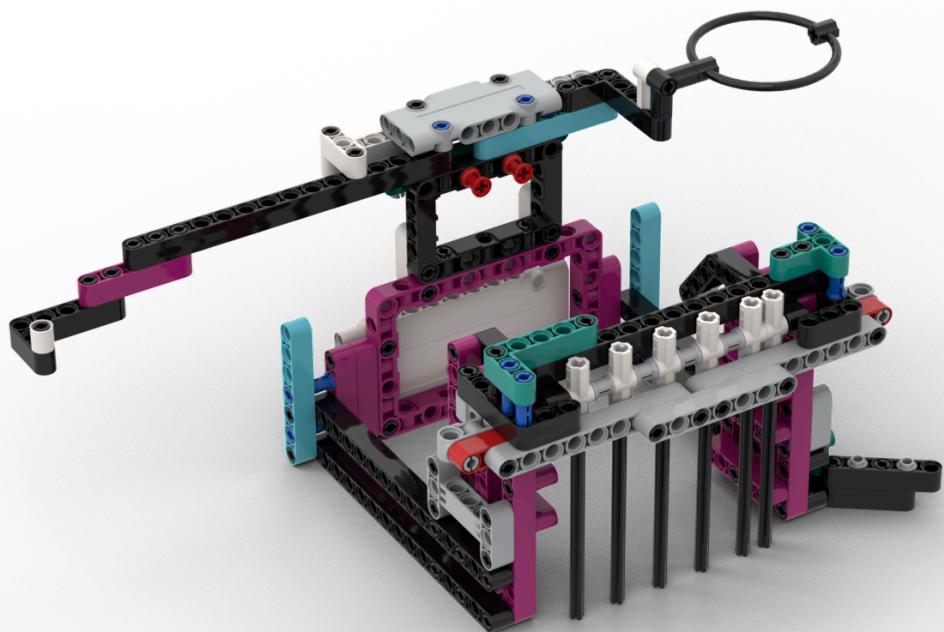
First Lego League Asia Pacific
Open Championship - Sydney



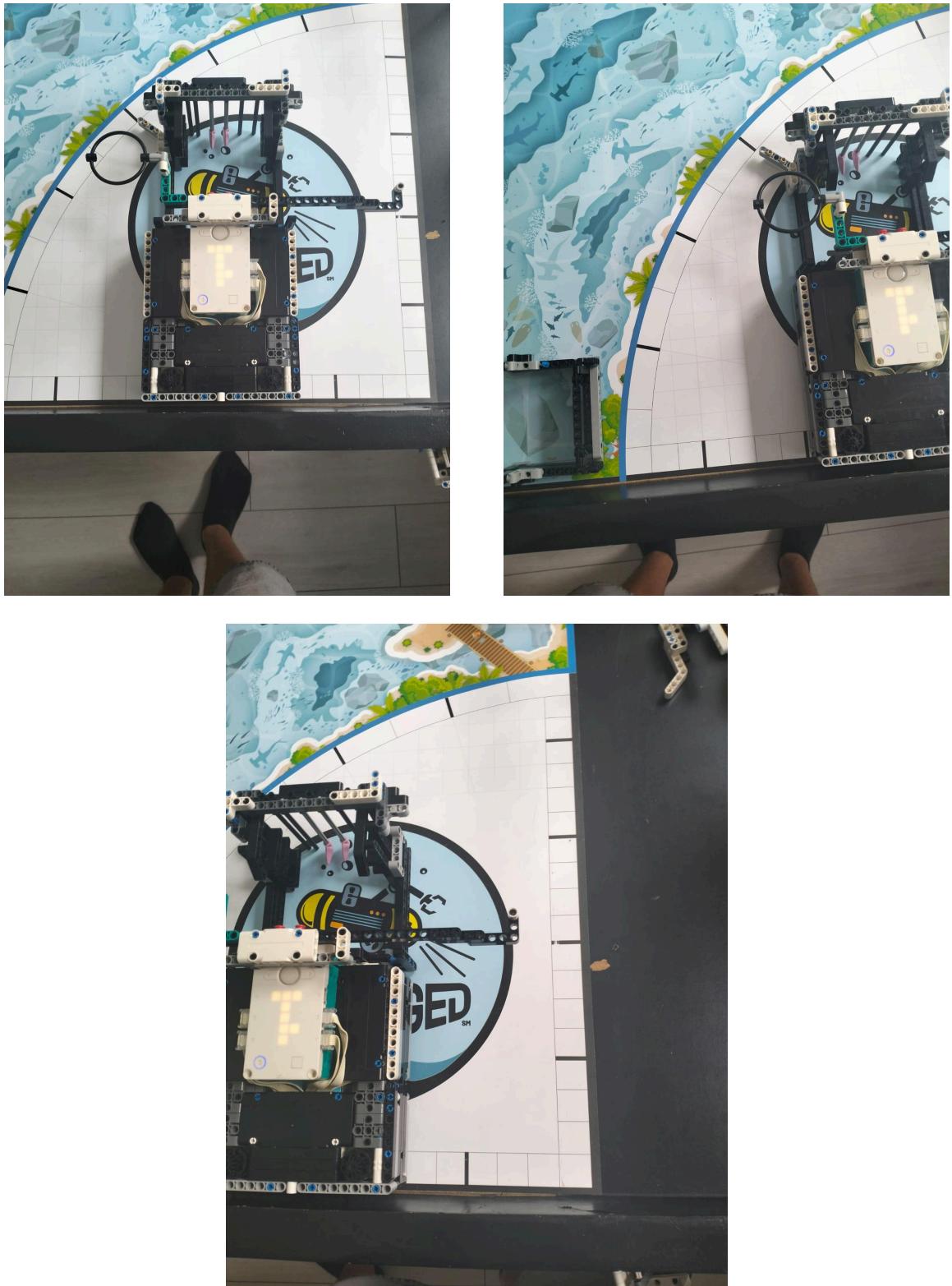
Robot design & strategy book

I. Run

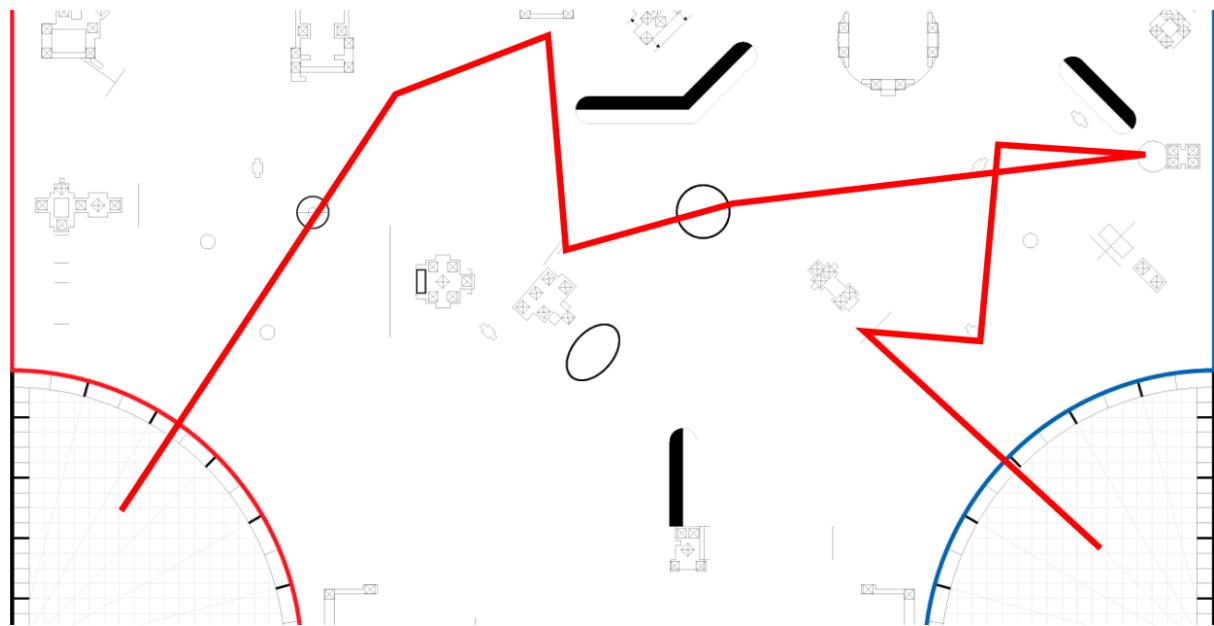
Attachment



Starting position



Route



Script

```
#robot starts
#we collect the unknown creature
drive_base.straight(-170)
drive_base.turn(-40)
drive_base.straight(-290)
wait(50)
drive_base.straight(144)
#we collect three more krill and one sample
drive_base.turn(35.5)
drive_base.straight(-270)
drive_base.curve(radius=-230, angle=12)
drive_base.straight(-40)
drive_base.turn(60)
drive_base.straight(-30)
drive_base.curve(radius=-100, angle=-30)
drive_base.straight(-80)
wait(50)
drive_base.straight(200)
drive_base.turn(48.5)
#we drive to the anglerfish and push it into the correct position
drive_base.curve(radius=900, angle=-30)
```

```

drive_base.turn(81)
wait(50)
drive_base.turn(77)
#we go to the seafloor sample and collect it
drive_base.straight(-100)
wait(50)
#we collect two more corals, the final sample, and one more krill
drive_base.turn(54.5)
drive_base.straight(-279)
drive_base.turn(-54.5)
drive_base.straight(-300)
drive_base.curve(radius=-262, angle=22.5)
drive_base.turn(-26.5)
drive_base.straight(-600)

```

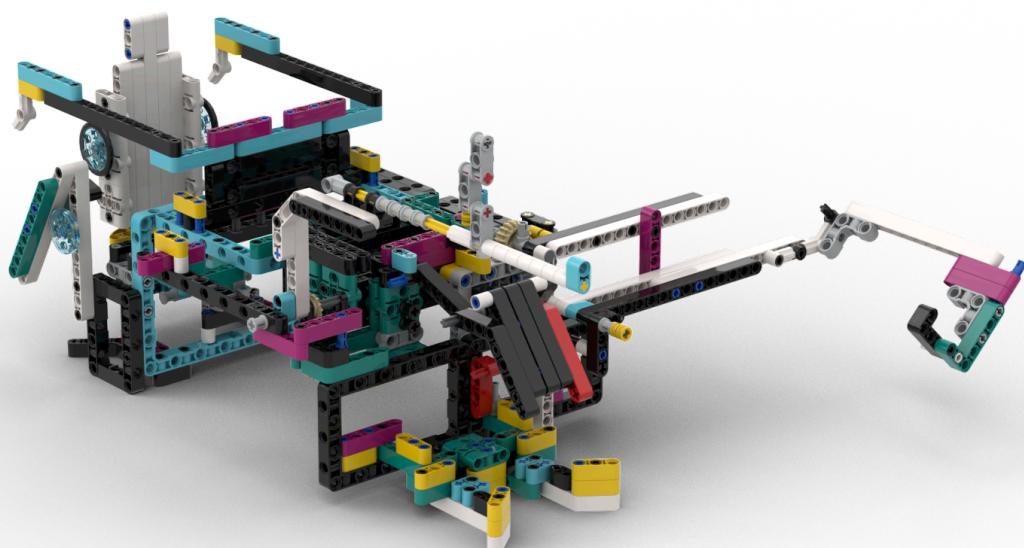
Testing Spreadsheet

Test Runs	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
Krills	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/3	4/4	4/4	4/4	4/3	4/4	4/4	4/3	4/4	4/4	4/4	4/4	4/4
Reef Segments	3/3	3/3	3/3	3/3	3/3	3/3	3/2	3/3	3/2	3/3	3/3	3/2	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3
Plankton Sample	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Seabed Sample	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Water Sample	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Angler Fish M05	✓	✓	✓	✓	✓	✓	✓	✓	✓	□	✓	✓	□	✓	✓	✓	✓	□	✓	

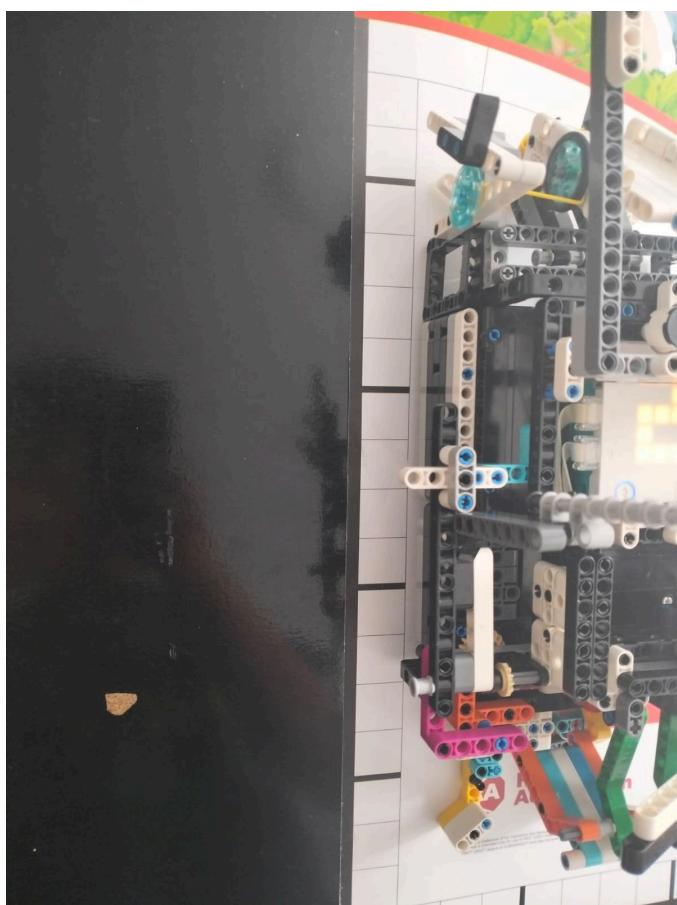
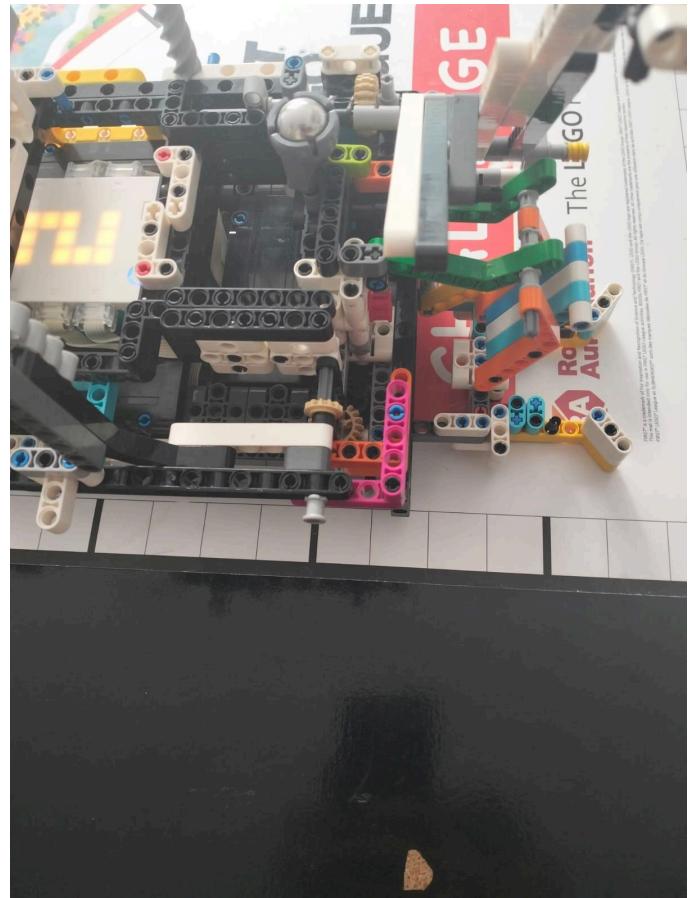
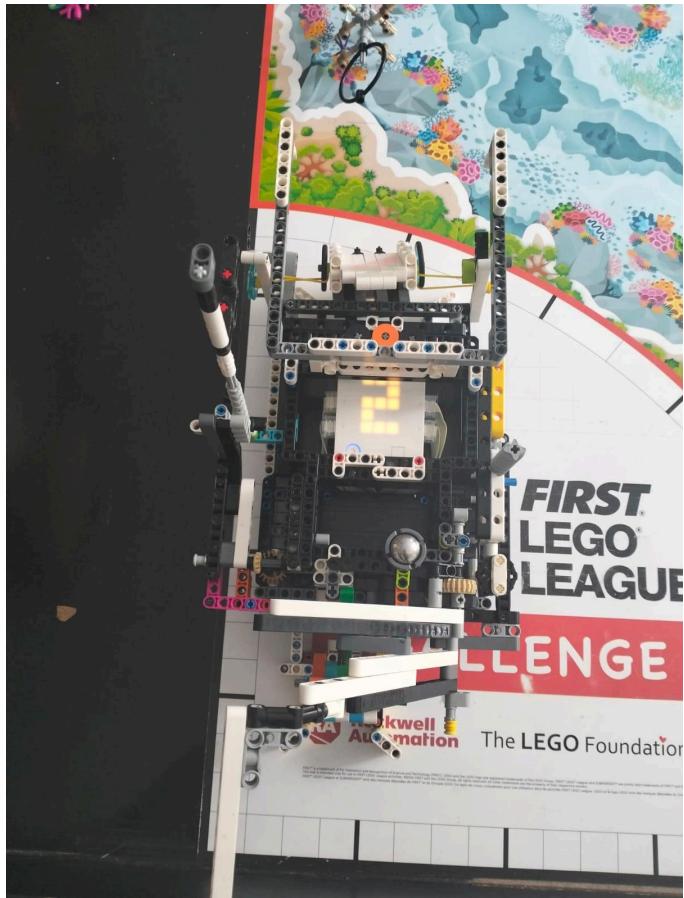
Run time	28.32 sec
Mounting time	0 sec
Score Achieved	75 points

II.Run

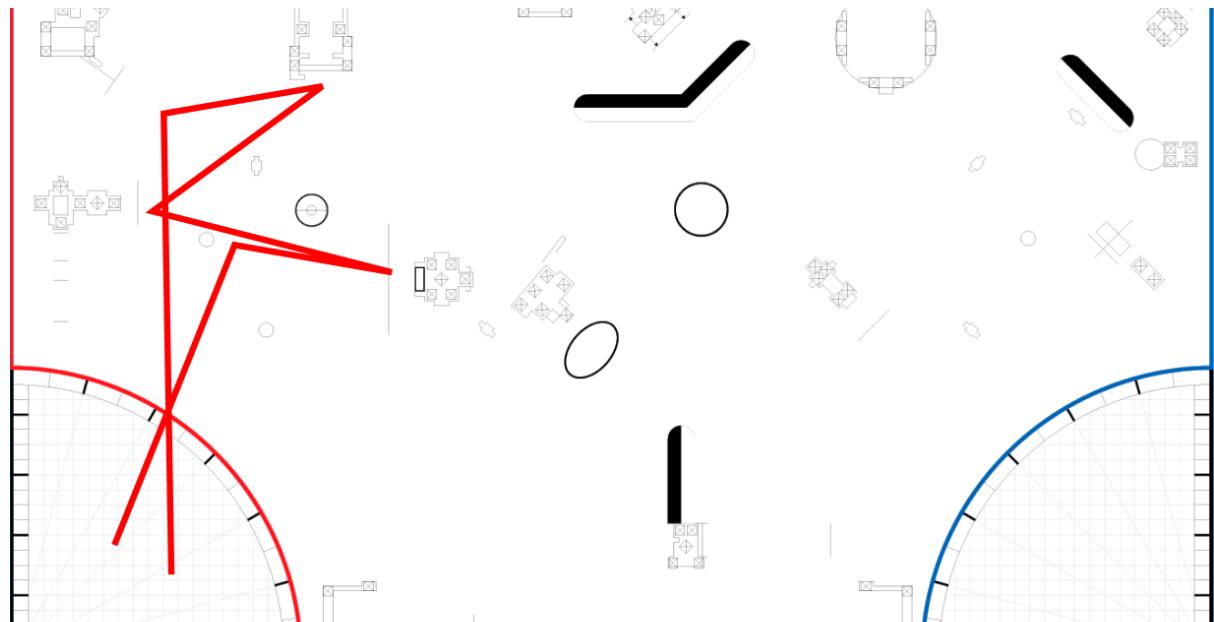
Attachment



Starting position



Road



Script

```
#robot starts
#driving out from the base
drive_base.straight(distance=-60)
drive_base.turn(angle=42)
drive_base.straight(distance=-380)
drive_base.turn(angle=47)
#we push the shipwreck upright and take the box from underneath
drive_base.settings(550, 450, 500, 120)
drive_base.straight(distance=-300)
wait(50)
drive_base.straight(distance=120)
drive_base.settings(700, 600, 500, 120)
drive_base.turn(angle=78)
drive_base.straight(distance=122)
drive_base.turn(angle=-72)
#we lower both arms to reach the diver and coral tree
motor_config.a_motor.run_time(speed=-999, time=830)
drive_base.settings(200, 150, 500, 120)
motor_config.b_motor.run_time(speed=-300, time=680)
#we press the button in front of the coral tree
drive_base.straight(distance=105)
```

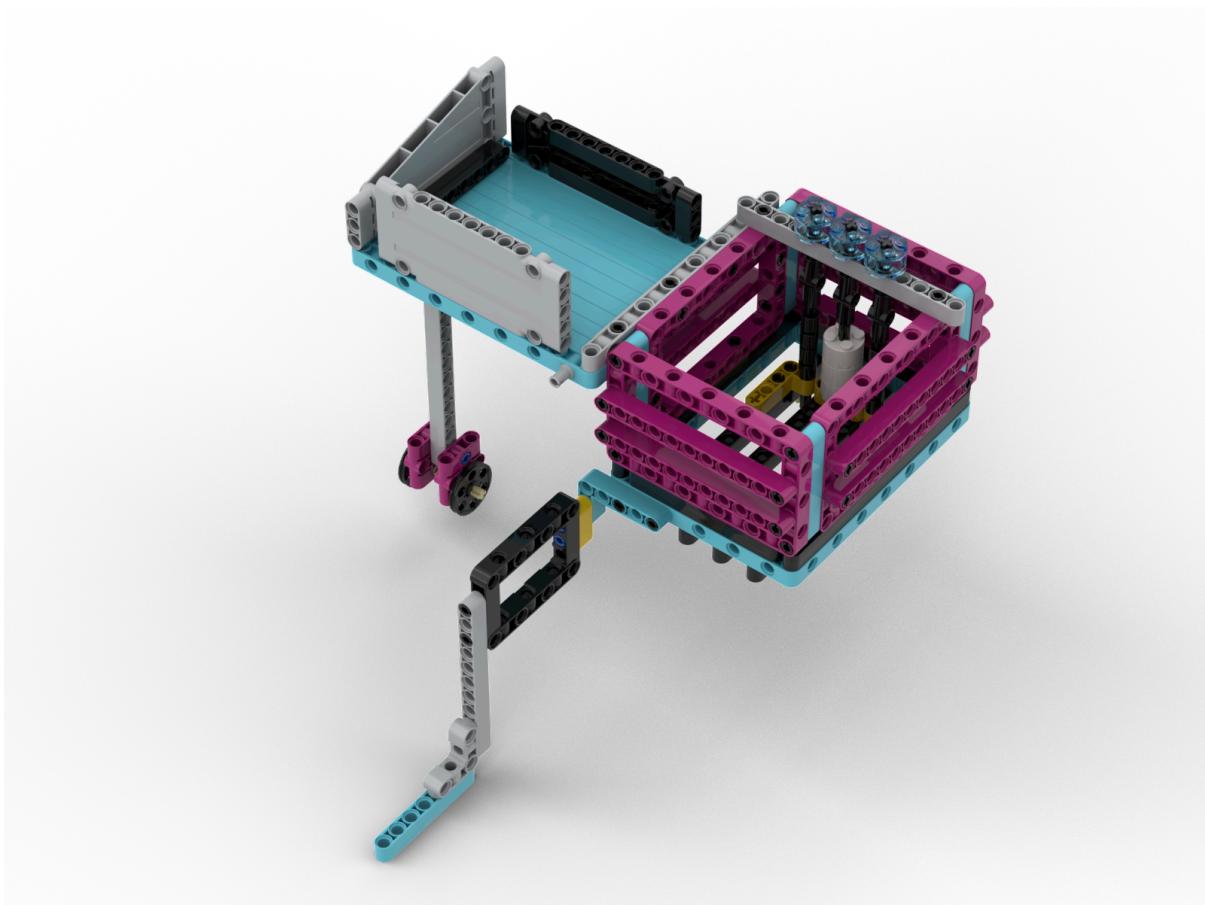
```
#we hook the coral tree
motor_config.a_motor.run_time(200, 2125)
motor_config.a_motor.run_time(-200, 800)
#we lift the diver
motor_config.b_motor.run_time(speed=800, time=350)
wait(100)
drive_base.straight(-60)
#heading to the corals
drive_base.curve(radius=-90, angle=-81)
drive_base.straight(92)
#we hang the diver on the hook
motor_config.b_motor.run_time(-400, 340)
wait(100)
drive_base.straight(-70)
drive_base.turn(-0.7)
#we press the button to raise the coral garden
drive_base.settings(300, 300, 150, 150)
motor_config.b_motor.run_time(1000, 700)
drive_base.straight(68)
wait(100)
#we head to the shark and lower it
motor_config.b_motor.run_time(-1000, 900)
wait(200)
motor_config.b_motor.run_time(1000, 100)
drive_base.turn(-5)
motor_config.b_motor.run_time(1000, 700)
#returning to base
drive_base.straight(-30)
drive_base.turn(-50)
drive_base.straight(77)
motor_config.b_motor.run_time(speed=-1000, time=1000)
motor_config.b_motor.run_time(speed=1000, time=1000)
drive_base.settings(900, 900, 250, 250)
drive_base.curve(radius=-100, angle=-85.0)
drive_base.straight(-600)
```

Testing Spreadsheet

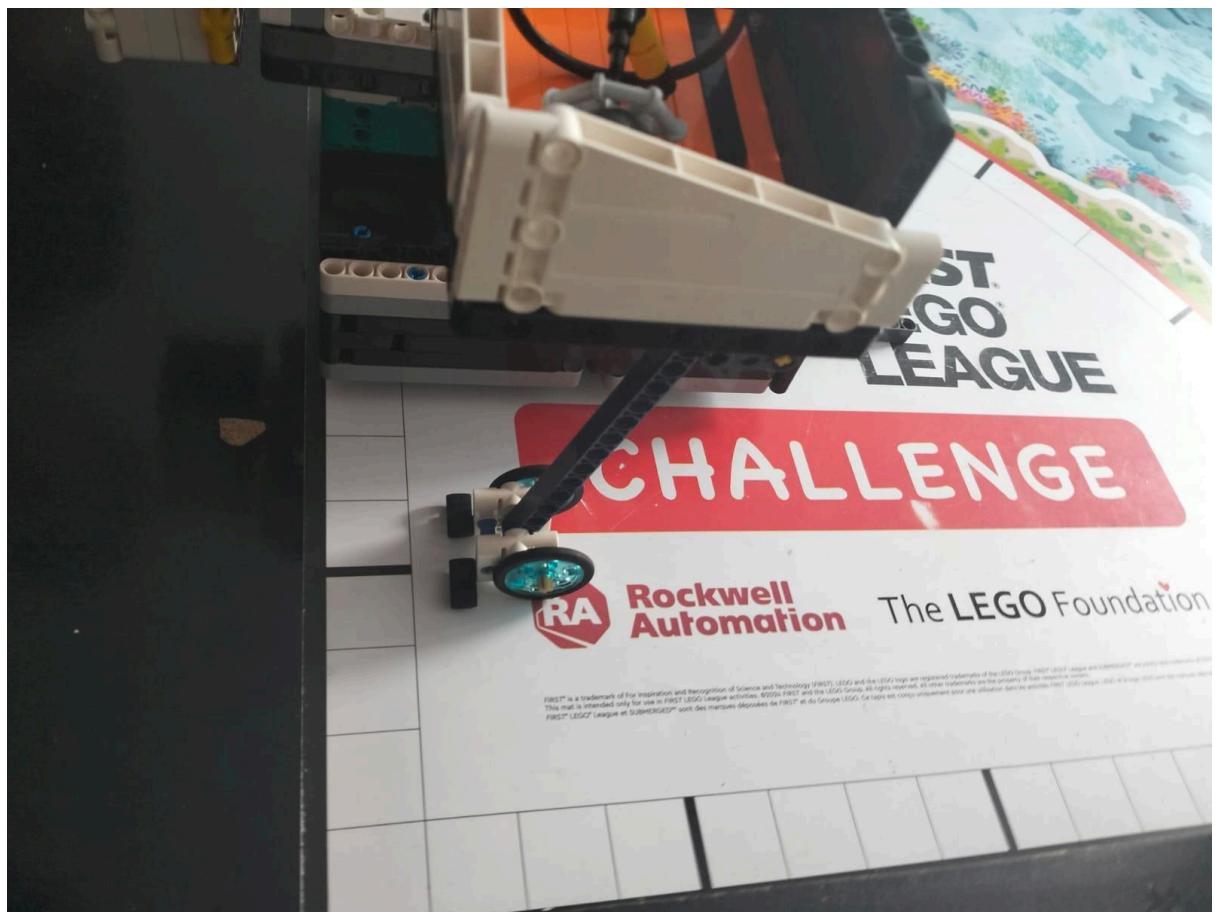
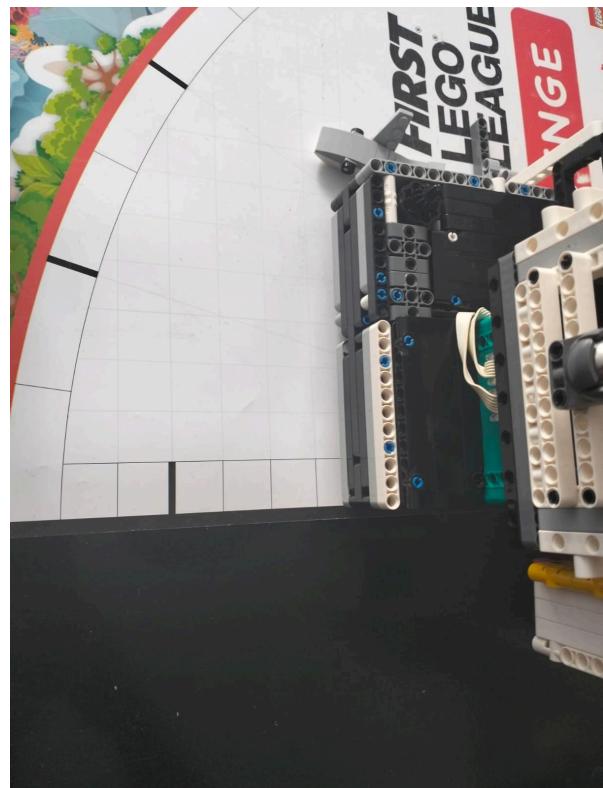
Run time	42.47 sec
Mounting time	6.33 sec
Score Achieved	180 points

III. Run

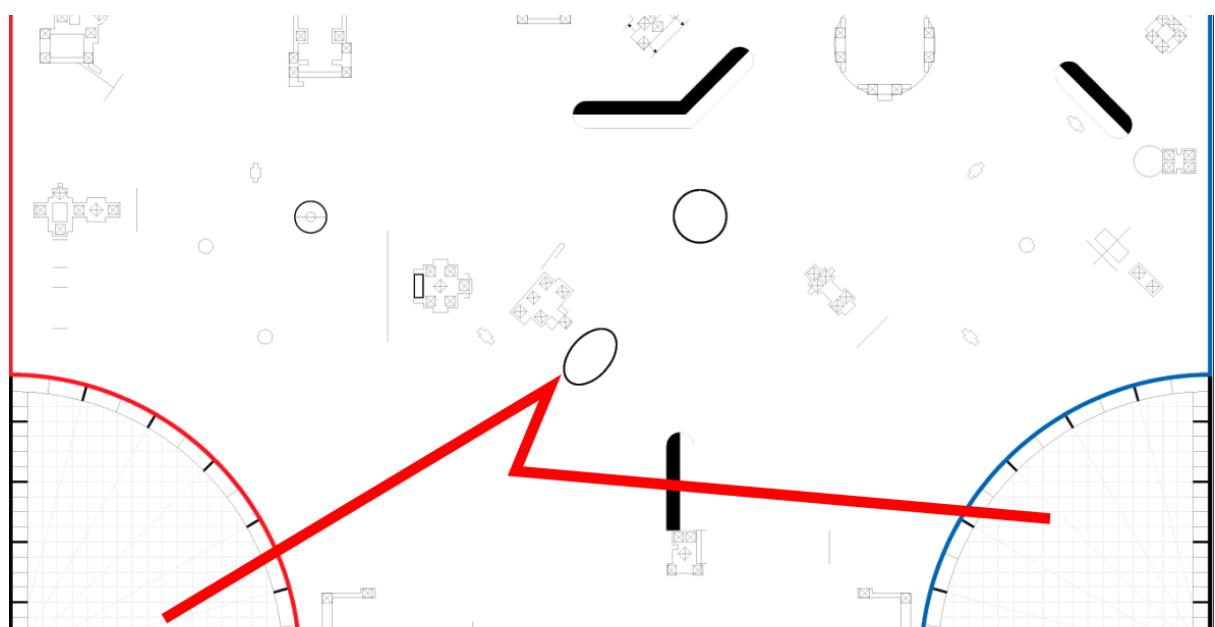
Attachment



Starting positions



Road



Script

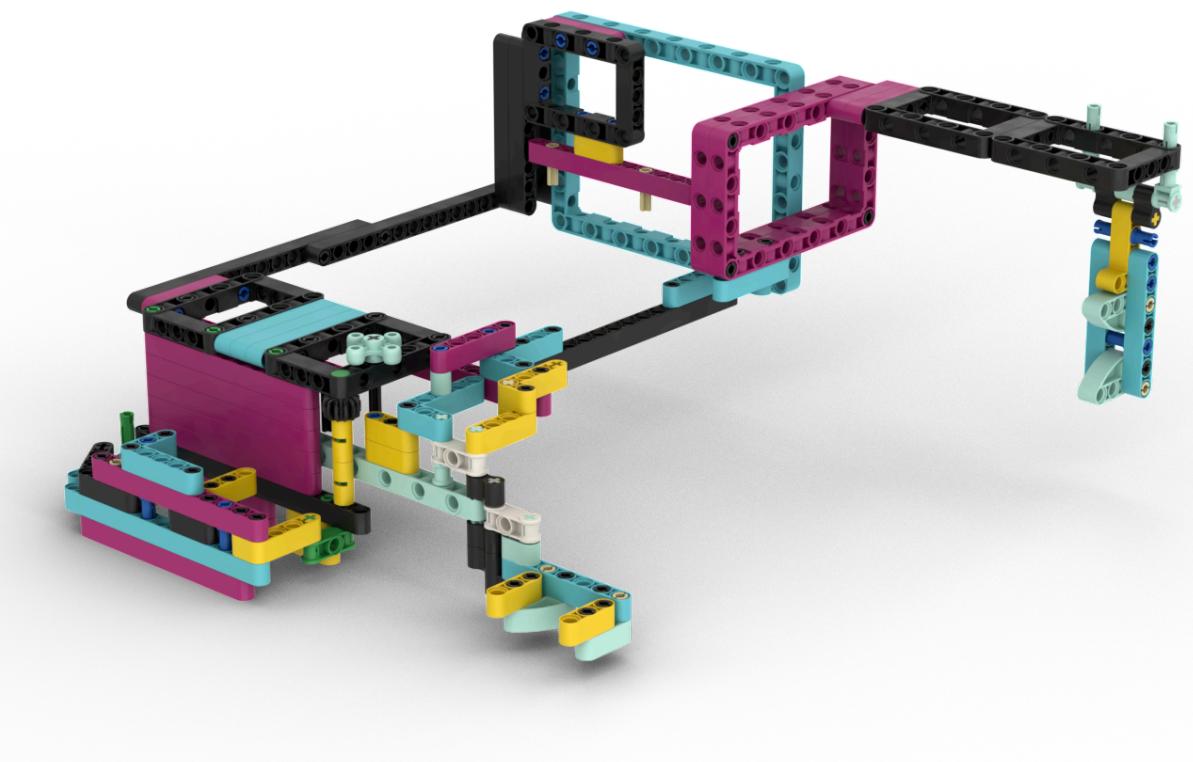
```
#program starts
#we move forward and unload the samples and the box into the ship
drive_base.settings(500, 500, 250, 250)
drive_base.straight(650)
drive_base.turn(-47)
#we push the shark into its target area
drive_base.settings(1000, 1000, 190, 190)
drive_base.straight(240)
#we drive to the other base
drive_base.turn(50)
drive_base.straight(1000)
```

Testing Spreadsheet

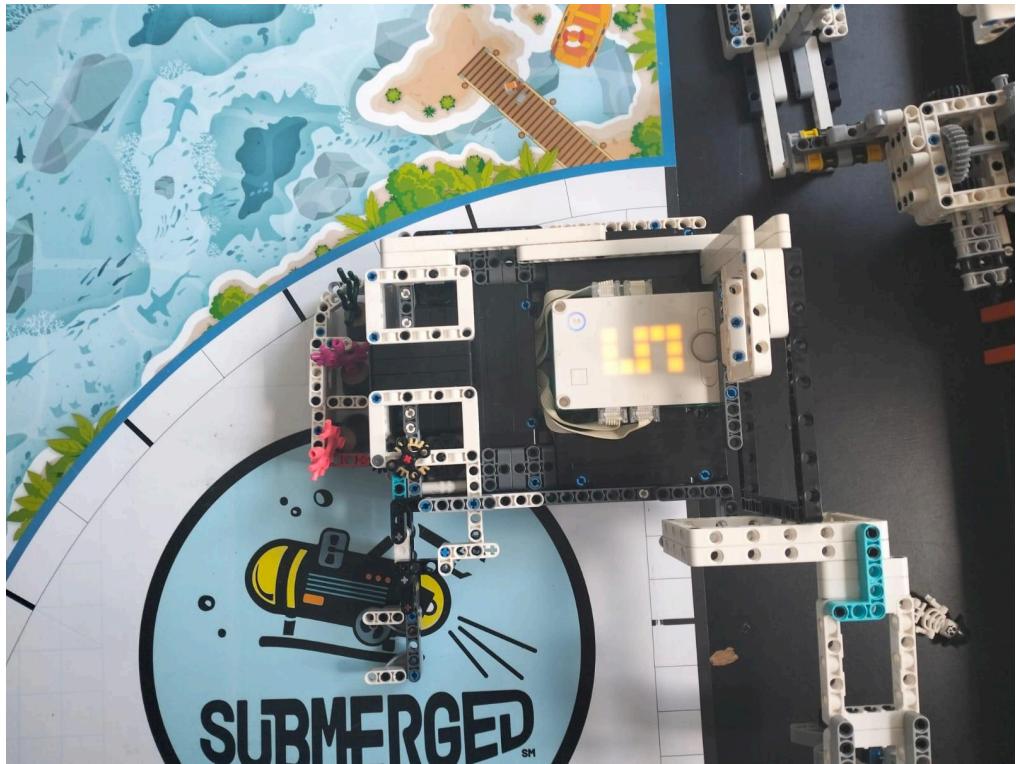
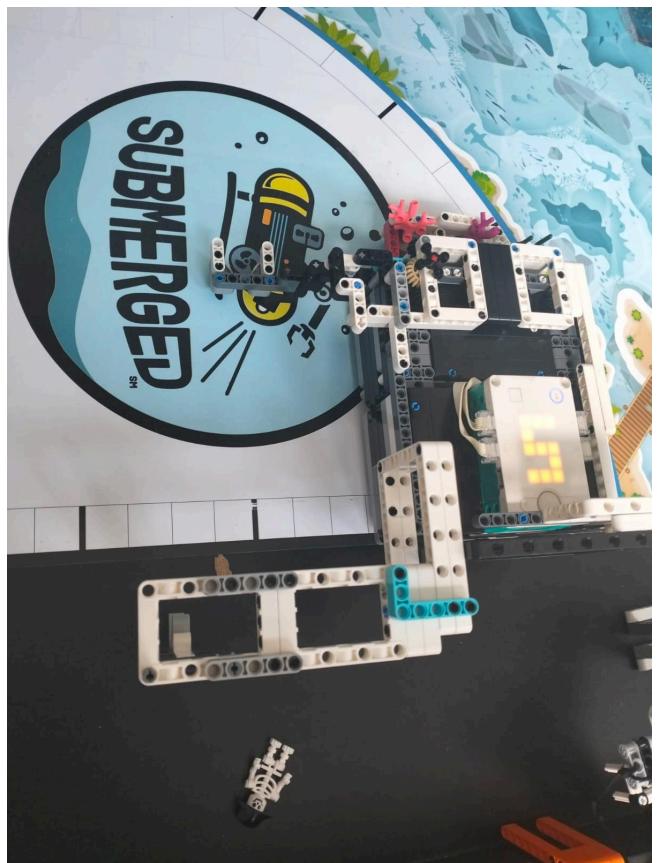
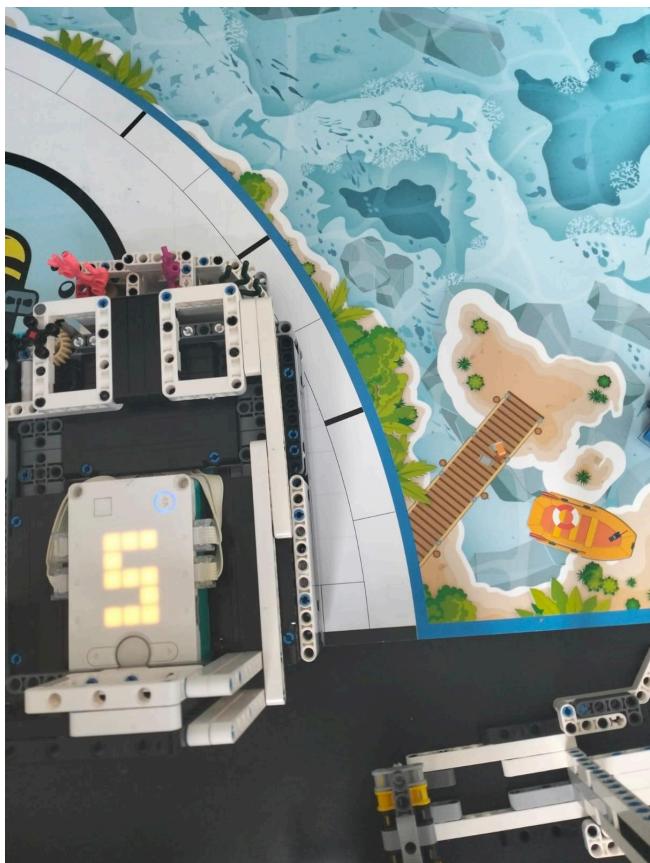
Run time	7.65 sec
Mounting time	7.21 sec
Score Achieved	25 points

IV.Run

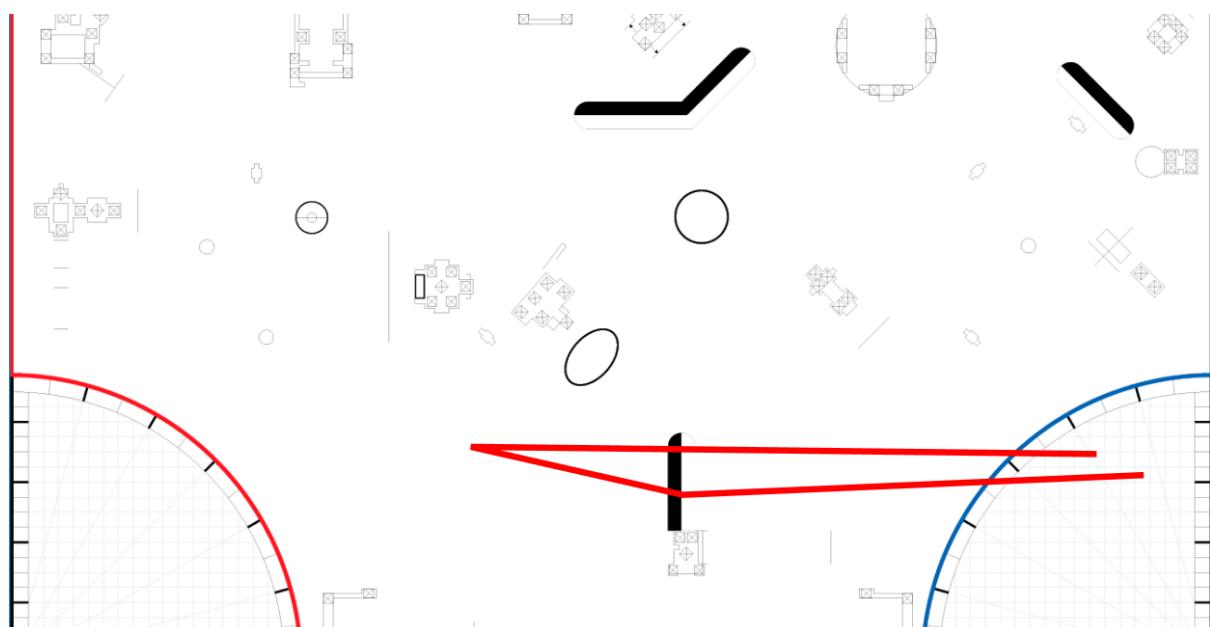
Attachment



Starting position



Road



Script

```
#robot starts
drive_base.curve(radius=3800, angle=10)
wait(100)
#we set the crab traps upright
drive_base.settings(1000, 1000, 500, 500)
wait(100)
#we flip them to score 40 points
drive_base.turn(-5)
drive_base.straight(600)
drive_base.settings(1000, 500, 250, 250)
#after moving forward, we release the corals so they stand properly on the map
motor_config.a_motor.run_time(speed=-400, time=500)
wait(50)
drive_base.straight(-100)
#we return to base
drive_base.turn(-26)
drive_base.curve(radius=-1600, angle=-17)
drive_base.straight(-300)
drive_base.curve(radius=-200, angle=-70)
drive_base.straight(-200)
```

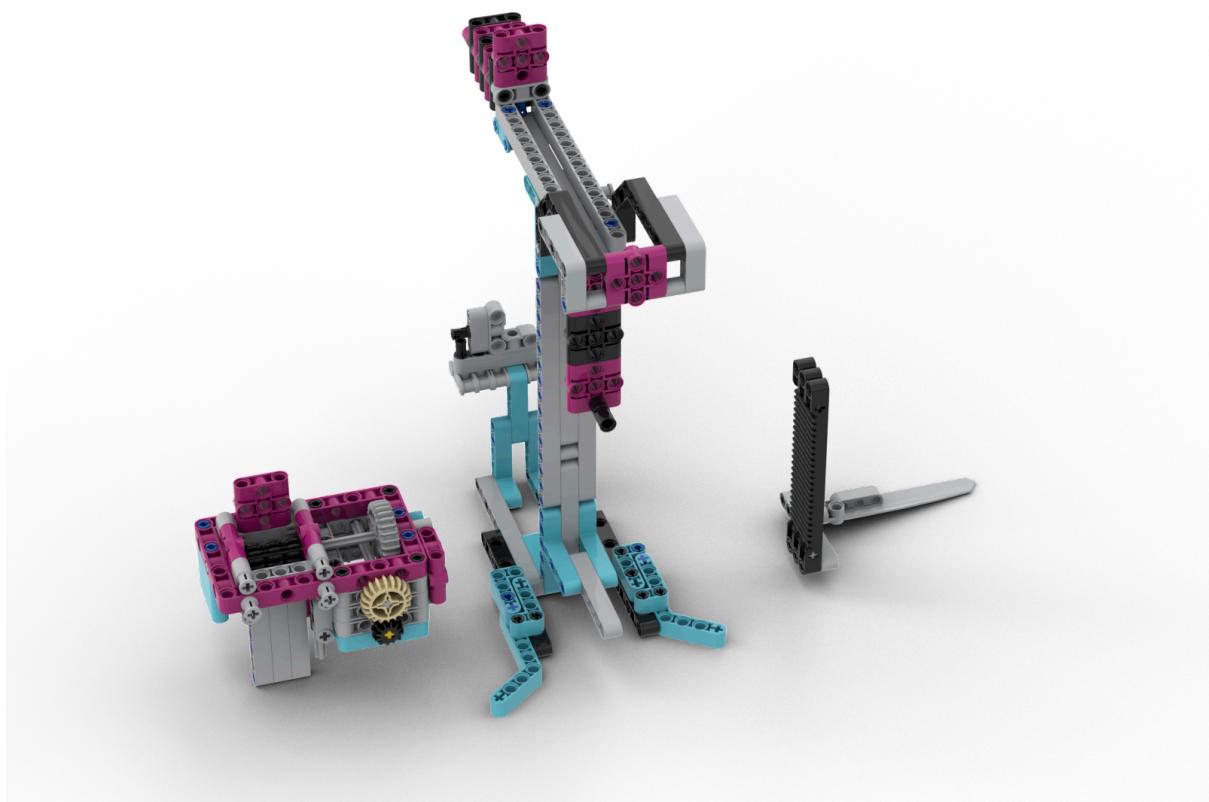
Testing Spreadsheet

Test Runs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Artificial Habitat M08	✓	✓	✓	✓	✓	□	✓	✓	✓	✓	□	✓	✓	✓	✓	✓	✓	✓	✓	
Reef Segments	3/3	3/3	2/3	3/3	1/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	3/3	1/3	3/3	2/3	3/3

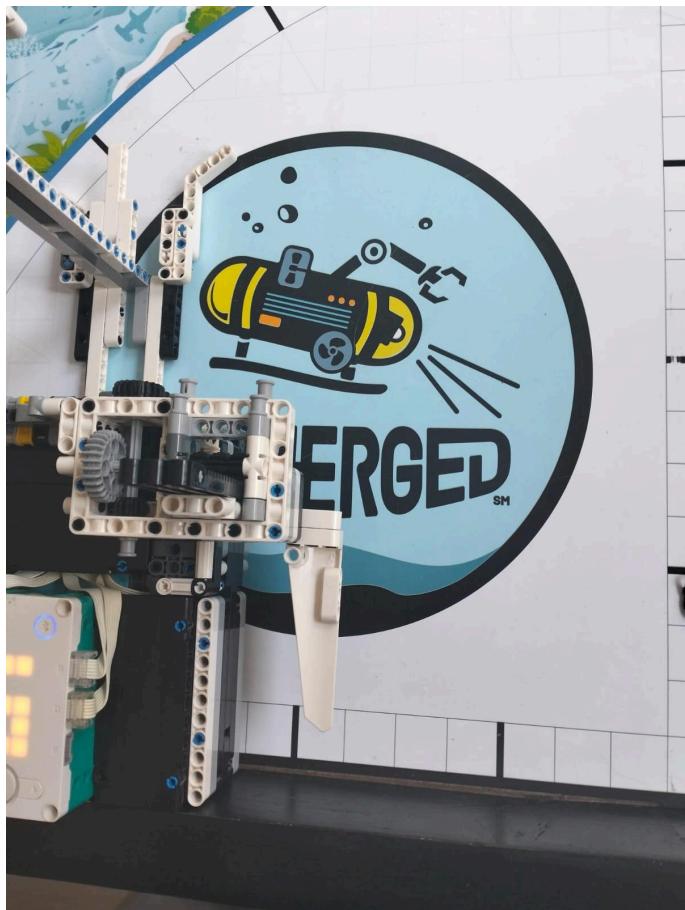
Run time	11.66 sec
Mounting time	7.37 sec
Score Achieved	70 points

V.Run

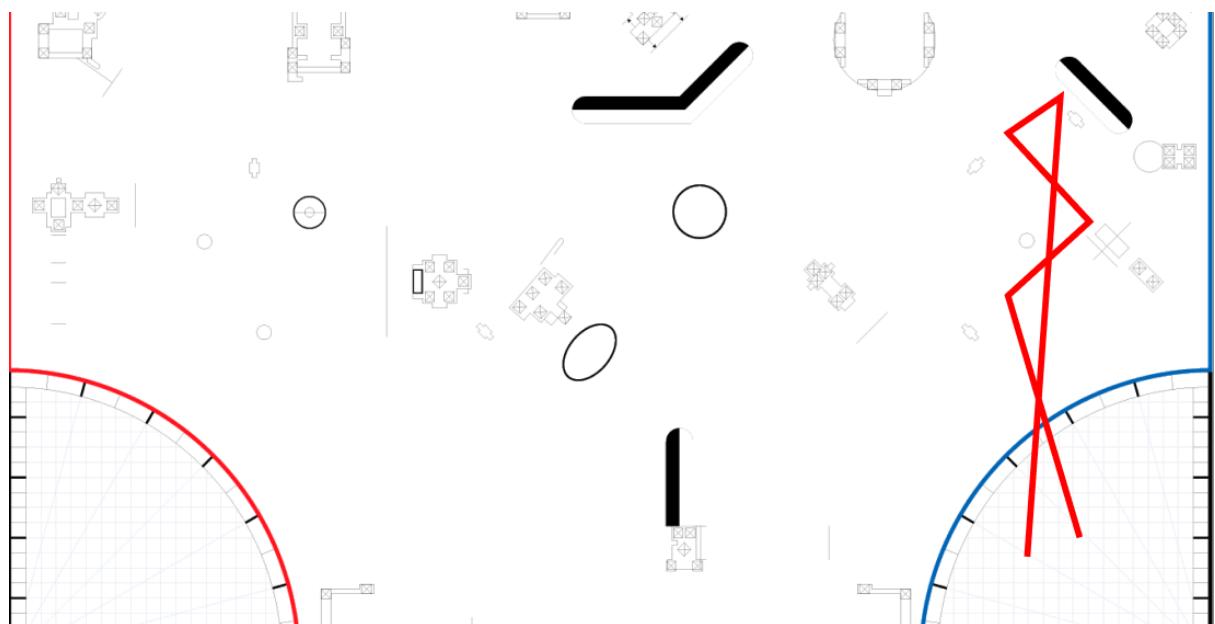
Attachment



Starting position



Road



Script

```
#robot starts
#we drive forward to reach the whale
drive_base.straight(710.8)
drive_base.turn(38)
drive_base.straight(123)
wait(500)
#we release the krill into the whale's mouth
drive_base.straight(-145)
#we move to the smaller boat to place it into another lane
drive_base.turn(-40)
drive_base.straight(-100)
#we lift the boat and reposition it into the new lane
drive_base.turn(-45)
motor_config.b_motor.run_time(speed=-1000, time=2300)
drive_base.straight(-132)
motor_config.b_motor.run_time(speed=1000, time=2300)
drive_base.straight(-150)
#we return to base
drive_base.straight(140)
drive_base.settings(1000, 1000, 500, 500)
drive_base.turn(50)
drive_base.straight(-600)
```

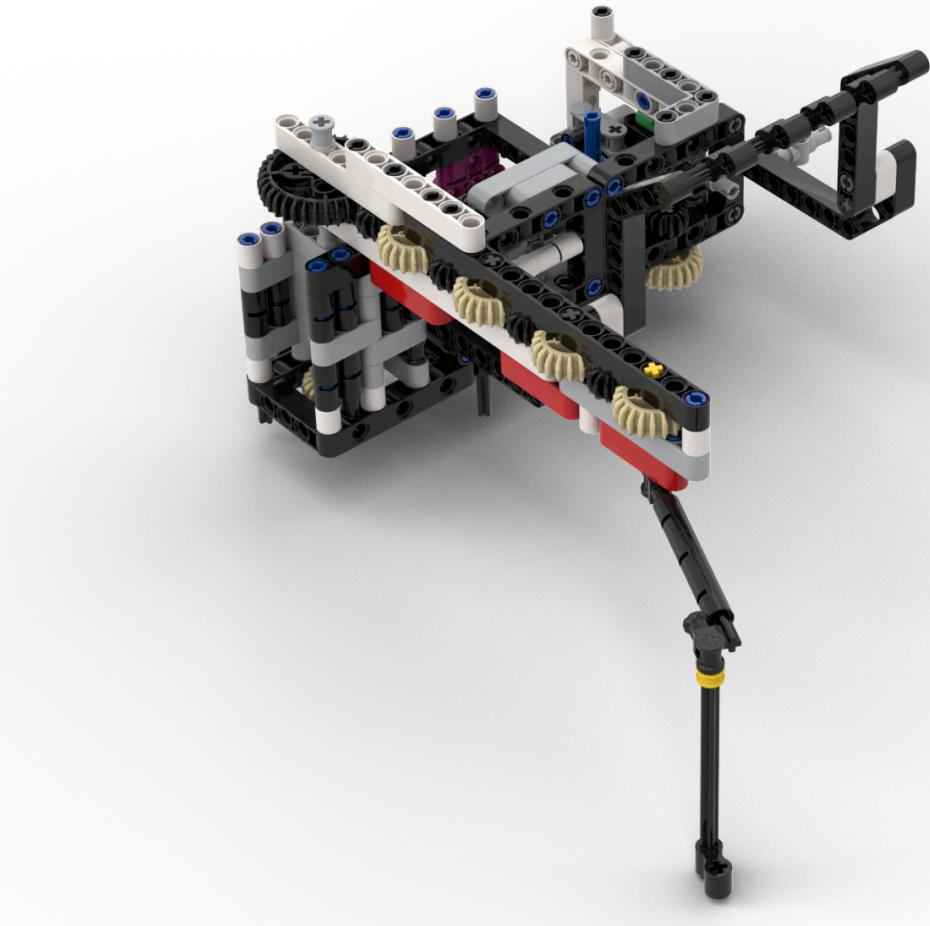
Testing Spreadsheet

Test Runs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Changing Shipping Lanes M13	✓	✓	□	✓	✓	□	✓	✓	✓	✓	□	✓	✓	□	✓	✓	✓	✓	✓	
Feed The Wale M12	4/4	4/4	4/4	4/4	4/4	2/4	4/4	4/4	0/4	4/4	4/4	3/4	4/4	4/4	4/4	0/4	4/4	4/4	4/4	

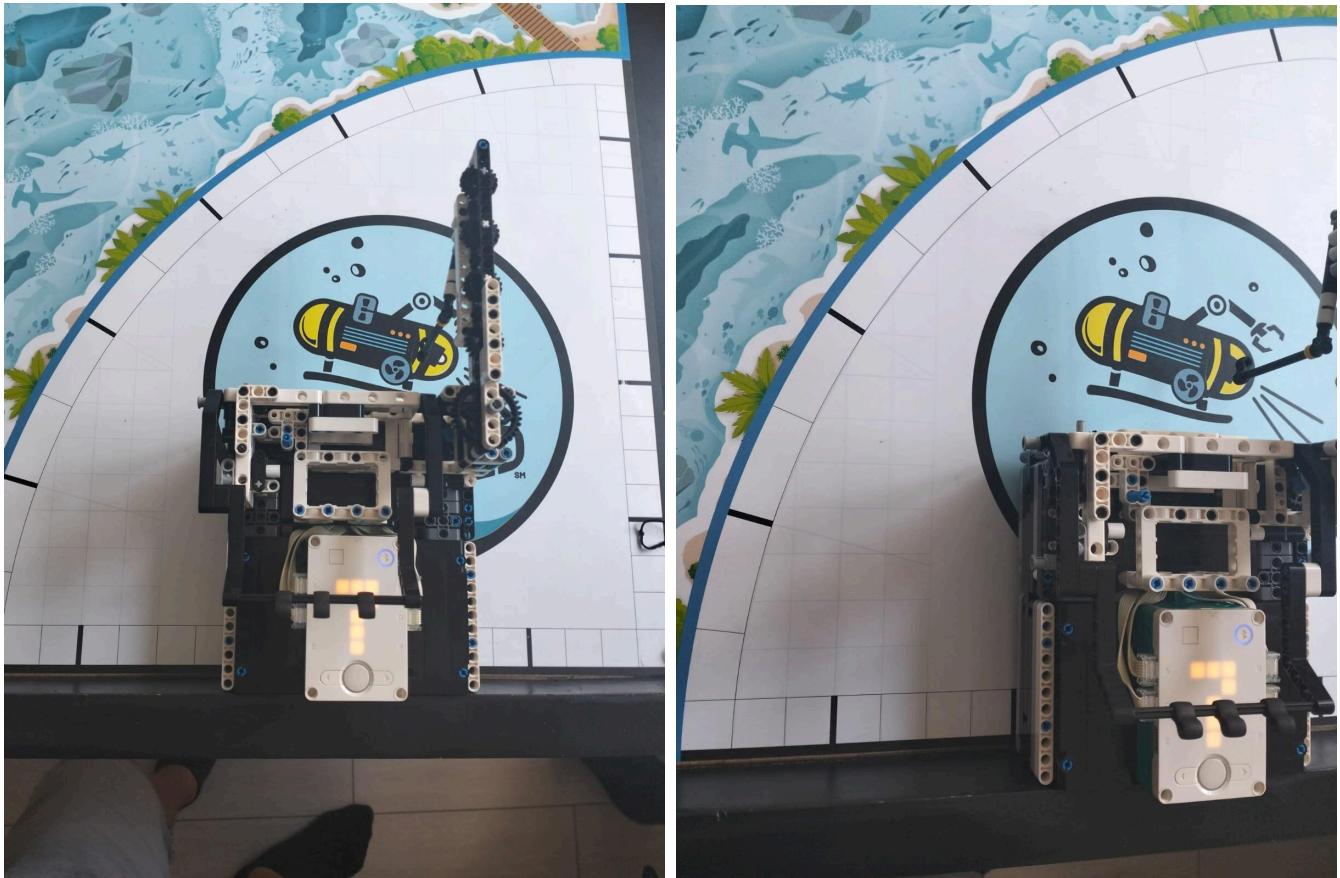
Run time	22.25 sec
Mounting time	5.15 sec
Score Achieved	55 points

VI.Run

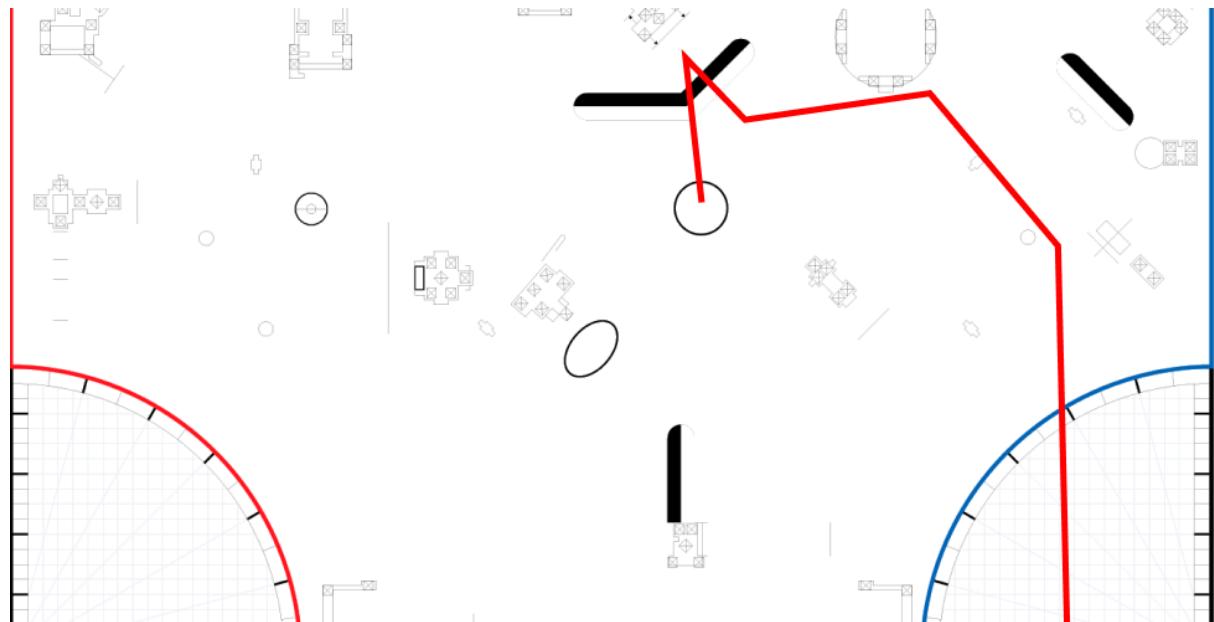
Attachment



Starting position



Road



Script

```
#robot starts
#we approach the sonar
drive_base.straight(500)
drive_base.turn(-39)
drive_base.straight(330)
#we rotate it so both whales are detected
motor_config.b_motor.run_time(speed=-1000, time=1340)
wait(100)
drive_base.straight(10)
#we head to the submarine to release it into the water
wait(400)
drive_base.straight(-150)
drive_base.turn(-14)
#we launch the submarine to the other side of the field
motor_config.a_motor.run_time(speed=1000, time=800)
drive_base.straight(448)
motor_config.a_motor.run_time(speed=-1000, time=900)
wait(1500)
#we transport the unknown creature above the deep-sea zone
motor_config.a_motor.run_time(speed=1000, time=600)
drive_base.straight(-100)
```

```

drive_base.turn(-60)
drive_base.straight(200)
#end

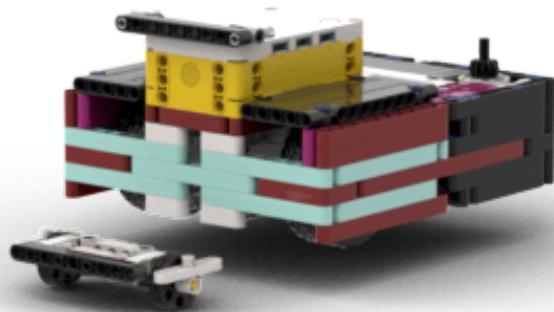
```

Testing Spreadsheet

Test Runs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Send Over The Submersible M10	✓	✓	□	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	□	✓	✓	✓	
Sonar Discovery M11	□	□	✓	✓	✓	✓	✓	□	□	✓	□	✓	✓	□	✓	✓	✓	✓	✓	
Cold Seep M09	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

Run time	17.15 sec
Mounting time	4.65 sec
Score Achieved	80 points

Base Robot



Configuration

```
from pybricks.hubs import InventorHub
from pybricks.pupdevices import Motor, ColorSensor, UltrasonicSensor
from pybricks.parameters import Button, Color, Direction, Port, Side, Stop
from pybricks.robots import DriveBase
from pybricks.tools import wait, StopWatch

hub = InventorHub()

def run__7_submersible(motor_config: MotorConfig):

    straight_speed = 700
    straight_acceleration = 500
    turn_rate = 500
    turn_acceleration = 120

    drive_base = DriveBase(motor_config.left_motor, motor_config.right_motor,
wheel_diameter=62, axle_track=180)

    #configure drive base
    drive_base.settings(straight_speed, straight_acceleration,
turn_rate, turn_acceleration)
    drive_base.use_gyro(True)
```

Motor Configuration

```
from pybricks.pupdevices import Motor
from pybricks.parameters import Port, Direction

class MotorConfig():
    def __init__(self, left_motor = Motor(Port.C, Direction.COUNTERCLOCKWISE),
                 right_motor = Motor(Port.D),
                 a_motor = Motor(Port.A),
                 b_motor = Motor(Port.B)):
        self.left_motor = left_motor
        self.right_motor = right_motor
        self.a_motor = a_motor
        self.b_motor = b_motor

motor_config = MotorConfig()
```

Menu Script

```
from pybricks.hubs import InventorHub
from pybricks.parameters import Button, Color, Direction, Port, Stop
from pybricks.pupdevices import Motor
from pybricks.tools import wait
from M05_M09_M14_run_1 import run_1_anglerfish
from M01_M02_M03_M04_M06_M07_run_2 import run_2_scuba
from M02_M14_run_3 import run_3_trident
from M15_run_4 import run_4_vessel
from M03_M08_run_5 import run_5_coralls
from M12_M13_run_6 import run_6_whale
from M09_M10_M11_run_7 import run_7_submersible

from motor_config import motor_config, MotorConfig

def init_motor_conf():
    motor_config= MotorConfig(
        left_motor = Motor(Port.C, Direction.COUNTERCLOCKWISE),
        right_motor = Motor(Port.D),
        a_motor = Motor(Port.A),
        b_motor = Motor(Port.B),
    )
    # Let's offer these menu options. You can add as many as you like.
    menu_options = ("1", "2", "3", "4", "5", "6", "7", "8")
    menu_index = 0

    hub = InventorHub()

def run_program(selected: int):
    print("running program: " + str(selected))
    if selected == 1:
        run_1_anglerfish(motor_config=motor_config)
    elif selected == 2:
```

```

    run__2_scuba(motor_config=motor_config)
elif selected == 3:
    run__3_trident(motor_config=motor_config)
elif selected == 4:
    run__4_vessel(motor_config=motor_config)
elif selected == 5:
    run__5_coralls(motor_config=motor_config)
elif selected == 6:
    run__6_whale(motor_config=motor_config)
elif selected == 7:
    run__7_submersible(motor_config=motor_config)

while True:

    # Normally, the center button stops the program. But we want to use the
    # center button for our menu. So we can disable the stop button.
    print("Hello to menu")
    hub.system.set_stop_button(None)

    while True:

        hub.display.char(menu_options[menu_index])

        # Wait for any button.
        pressed = ()
        while len(pressed) == 0:
            pressed = hub.buttons.pressed()
            wait(10)

        # Wait for the button to be released.
        while hub.buttons.pressed():
            wait(10)

        # Now check which button was pressed.
        if Button.CENTER in pressed:
            # Center button, so the menu is done!
            break
        elif Button.LEFT in pressed:
            # Left button, so decrement menu menu_index.

```

```
    menu_index = (menu_index - 1) % len(menu_options)
elif Button.RIGHT in pressed:
    # Right button, so increment menu menu_index.
    menu_index = (menu_index + 1) % len(menu_options)

# Now we want to use the Center button as the stop button again.
hub.system.set_stop_button(Button.CENTER)

# Based on the selection, choose a program.
selected = int(menu_options[menu_index])
try:
    run_program(selected=selected)
    pressed = ()
except SystemExit as ex:
    motor_config.left_motor.close()
    # global right_motor
    motor_config.right_motor.close()
    # global a_motor
    motor_config.a_motor.close()
    # global b_motor
    motor_config.b_motor.close()
    print(hub.imu.ready())
    while not hub.imu.ready():
        wait(50)
        hub.display.text("X")
    #hub.color.on(Color.BLUE)
    init_motor_conf()
```

