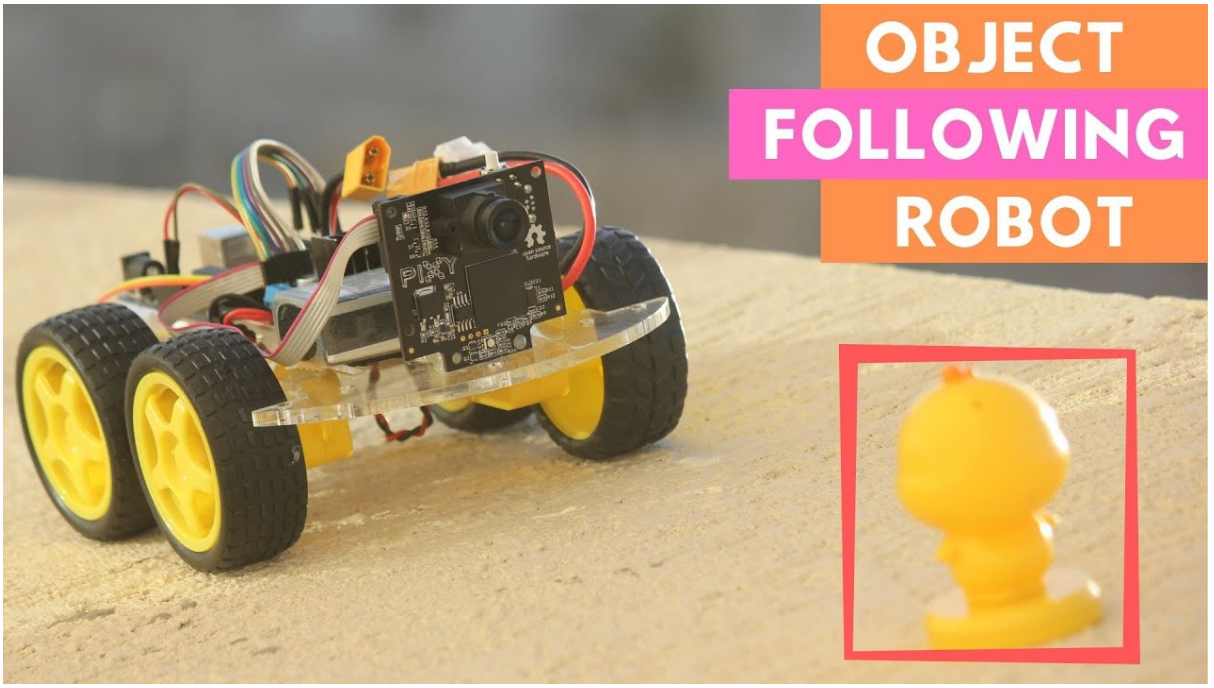
1. **PROJECT TITLE -** OBJECT FOLLOWING ROBOT



2. PROJECT DESCRIPTION

Lets begin with tracking, tracking means the act of following something or someone. This project is designed to teach the robot (in the form of a car), how to learn from its environment. The purpose of this project is to train the car to track every object whose color has been registered in the system of the robot. We can also teach the car to track more than one color. The materials used for this project is in the component table section.

3. COMPONENT TABLE

NAME	QUANTITY
GEARED DC MOTOR	2
JUMPER WIRES	14
DC DRIVER L298N	1
ARDUINO UNO	1
TYRES	2
PIXY CAM	1
BATTERIES	2
BATTERY PACK	1
NUTS & BOLTS	8

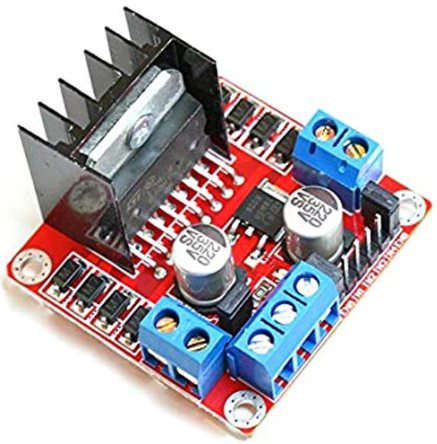
CHASSIS	1
GLUE	1
THIRD WHEEL	1
ARDUINO UNO & PIXY Softwares	

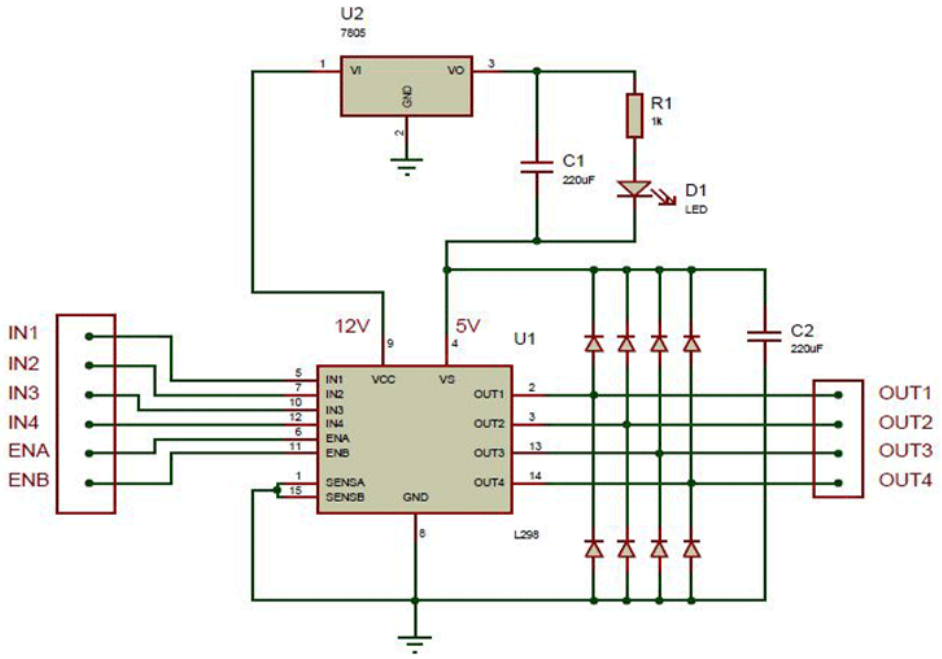
4. COMPONENT DESCRIPTION

Geared DC Motor: is an all-in-one combination of a motor and gearbox. The addition of a gear head to a motor reduces the speed while increasing the torque output.

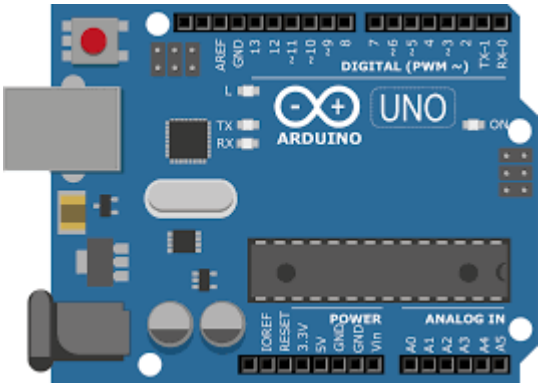
Jumper Wires: are used for making connections between items on your breadboard and your Arduino's header pins. Use them to wire up all your circuits!

L298N Driver: The L298N is a dual-channel H-Bridge motor driver capable of driving two DC motors and one stepper motor. means it can individually drive up to two DC motors for any applications like 2WD robots, Small drill machine, solenoid valve, DC lock etc. An L298N motor driver module consists of an L298N motor driver chip(IC). which is an integrated monolithic circuit in a 15-lead Multiwatt package. It is a high voltage, a high current dual full-bridge driver designed to accept standard TTL logic levels.





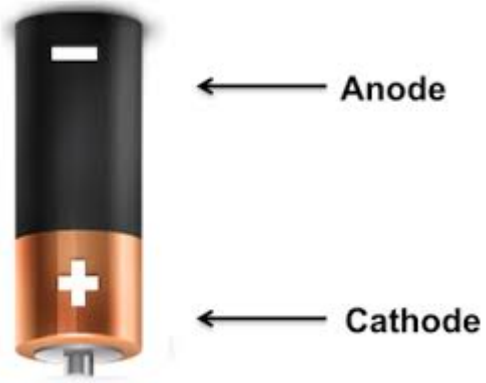
Arduino Uno: is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.



Tyres: a rubber covering, typically inflated or surrounding an inflated inner tube, placed round a wheel to form a soft contact with the road. These tyres will be attached to the DC Motor.

Pixy 2 cam: Pixy2 is smaller, faster and more capable than the original Pixy. Like its predecessor, Pixy2 can learn to detect objects that you teach it, just by pressing a button. Pixy is a camera used for vision.
https://youtu.be/EcCbEWiyiQY

Batteries: is a device consisting of one or more electrochemical cells with external connections for powering electrical devices such as flashlights, mobile phones, and electric cars.



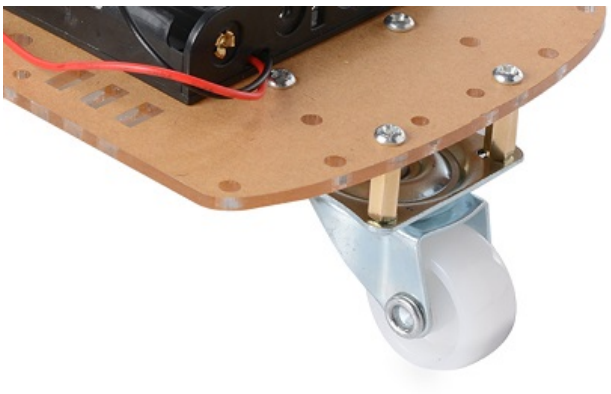
Battery Pack: is a case to hold the batteries. A group of (especially rechargeable) **batteries** contained within a casing and used as a power source.

Nuts & Bolt :A **nut** is a type of fastener with a threaded hole. **Nuts** are almost always used in conjunction with a mating **bolt** to fasten multiple parts together.

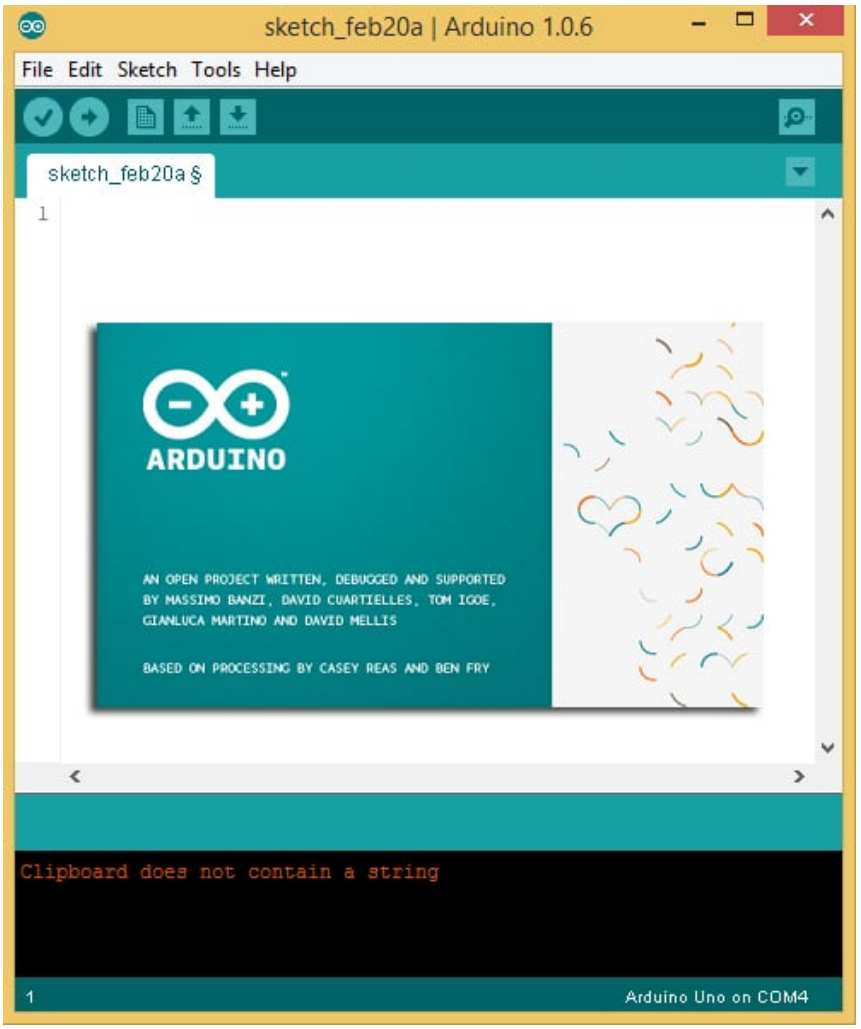
Chassis: is a framework which supports the body of a **robot**. It is a vehicle frame on which one can install the body of the **robot**.

Glue: a sticky substance that is used for joining things together permanently, produced from animal bones and skins or by a chemical process.

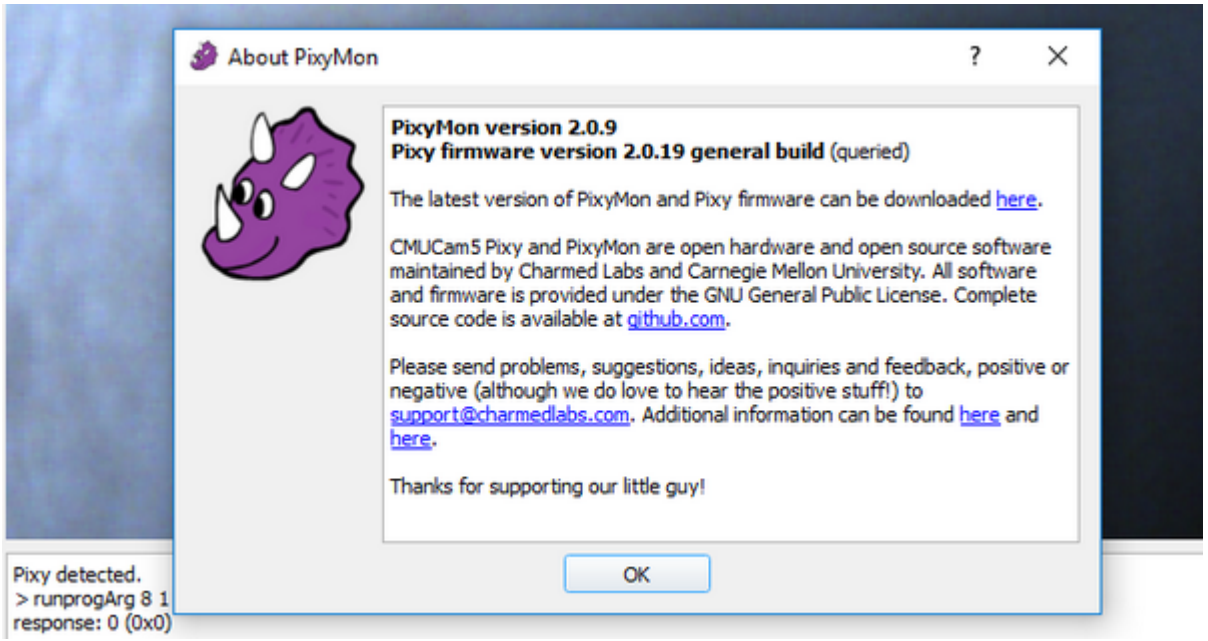
Third Wheel: this is the front tyre that is fixed to the shaft structure



Arduino IDE: contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the **Arduino** and Genuino hardware to upload programs and communicate with them.



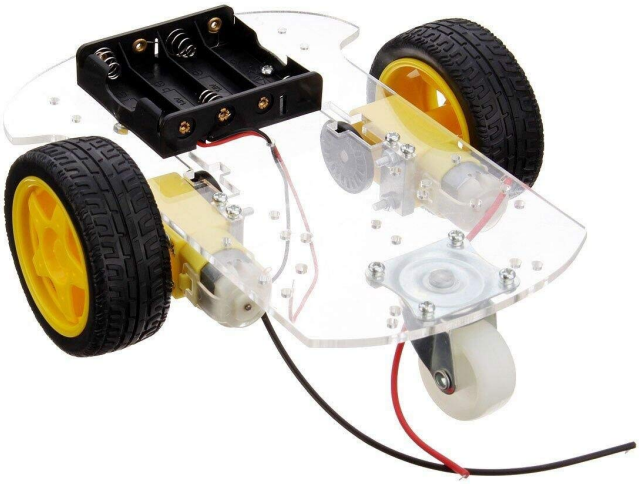
Pixymon: is an application that runs on Windows, MacOs and Linux. It allows you to see what Pixy2 sees, either as raw or processed video. It also allows you to configure your Pixy2, set the output port and manage color signatures.
PixyMon communicates with Pixy2 over a standard mini USB cable.



5. PROJECT WORKFLOW

Step 1: Get all necessary materials needed for this project.

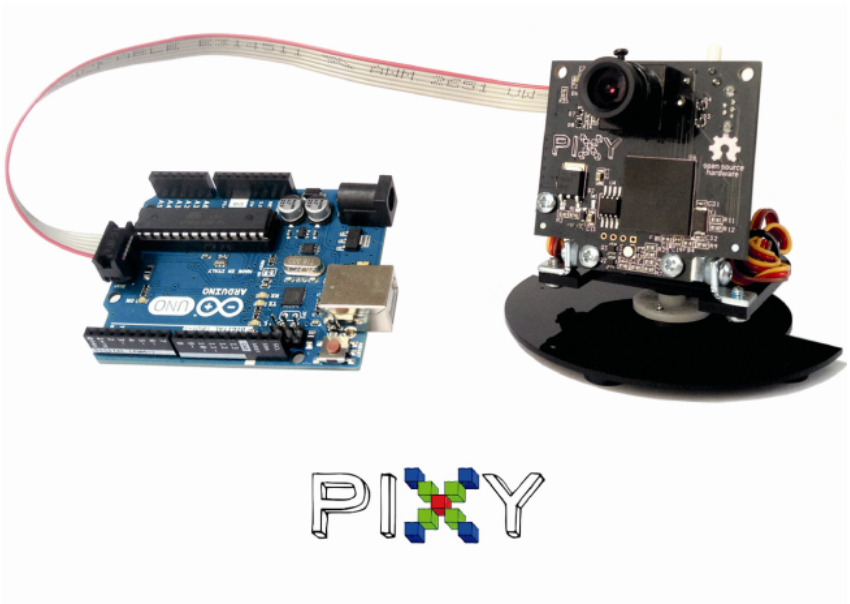
Step 2: First, we'll have to assemble the chassis:
In assembling the chassis, we will be attaching the geared dc motors to it and pass the wires to the top of the chassis from underneath it. Just as shown in the image below:



Step 3: Mount the arduino, l298N driver on top of the chassis, connect the l298N driver to the arduino.
Using the connection details below:
Driver l298N - Arduino Uno
IN1 - Digital Pin 6
IN2 - Digital Pin 7
IN3 - Digital Pin 8
IN4 - Digital Pin 9
ENA - Permanent (to do this we use the jumper)
ENB - Permanent

Step 4: Glue the battery pack to the chassis as shown in the image above.
Step 5: The next important step is to connect the battery pack to the L298N driver, we connect the battery using the instruction below:
Positive - 12V of Driver
Negative - GND of Driver

Step 6: Connect the Pixy 2 cam to the arduino, as seen in the image below



Step 7:run the code attached to this document (in the arduino IDE installed on your system, to download the IDE click the link next, https://grobotronics.com/dc-gear-motor.html?sl=en and upload the code to the arduino using the port).

Step 8: connect the DC Motors to the dc l298N driver, using the instructions below:
Geared Dc motor - L298N driver
First DC Motor - OUT1 & OUT2
Second DC Motor - OUT3 & OUT4

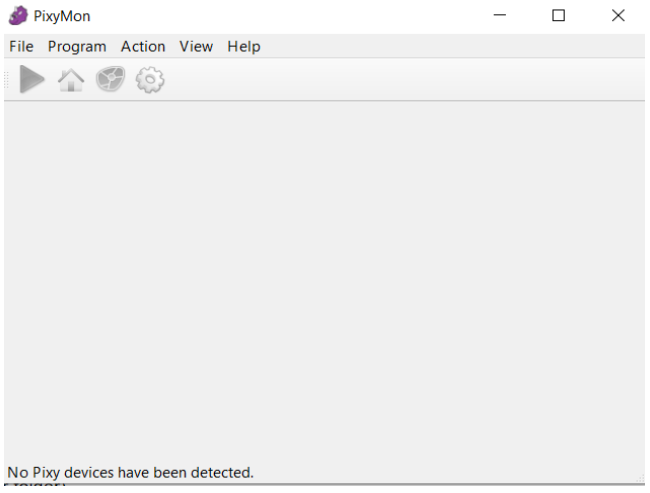
Step 9: add the batteries to the battery pack (this will supply power to the arduino, geared dc motor and the driver).

Step 10: Teaching the pixy to track

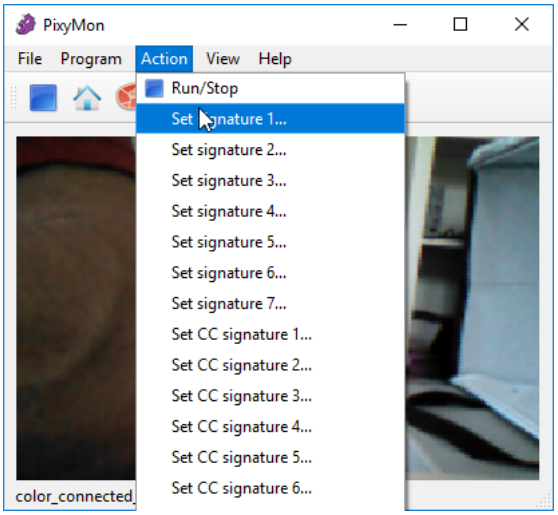
I. Install the pixymon software (https://github.com/charmedlabs/pixy/raw/master/releases/pixymon_windows/pixymon_windows-2.0.9.exe)

Ii. Open the pixymon once installation is completed

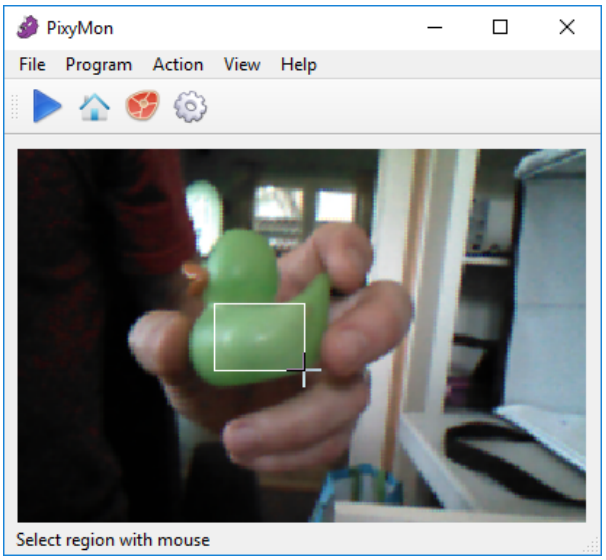
Iii. you should see this page - in the image below:



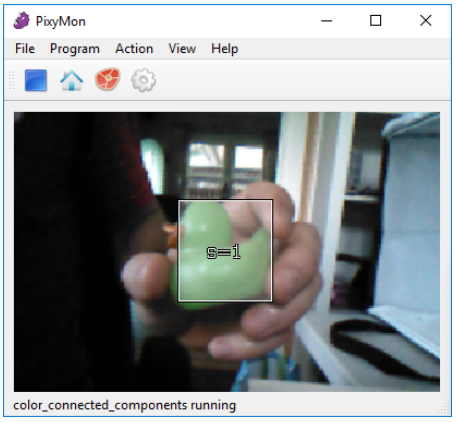
when pixy is not attached that's what you will see.
Iv. Plug the pixy to the computer using the USB cable
v. hold the object you want to train the pixy to track
Vi. click on Action and set signature just as shown below



Vii. Using the mouse, click and drag to select the region you want Pixy2 to use to learn the object. As shown below



Viii. That's it! After you select the region, Pixy2 will "learn" the object automatically and start tracking it.



lx. detach the pixy from the computer and connect it back to the arduino uno.

Step 11: done with all connectivity, power on the system

6. SOURCE CODE

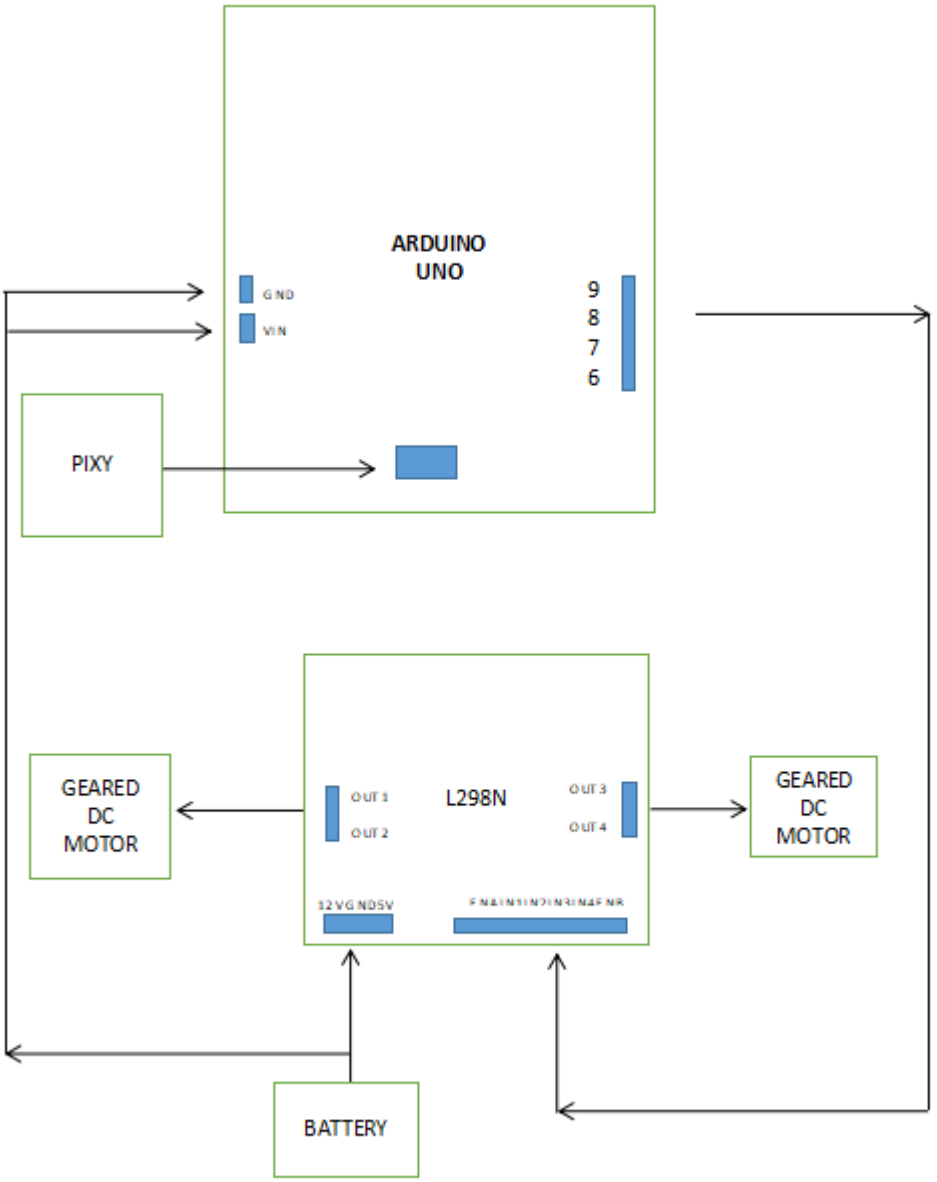
To run this code you will need to have the Pixy library installed:
https://github.com/charmedlabs/pixy2/raw/master/releases/arduino/arduino_pixy2-1.0.3.zip
Attached is the link to download it.

```
#include <Pixy2.h>
int S1 = 7;
int HM = 6;
int S2 = 8;
int VM = 9;
const int pwm = 2;
//int valy = 255;
//int valx = 255;
int x = 0;
int y = 0;
int n = 0;
uint16_t blocks;
int timer = 0;

Pixy2 pixy;

void setup() {
  pinMode(pwm, OUTPUT) ;
  pinMode(HM, OUTPUT);
  pinMode(VM, OUTPUT);
  pinMode(S1, OUTPUT);
  pinMode(S2, OUTPUT);

  timer = millis();
  pixy.init();
  pixy.ccc.getBlocks();
}

void loop() {
  for (int i = 0; i < pixy.ccc.numBlocks; i++) {
    x += pixy.ccc.blocks[i].m_x;
    y += pixy.ccc.blocks[i].m_y;
    n++;
  }

  x = x / n;
  y = y / n;

  if (pixy.ccc.numBlocks) {
    Serial.print("X: ");
    Serial.println(x);
    Serial.print("Y: ");
    Serial.println(y);
```

```
  }

  followAverage(x, y);
  digitalWrite(S1, LOW);
  digitalWrite(S2, LOW);
  pixy.ccc.getBlocks();
  x = 0;
  y = 0;
  n = 0;
  analogWrite(pwm, 255);
}

void followAverage(int x, int y) {
  if (x < 135 && y < 90 && pixy.ccc.numBlocks) {
    digitalWrite(S1, HIGH);
    digitalWrite(S2, HIGH);
    digitalWrite(HM, HIGH);
    digitalWrite(VM, HIGH);
    Serial.println("UL");

  }
  if (x < 135 && y > 110 && pixy.ccc.numBlocks) {
    digitalWrite(S1, HIGH);
    digitalWrite(S2, HIGH);
    digitalWrite(HM, HIGH);
    digitalWrite(VM, LOW);
    Serial.println("BL");

  }
  if (x > 165 && y < 90 && pixy.ccc.numBlocks) {
    digitalWrite(S1, HIGH);
    digitalWrite(S2, HIGH);
    digitalWrite(HM, LOW);
    digitalWrite(VM, HIGH);
    Serial.println("UR");

  }
  if (x > 165 && y > 110 && pixy.ccc.numBlocks) {
    digitalWrite(S1, HIGH);
    digitalWrite(S2, HIGH);
    digitalWrite(HM, LOW);
    digitalWrite(VM, LOW);
    Serial.println("BR");

  }
  if (x < 135 && y > 90 && y < 110 && pixy.ccc.numBlocks) {
    digitalWrite(S1, HIGH);
    digitalWrite(HM, HIGH);
    digitalWrite(VM, HIGH);
    Serial.println("L");

  }
  if (x > 165 && y > 90 && y < 110 && pixy.ccc.numBlocks) {
    digitalWrite(S1, HIGH);
```

```
  digitalWrite(HM, LOW);
  digitalWrite(VM, LOW);
  Serial.println("R");

 }
 if (x < 165 && x > 135 && y < 90 && pixy.ccc.numBlocks) {
  digitalWrite(S2, HIGH);
  digitalWrite(HM, HIGH);
  digitalWrite(VM, HIGH);
  Serial.println("U");

 }
 if (x < 165 && x > 135 && y > 110 && pixy.ccc.numBlocks) {
  digitalWrite(S2, HIGH);
  digitalWrite(HM, LOW);
  digitalWrite(VM, LOW);
  Serial.println("B");

 }
 if (x < 165 && x > 135 && y < 110 && y > 90) {
  digitalWrite(HM, LOW);
  digitalWrite(VM, LOW);
  digitalWrite(S1, LOW);
  digitalWrite(S2, LOW);
  Serial.println("on target");

 }
 if (pixy.ccc.numBlocks == 0) {
  digitalWrite(HM, LOW);
  digitalWrite(VM, LOW);
  digitalWrite(S1, LOW);
  digitalWrite(S2, LOW);

 }
}
```

7. BLOCK DIAGRAM


ARDUINO
UNO
GND
VIN
9
8
7
6
PIXY
GEARED
DC
MOTOR
OUT 1
OUT 2
L298N
OUT 3
OUT 4
GEARED
DC
MOTOR
12V GND 5V
BATTERY