SASTA OLIPHANT SCIENCE AWARDS

SOUTH AUSTRALIAN SCIENCE TEACHERS ASSOCIATION

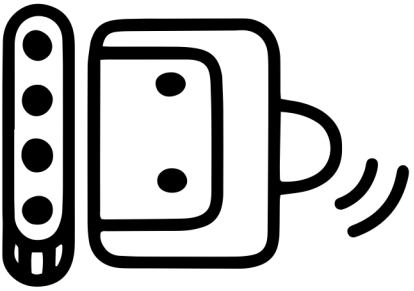
Highly Commended

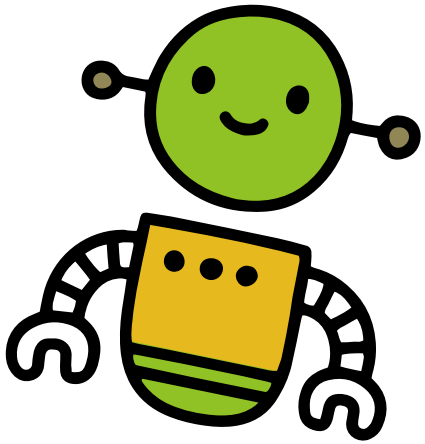
Programming, Apps & Robotics

Year 3-4

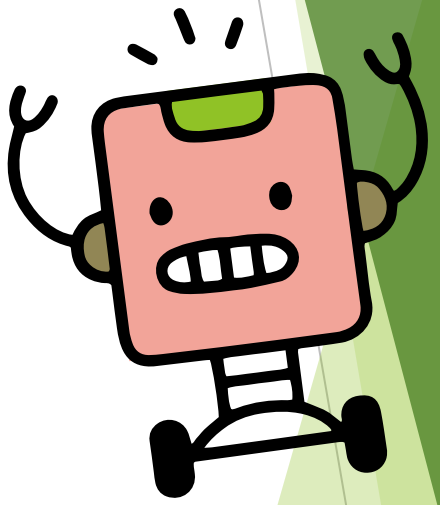
Xavier Lo

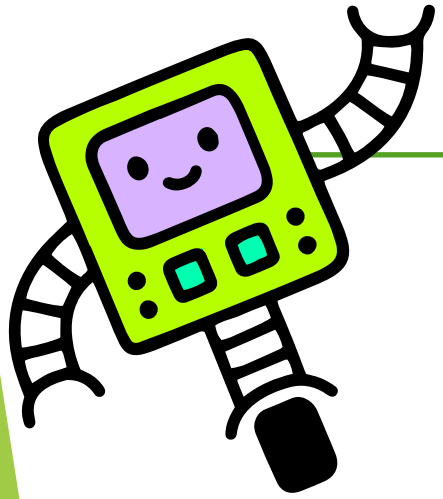
Concordia College - St John's Campus





Obstacle Avoidance Robot





SASTA Oliphant Science 2024 -Programming, Apps & Robotic

Student Name: Xavier Lo

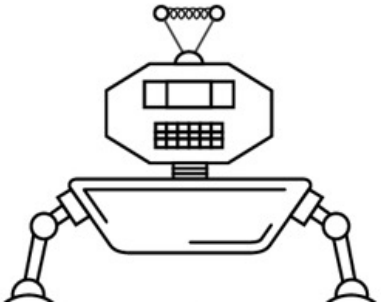
School: Concordia College St. John's Campus

Class: Year 4

Aim of the Entry

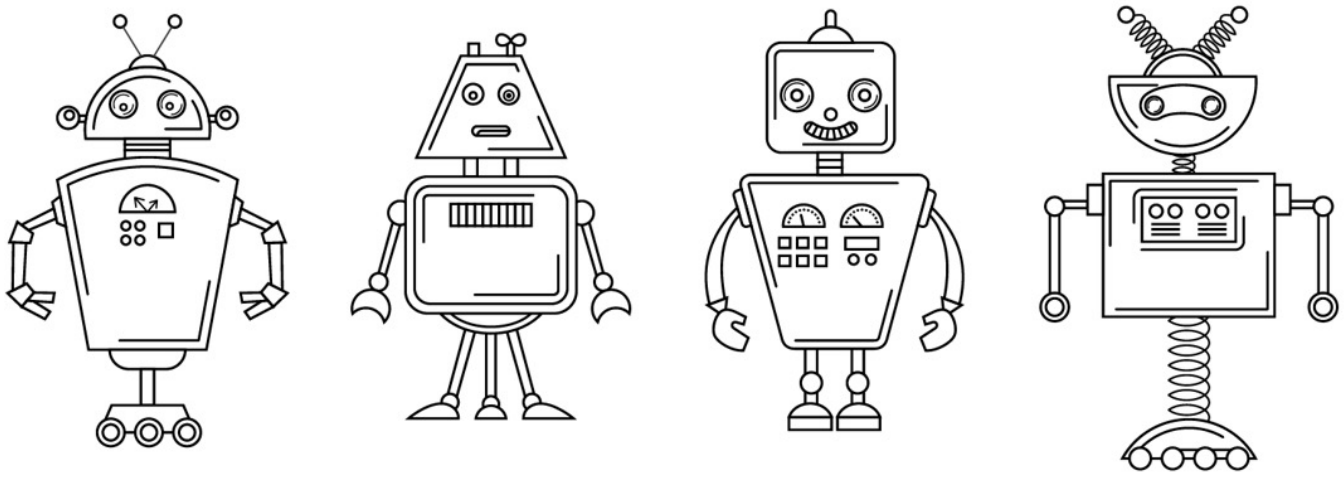
Robotics is a fast-growing field that has been integrated into many aspects of our daily lives.

I have a particular interest in autonomous robotic science that may improve our future living by simplify complex task and improve living standard. So I have idea create the Obstacle Avoidance Robot code to avoid obstacles when distance <10cm.



Types of Robot

My Autonomous robot is an obstacles avoidance robot. It is a very intelligence device that able to move without hitting surrounding objects. It uses an ultrasonic sensor that can detect distance while operating and having a microcontroller to command the robot to move forward, backward, turn left and right from its left and right motor that connected to the wheels.



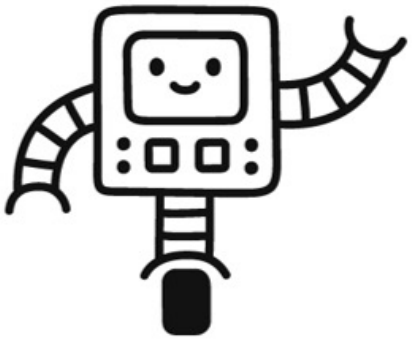
Parts Involved

Motor drive module, left and right motor and wheels

The Motor drive module detect output high and low levels or output pulse width modulation (pwm) to control the forward and reverse rotation of the motor. Each motor has a wheel attached to it.

Servo motor

Servo motor control the ultrasonic sensor to moves between 30 degrees (turn right), 90 degrees (front), and 150 degrees (turn left) to detect the distance of right side, front and left side set by the programmed microcontroller.



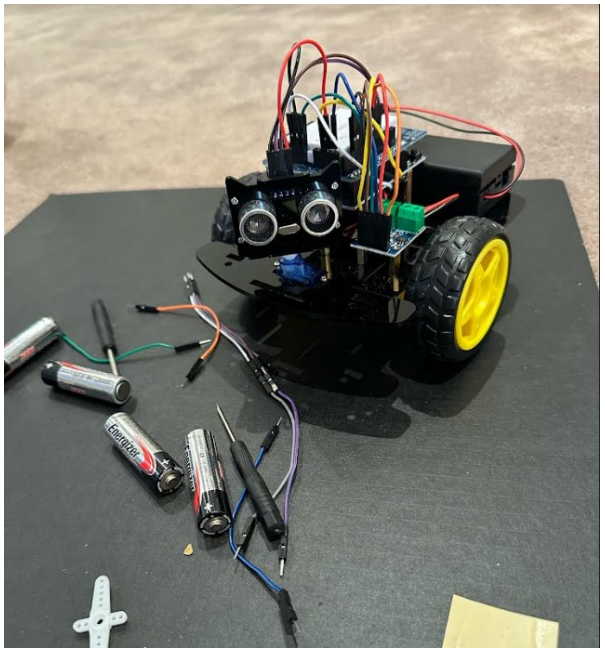
Parts Involved

Ultrasonic Module

This module is attached on top of servo motor. Transmitter (trig pin) sends a signal in ultrasonic wave (high-frequency sound) out when it hits an object then reflect in back to the receiver (echo pin). A distance will be measured and recorded.

Arduino Uno

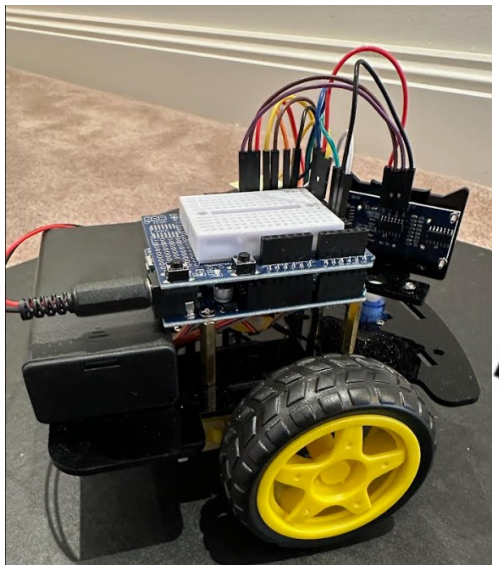
Arduino Uno is an easy to use programmable microcontroller board that allows user to program the robot via USB port and consist a power jack to connect to battery compartment.

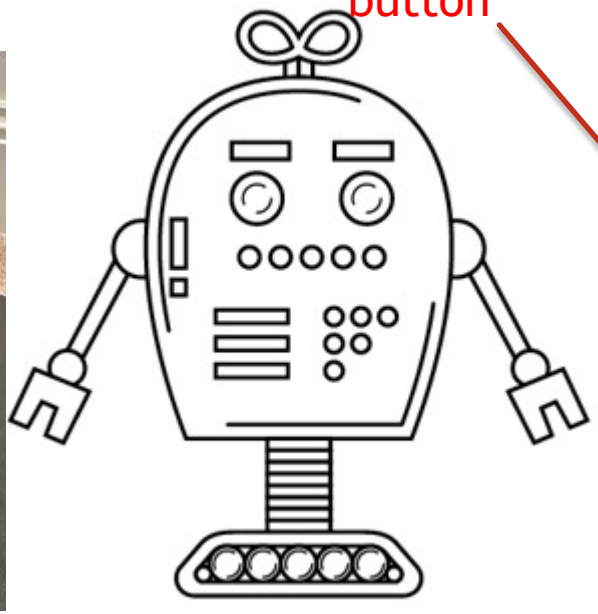


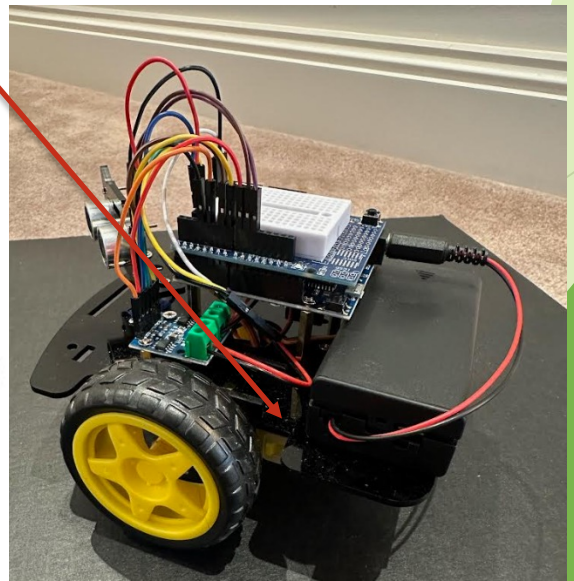
Operation

To start the robot, you just need to place two 3.7V batteries to the battery compartment and plug in the power cable to the power jack on the device body (Arduino uno).

Switch on the power button on battery compartment to start the robot.







Coding/Programming

- By Using Arduino IDE 2.3.3 to program the robot, all the detections, movements were programmed to get this robot to have at least minimum of 10cm distance to manoeuvre its way to avoid hitting any objects while moving.

- When the distance between the ultrasonic module and the obstacle in front is less than 10cm, the robot will stop for 200 milliseconds, and the servo motor will turn ultrasonic module left and right to obtain the distance. The distance between them is saved to the variable leftDis or rightDis.

- Lastly, the servo motor will return to the front. By comparing the distance between the left and right sides, Arduino microcontroller will command the car drive to the side with the larger distance. If the maximum distance is less than 10cm, then the car will go backward then turn to avoid obstacles.

- The robot will move forward where there is no obstacle or distance between the ultrasonic module and obstacle is larger than 10cm.

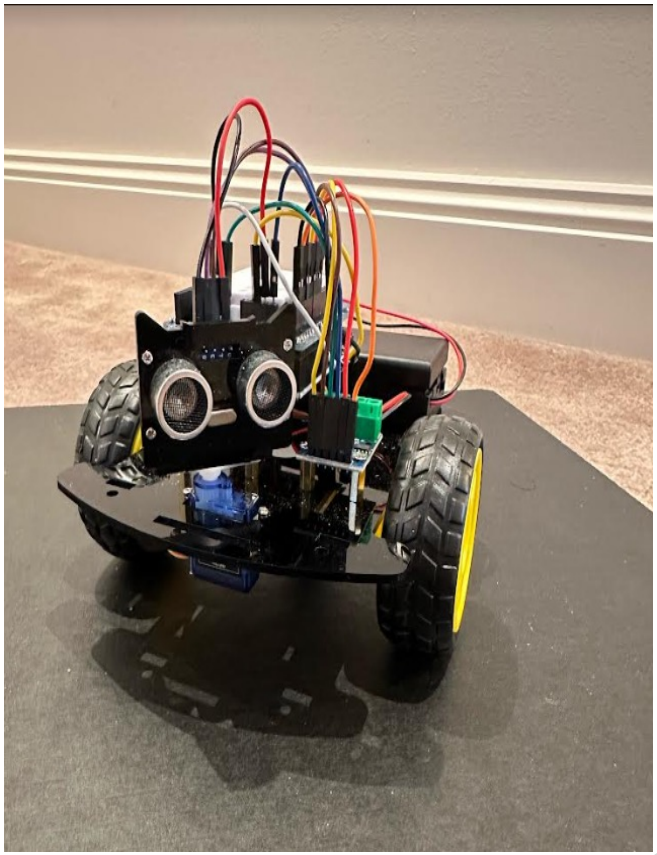
Setting Up Obstacle Course with Lego and cardboard with unsuccessful attempt ☹

https://www.youtube.com/shorts/8s3aX_LG0ws

Lego Block felled down☹

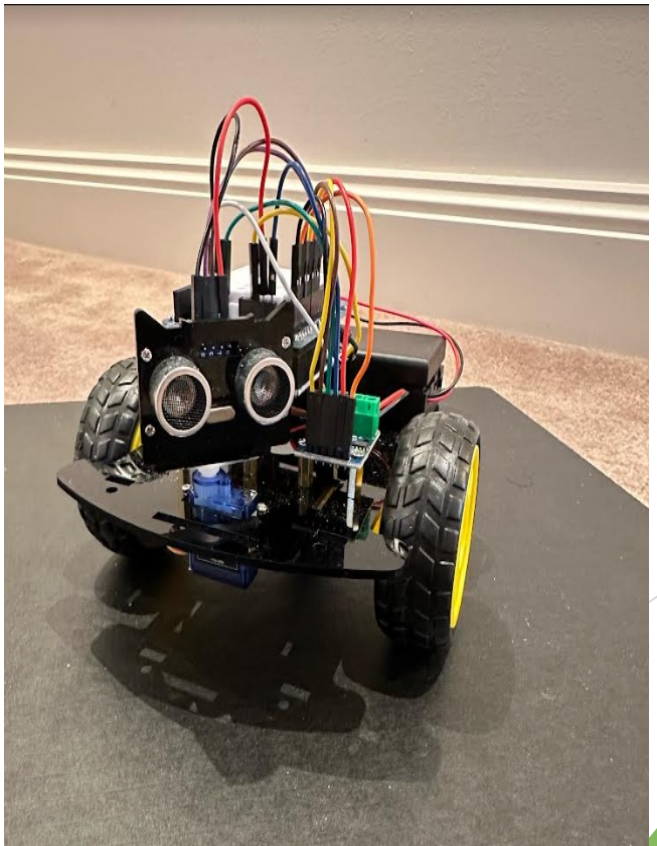
Reverse coding Added to the Obstacle Avoidance Robot

https://www.youtube.com/watch?v=tj_N5Mk_xmg



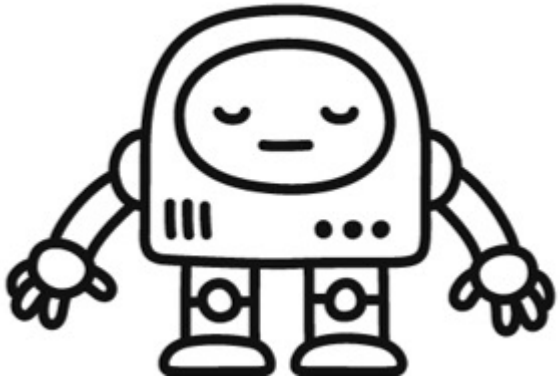
Setting Up Obstacle Course with Cardboard successful attempt ☺

https://www.youtube.com/shorts/if9ijhxcPmE

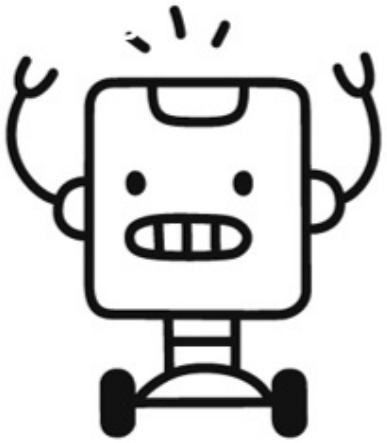


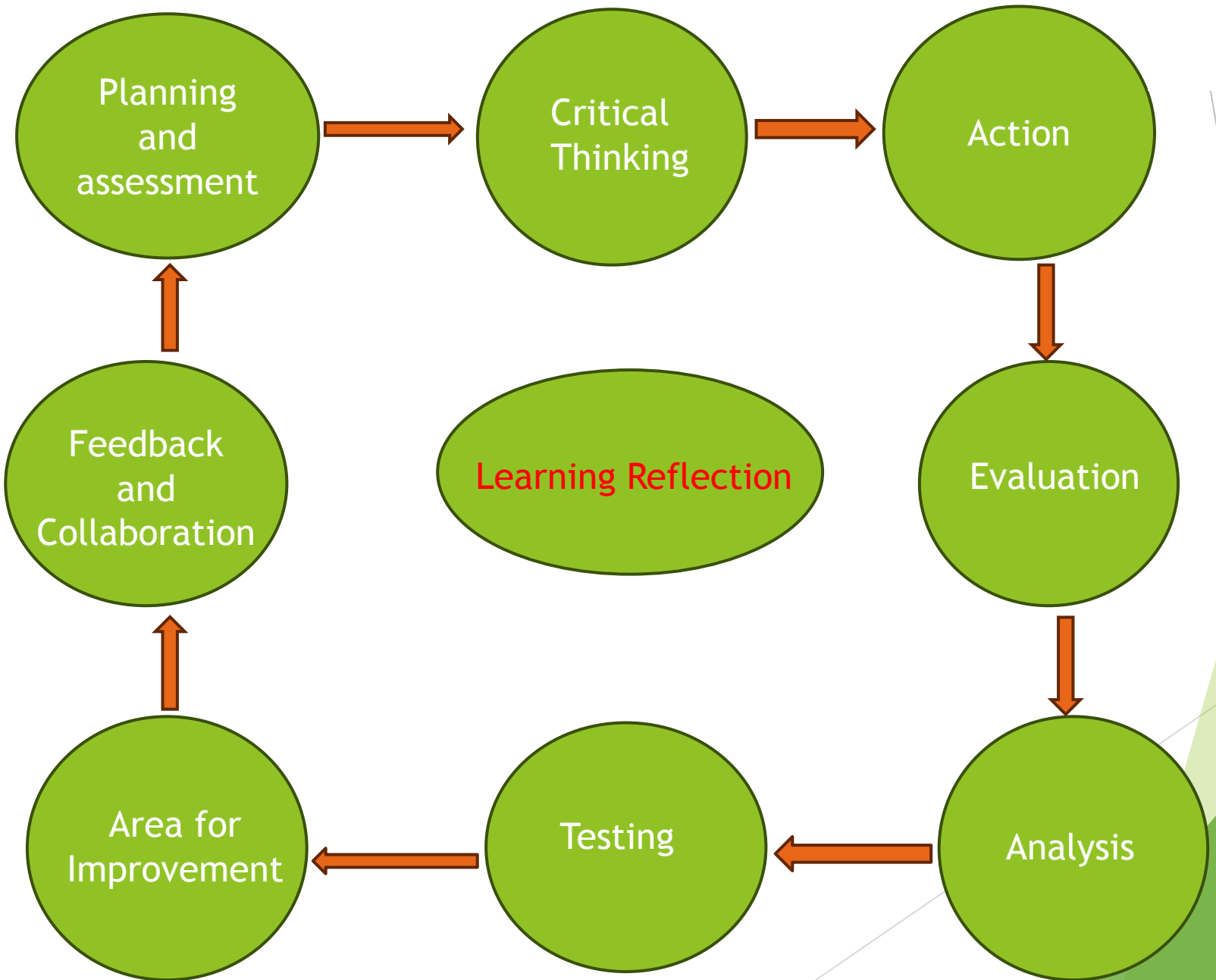
Troubleshooting

- Check that everything is wired and connected.
- Most of times the robot will run right into an obstacle or into the wall, too fast , too slow and sometimes stopping with no action- then I need to recheck correct coding.
- I need to check the distance in front and move forward as long as the measured distance is greater than the distance limit. If the distance is less than distance limit, the robot should stop, then need to retake a measurement to the left and right, then start again.



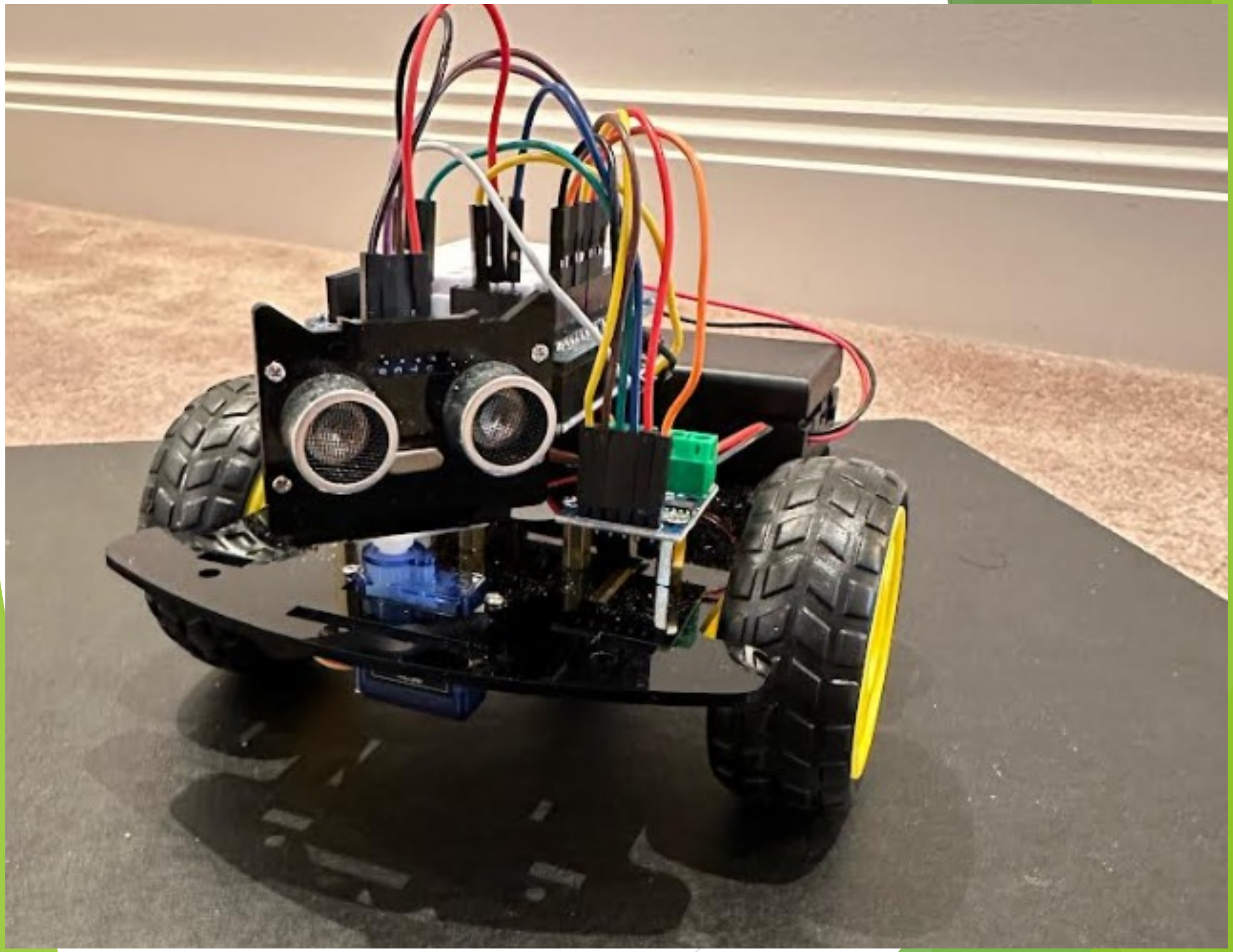
Leaning Reflection for Obstacle Avoidance Robot Science Project





Acknowledgment Support

I want to Thank my Dad for support with the coding process.
Even though there have been many failed attempts at this process, we have spent a lot of time figuring out what went wrong. Over the previous several months, I have learned a lot about robotic coding. It's incredibly fun for me.
One extremely significant lesson
I took away from this experience was
to never give up & Keep Trying !




Thank
you!

SASTA Oliphant Science 2024 –Programming, Apps & Robotic
Student Name: Xavier Lo
School: Concordia College St. John's Campus
Class: Year 4

```
//Obstacle Avoidance Robot code to avoid obstacle < 10cm
#define Trig 2
#define Echo 15
float distance;
float cm;


#define IN_1 0
#define IN_2 4
#define IN_3 13
#define IN_4 12
int speedCar = 180;

#include <Servo.h>
#define ServoPin 5
float leftDis;
float rightDis;
Servo myservo;


void setup() {
  Serial.begin(115200);
  pinMode(IN_1, OUTPUT);
  pinMode(IN_2, OUTPUT);
  pinMode(IN_3, OUTPUT);
  pinMode(IN_4, OUTPUT);

  pinMode(Trig, OUTPUT);
  pinMode(Echo, INPUT);

  myservo.attach(ServoPin, 700, 2400);
  myservo.write(90);
  Stop();
}


void loop() {
  avoidance(10);
}


*/
```

SASTA Oliphant Science 2024 –Programming, Apps & Robotic
Student Name: Xavier Lo
School: Concordia College St. John's Campus
Class: Year 4

```
float GetDistance() {
  digitalWrite(Trig, LOW);
  delayMicroseconds(2);
  digitalWrite(Trig, HIGH);
  delayMicroseconds(10);
  digitalWrite(Trig, LOW);
  distance = pulseIn(Echo, HIGH) / 58.00;
  return distance;
}

void Forward() {
  digitalWrite(IN_1, LOW);
  analogWrite(IN_2, speedCar);
  analogWrite(IN_3, speedCar);
  digitalWrite(IN_4, LOW);
}

void Backward() {
  analogWrite(IN_1, speedCar);
  digitalWrite(IN_2, LOW);
  digitalWrite(IN_3, LOW);
  analogWrite(IN_4, speedCar);
}

void TurnLeft() {
  analogWrite(IN_1, speedCar);
  digitalWrite(IN_2, LOW);
  analogWrite(IN_3, speedCar);
  digitalWrite(IN_4, LOW);
    Serial.println("TurnLeft");
}

void TurnRight() {
  digitalWrite(IN_1, LOW);
  analogWrite(IN_2, speedCar);
  digitalWrite(IN_3, LOW);
  analogWrite(IN_4, speedCar);
    Serial.println("TurnRight");
}

void Stop() {
  digitalWrite(IN_1, LOW);
```

SASTA Oliphant Science 2024 –Programming, Apps & Robotic
Student Name: Xavier Lo
School: Concordia College St. John's Campus
Class: Year 4

```
  digitalWrite(IN_2, LOW);
  digitalWrite(IN_3, LOW);
  digitalWrite(IN_4, LOW);
}


void avoidance(int set_dis) {
  myservo.write(90);  //Servo back to front
  //Obtain the distance between the robot and the obstacle and store it in
cm
  cm = GetDistance();
  // Serial.print("cm = ");
  // Serial.println(cm);
  if (cm <= set_dis) {
    Stop();                    //Stop the car
    delay(200);
      Backward();              //Go backward
      delay(300);
      Stop();
      delay(200);
    myservo.write(150);
    delay(500);
    leftDis = GetDistance();  // Measure the distance between the left
obstacle and the robot, and store the measurement data in leftDis
    // Serial.print("leftDis = ");
    // Serial.println(leftDis);
    myservo.write(90);
    delay(100);
    myservo.write(30);
    delay(500);
    rightDis = GetDistance();  // Record the range data on the right
obstacle and the robot, and store the measurement data in rightDis
    // Serial.print("rightDis = ");
    // Serial.println(rightDis);
    myservo.write(90);

    //The right is more distant from the obstacle than the Left
    if (leftDis < rightDis) {
      if (rightDis < 10) {
        Backward();
        delay(300);
        TurnRight();
```

SASTA Oliphant Science 2024 –Programming, Apps & Robotic
Student Name: Xavier Lo
School: Concordia College St. John's Campus
Class: Year 4

```
        delay(200);
      } else {
        TurnRight();
        delay(200);
      }
    }
    //The left is more distant from the obstacle than the Right
    else if (leftDis > rightDis) {
      if (leftDis < 10) {
        Backward();
        delay(300);
        TurnLeft();
        delay(200);
      } else {
        TurnLeft();
        delay(200);
      }
    }
  } else {
    Forward();           //Go forward
  }
}
```