

Self-Driving Rover

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Personal goals:

- car to be semi-autonomous and avoid obstacles relatively well.
- Understand how to employ higher level code techniques(PWM, Interrupts and bit twiddling)
 - PWM for LEDS
 - PWM for motor speed
 - Interrupt to check for light level?
 - Bit twiddling to control motor on and off

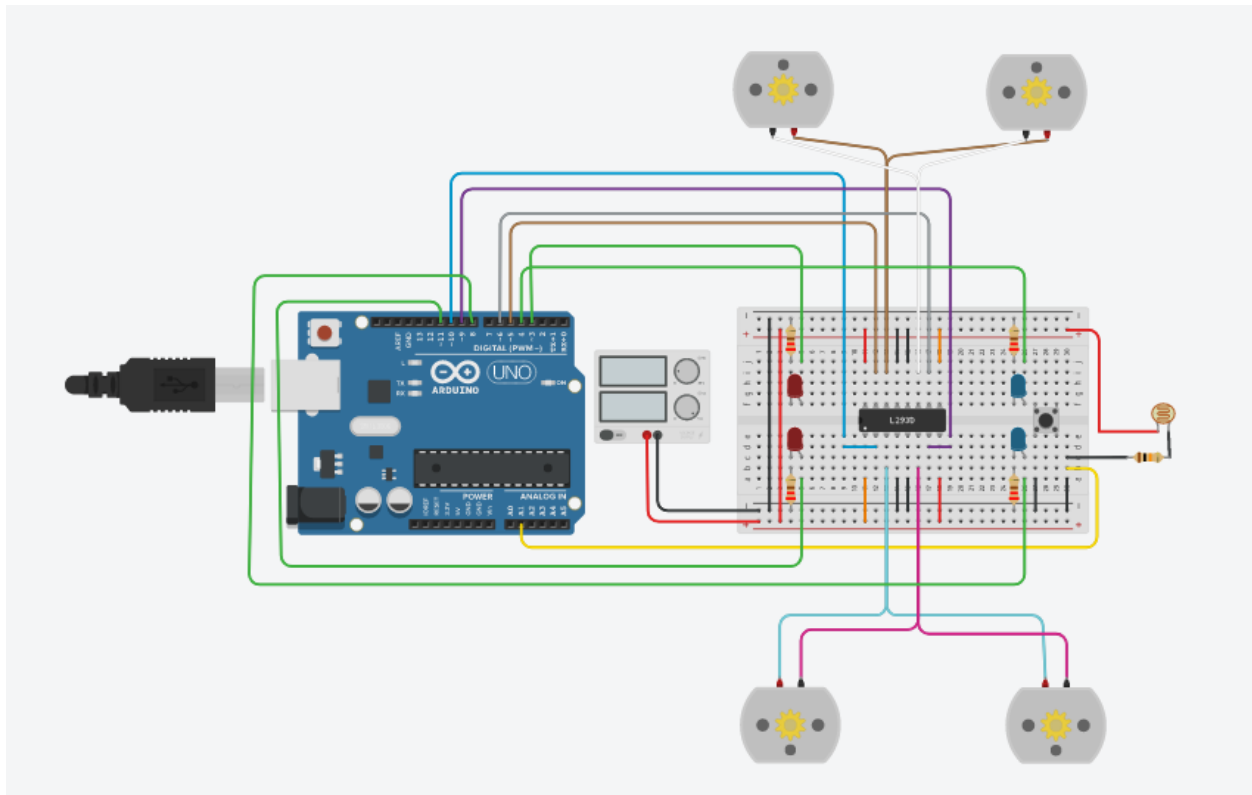
I want to make a self-driving rover because I feel like it will be a good starting platform that could be improved upon in many directions. Such as:

- Space exploration (one day)
- Explore here on earth
 - explore unique areas and record with 3D camera to build VR environments.
 - learn more about our oceans with a waterproof version
 - Robot involved AR games
- Search and rescue
 - A rover could potentially search for longer hours than a human
 - Deploys a drone to search from sky as well

Components:

- Elegoo Uno
- Power supply module
- L293D chip
- Button
- Photoresistor
- 10k resistor
- LEDs x4
- 220ohm resistor x4
- DC motors x4
- Jumperwires
- Breadboard

Wiring



Basic code getting motions down with PWM to control LED

```
int in1Pin = 10;
int in2Pin = 9;
int in3Pin = 5;
int in4Pin = 6;
int taillightR = 11;
int taillightL = 3;
int headlightR = 4;
int headlightL = 8;
```

```
void setup() {
  // put your setup code here, to run once:
  pinMode(in1Pin, OUTPUT);
  pinMode(in2Pin, OUTPUT);
  pinMode(in3Pin, OUTPUT);
  pinMode(in4Pin, OUTPUT);
  pinMode(taillightR, OUTPUT);
  pinMode(taillightL, OUTPUT);
  pinMode(headlightR, OUTPUT);
  pinMode(headlightL, OUTPUT);
}
```

```
void loop() {
  digitalWrite(headlightR, HIGH);
  digitalWrite(headlightL, HIGH);
}
```

```

forward();
delay(1000);
stop1();
delay(1000);
reverse();
delay(1000);
stop1();
delay(1000);
left();
delay(1000);
stop1();
delay(1000);
forward();
delay(1000);
stop1();
delay(1000);
reverse();
delay(1000);
stop1();
delay(1000);
right();
delay(1000);
stop1();
delay(1000);
}
void forward(){
  digitalWrite(in1Pin, LOW);
  digitalWrite(in2Pin, HIGH);
  digitalWrite(in3Pin, LOW);
  digitalWrite(in4Pin, HIGH);
  analogWrite(taillightR, 50);
  analogWrite(taillightL, 50);
}
void reverse(){
  digitalWrite(in1Pin, HIGH);
  digitalWrite(in2Pin, LOW);
  digitalWrite(in3Pin, HIGH);
  digitalWrite(in4Pin, LOW);
  for (int i = 0; i<255; i++){
    analogWrite(taillightR, i);
    analogWrite(taillightL, i);
    delay(5);
  }
  for (int i = 255; i>0; i--){
    analogWrite(taillightR, i);
    analogWrite(taillightL, i);
  }
}

```

```

    delay(5);
}
}
void left(){
    digitalWrite(in1Pin, HIGH);
    digitalWrite(in2Pin, LOW);
    digitalWrite(in3Pin, LOW);
    digitalWrite(in4Pin, HIGH);
}
void right(){
    digitalWrite(in1Pin, LOW);
    digitalWrite(in2Pin, HIGH);
    digitalWrite(in3Pin, HIGH);
    digitalWrite(in4Pin, LOW);
}
void stop1(){
    digitalWrite(in1Pin, LOW);
    digitalWrite(in2Pin, LOW);
    digitalWrite(in3Pin, LOW);
    digitalWrite(in4Pin, LOW);
    analogWrite(taillightR, 255);
    analogWrite(taillightL, 255);
}

```

Code using interrupts to drive the car forward and check light level. When the photoresistor senses the ambient light dim it starts an event in the loop

```
#include <TimerOne.h>
```

```

int in1Pin = 10;
int in2Pin = 9;
int in3Pin = 5;
int in4Pin = 6;
int taillightR = 11;
int taillightL = 3;
int headlightR = 4;
int headlightL = 8;
int switchPin = 7;
int photoResPin = A1;
long randomNumber;

```

```

int avoidObstacleRoutine = 0;
//int lightLv;

```

```

void setup() {
    // put your setup code here, to run once:
    pinMode(in1Pin, OUTPUT);
    pinMode(in2Pin, OUTPUT);
}

```

```

pinMode(in3Pin, OUTPUT);
pinMode(in4Pin, OUTPUT);
pinMode(taillightR, OUTPUT);
pinMode(taillightL, OUTPUT);
pinMode(headlightR, OUTPUT);
pinMode(headlightL, OUTPUT);

pinMode(switchPin, INPUT_PULLUP);
pinMode(photoResPin, INPUT);
randomSeed(analogRead(0));
//lightLv = analogRead(photoResPin);

Timer1.initialize(1000000); //initialize interrupt tp create an interupt with time from 100000us - 0.1s
Timer1.attachInterrupt(checkphPin); //Call checkPhPin when interrupt alarm goes off
Serial.begin(9600);
}

void loop() {
digitalWrite(headlightR, HIGH);
digitalWrite(headlightL, HIGH);
randNumber = random(1,4);
if (avoidObstacleRoutine == 1){
stop1();
delay(500);
left();
delay(1000);
avoidObstacleRoutine = 0;
}
else if (avoidObstacleRoutine == 2){
stop1();
delay(500);
left();
delay(3000);
reverse();
delay(1000);
avoidObstacleRoutine = 0;
}
else if (avoidObstacleRoutine == 3){
stop1();
delay(500);
right();
delay(1000);
avoidObstacleRoutine = 0;
}
}

void forward(){
digitalWrite(in1Pin, LOW);
digitalWrite(in2Pin, HIGH);

```

```

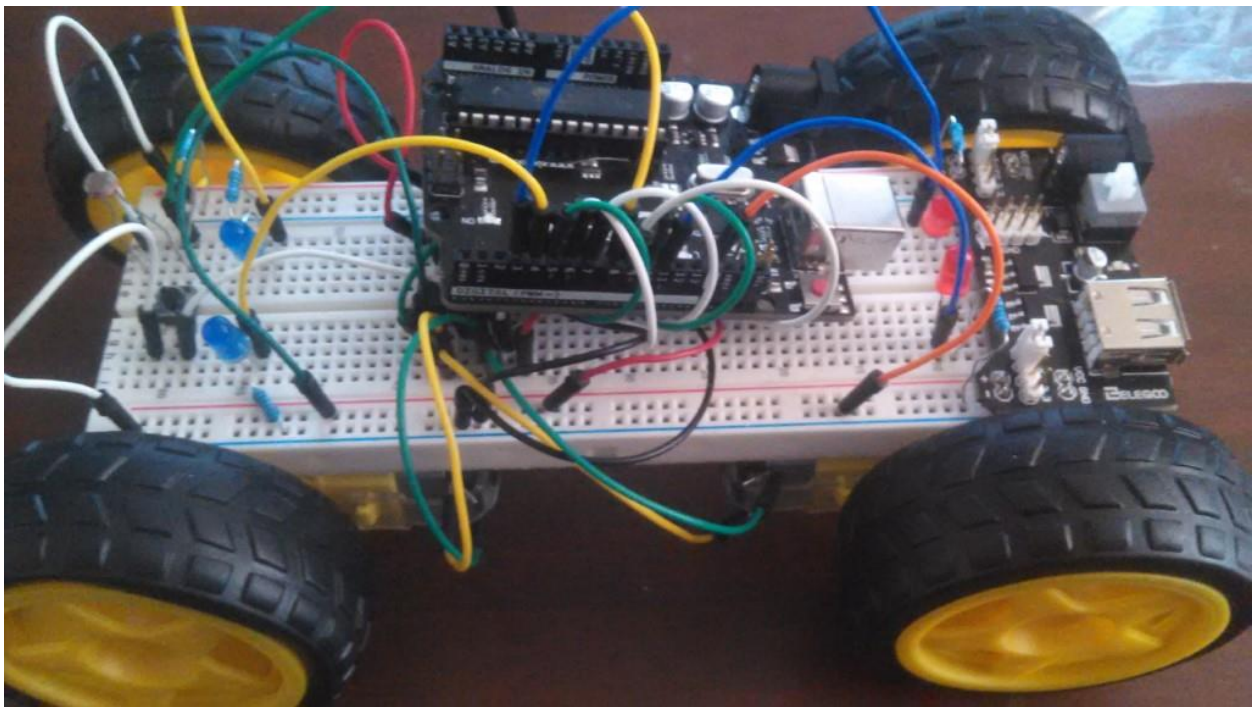
digitalWrite(in3Pin, LOW);
digitalWrite(in4Pin, HIGH);
analogWrite(taillightR, 25);
analogWrite(taillightL, 25);
}
void reverse(){
digitalWrite(in1Pin, HIGH);
digitalWrite(in2Pin, LOW);
digitalWrite(in3Pin, HIGH);
digitalWrite(in4Pin, LOW);
for (int i = 0; i<255; i++){
analogWrite(taillightR, i);
analogWrite(taillightL, i);
delay(5);
}
for (int i = 255; i>0; i--){
analogWrite(taillightR, i);
analogWrite(taillightL, i);
delay(5);
}
}
void left(){
digitalWrite(in1Pin, HIGH);
digitalWrite(in2Pin, LOW);
digitalWrite(in3Pin, LOW);
digitalWrite(in4Pin, HIGH);
}
void right(){
digitalWrite(in1Pin, LOW);
digitalWrite(in2Pin, HIGH);
digitalWrite(in3Pin, HIGH);
digitalWrite(in4Pin, LOW);
}
void stop1(){
digitalWrite(in1Pin, LOW);
digitalWrite(in2Pin, LOW);
digitalWrite(in3Pin, LOW);
digitalWrite(in4Pin, LOW);
analogWrite(taillightR, 250);
analogWrite(taillightL, 250);
}
void setavoidroutine(){
avoidObstacleRoutine = randomNumber;
}
void checkphPin(){
int lightLv = analogRead(photoResPin);
//Serial.println(lightLv);
if (lightLv < 400){

```

```
stop1();
setavoidroutine();
  Serial.println("getting dark");
}
else{
  forward();
}
}
```

Car so far – can drive forward back and turn left or right

Goes forward until it senses the ambient light dim, then randomly chooses from a list of pre made avoidance routines.



Improvements to make

- Add bit twiddling to control motors
- More complex maneuvers
- Integer to track what moves are currently working and continue on that path
- Servo 'head'
- Light level = motor speed?
- Slowdown as darkness increase

Video

<https://www.youtube.com/watch?v=0c1ygUnD01k>