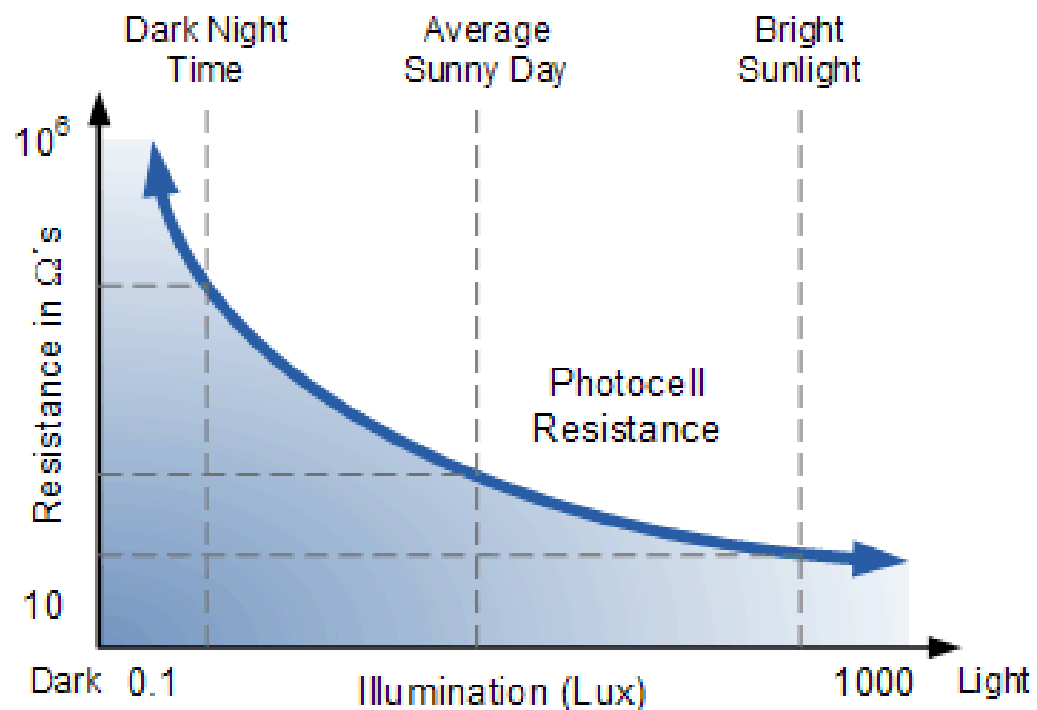
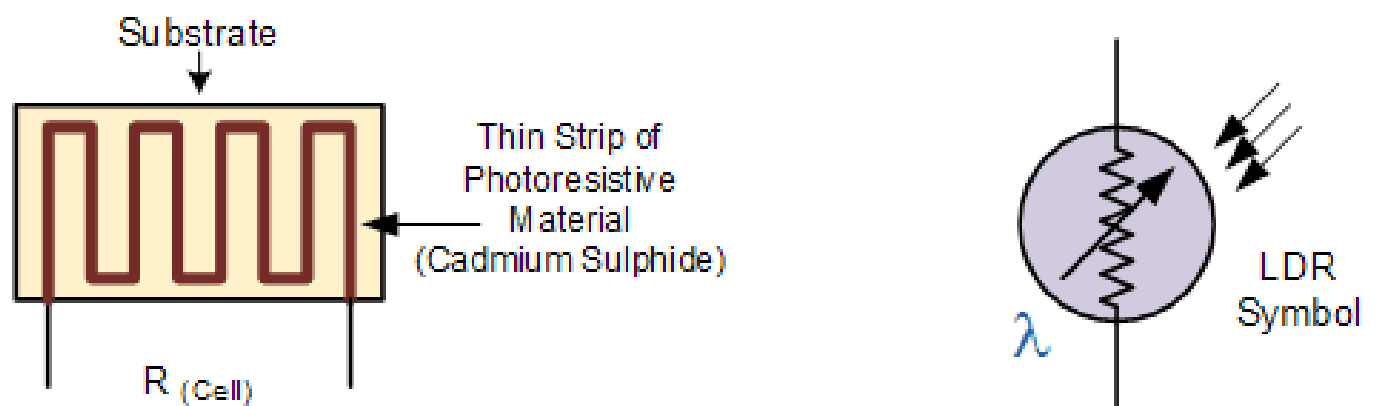


DS20613 - Assignment 5 – Light Dependent Resistor (LDR)
Submitted on 01 December 2020

Name: Theivaprakasham H

Roll Number: CB.EN.P2CEN20026

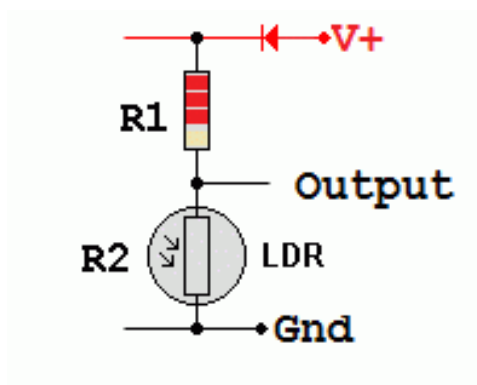
Light Dependent Resistor



List of Components

Name	Quantity	Component
U2	1	Arduino Uno R3
R1	2	Photoresistor
R5		
R2	1	0.5 kΩ Resistor
R3		
R4	3	1 kΩ Resistor
R6		
D1	2	Red LED
D2		

Wire Diagram of Pull up and Pull down Configuration of LDR



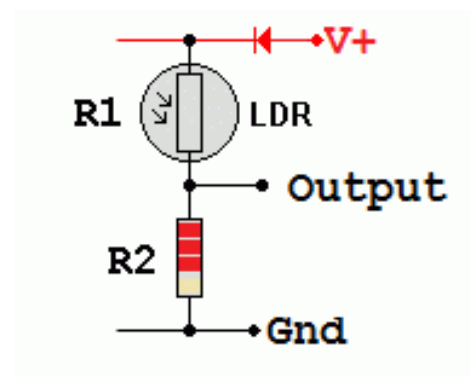
Pull Up Configuration

$$V_{out} = V_{in} \times R_2 / (R_1 + R_2)$$

As the light gets brighter, R2 decreases and the output voltage drops.

$$R_2 = V_{out} \times R / (V_{in} - V_{out})$$

Here R₂ is the LDR resistance



Pull Down Configuration

$$V_{out} = V_{in} \times R_2 / (R_1 + R_2)$$

As the light gets brighter, R1 decreases and the output

$$R_1 = R \times (V_{in} - V_{out}) / V_{out}$$

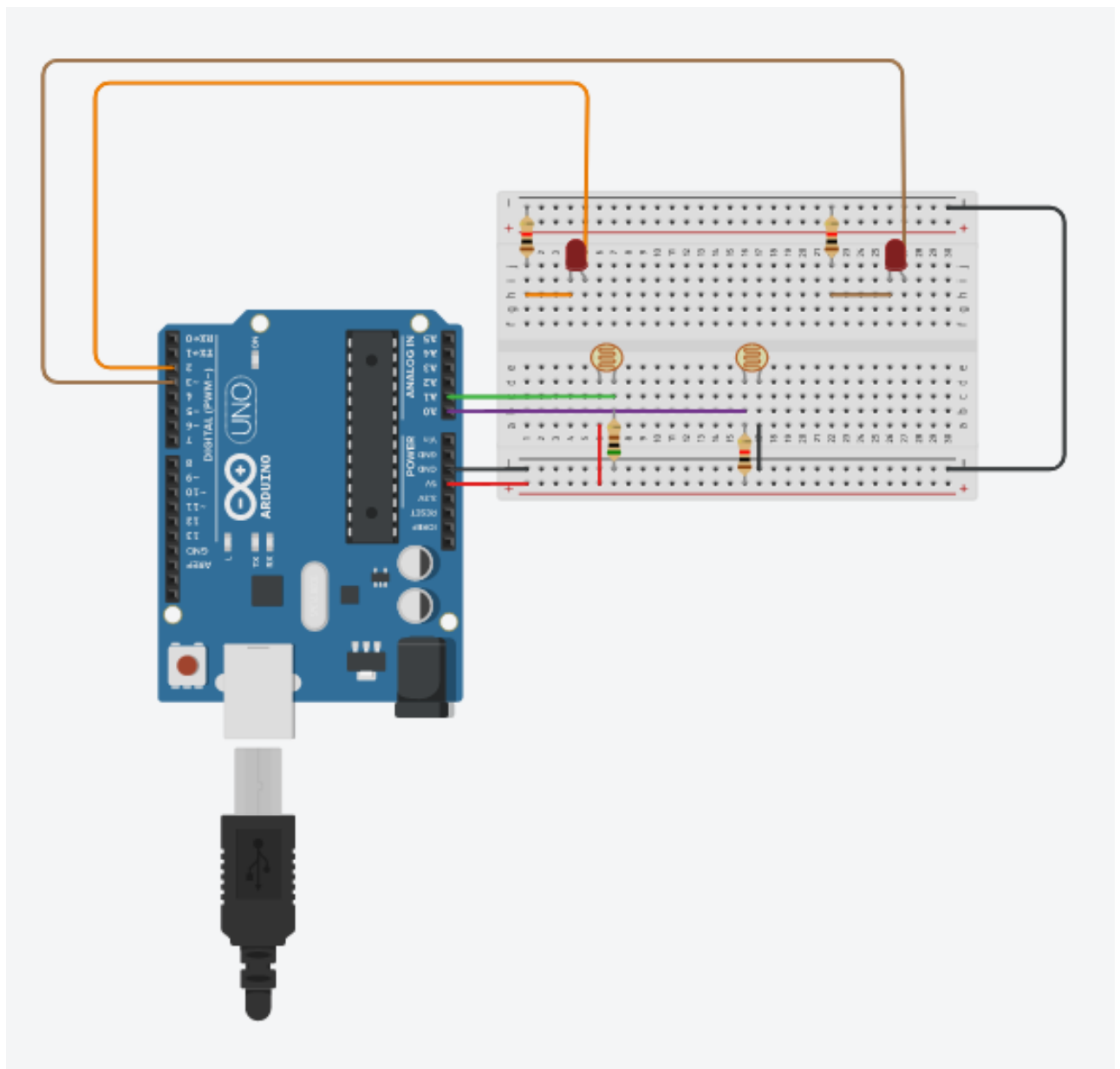
Here R₁ is the LDR resistance

Applications of LDR in Pull-up and Pull-down Configuration

Pull-up – Smart LED system where the LED switches OFF at high brightness and Switches on at Low Brightness

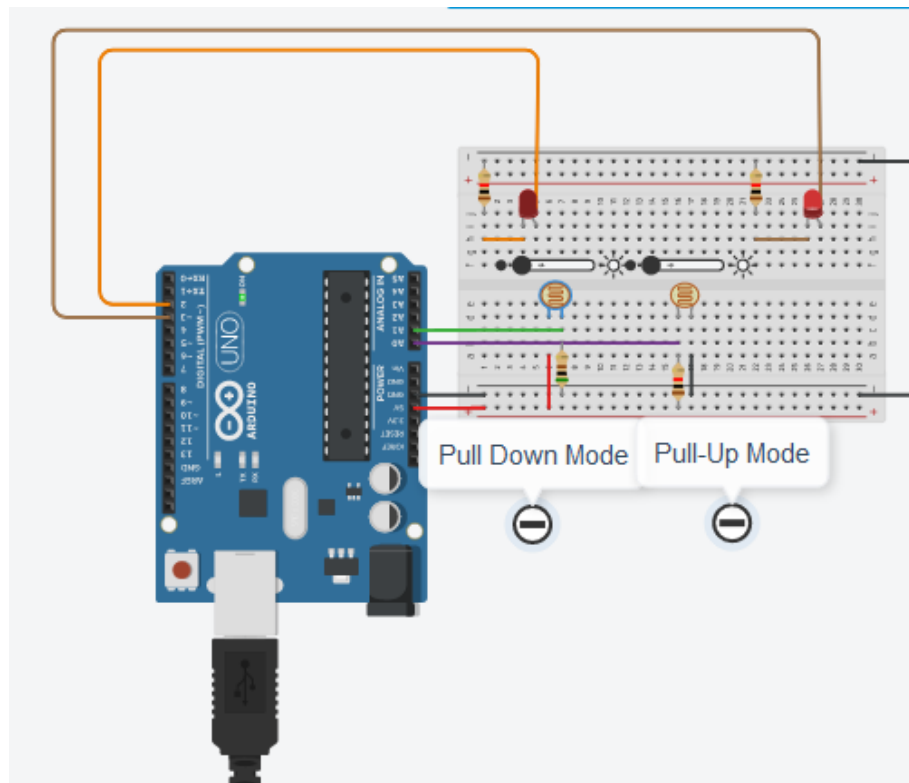
Pull-down – Smart controlling system where the LED switches ON at high brightness and Switches OFF at Low Brightness.

Breadboard view



Live implementation view

Case 1: When both LDR has not Light incident on it.



```
Pull Down LDR: 0.01V Pull Down Resistance: 340333.34ohms
Pull Down LDR: 0.01V Pull Down Resistance: 340333.34ohms
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Pull Down LDR: 0.01V Pull Down Resistance: 340333.34ohms
Pull Down
```

```
Pull up LDR: 4.96V Pull UP Resistance: 72642.85ohms
Pull up LDR: 4.96V Pull UP Resistance: 72642.85ohms
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Pull up LDR: 4.96V Pull UP Resistance: 72642.85ohms
```

Pull up Mode:

When No light is incident on LDR, then the output voltage will be nearly high as the input voltage as the internal impedance of the microcontroller is very high. And so the LED connected to the Digital PIN3 turns HIGH.

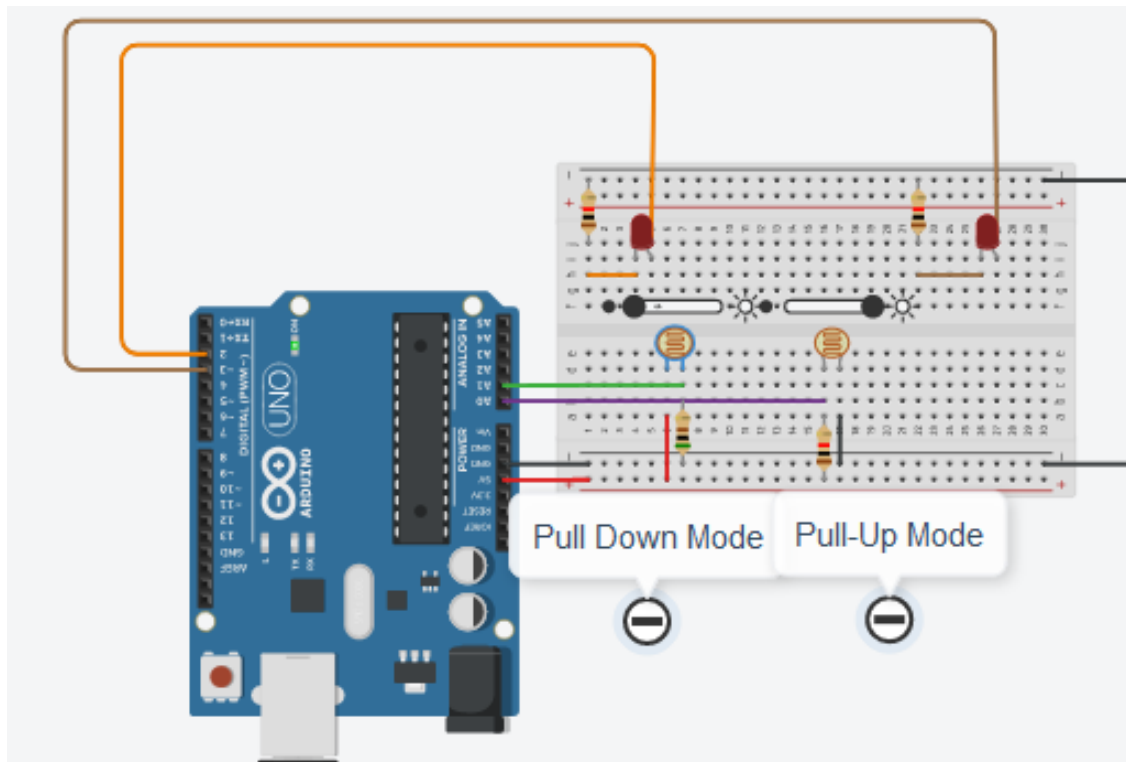
Resistance of the LDR will also be very high as no light is incident on it.

Pull down Mode:

When No light is incident on LDR, then the output voltage will be nearly zero as the impedance of the LDR is very high and very minimal current flows through it. And so, the LED connected to the Digital PIN2 turns LOW.

Resistance of the LDR will also be very high as no light is incident on it.

Case 2: When Pull-up LDR alone has Light incident on it.



```
Pull Down LDR: 0.01V Pull Down Resistance: 340333.34ohms
Pull Down LDR: 0.01V Pull Down Resistance: 340333.34ohms
Pull Down LDR: 0.01V Pull Down Resistance: 340333.34ohms
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Pull Down LDR: 0.01V Pull Down Resistance: 340333.34ohms
Pull Down LDR: 0.01V Pull Down Resistance: 340333.34ohms
```

```
Pull up LDR: 4.96V Pull UP Resistance: 72642.85ohms
Pull up LDR: 4.96V Pull UP Resistance: 72642.85ohms
Pull up LDR: 4.96V Pull UP Resistance: 72642.85ohms
Pull up LDR: 4.96V Pull UP Resistance: 72642.85ohms
Pull up LDR: 2.33V Pull UP Resistance: 439.44ohms
Pull up LDR: 1.94V Pull UP Resistance: 319.20ohms
Pull up LDR: 1.67V Pull UP Resistance: 252.94ohms
Pull up LDR: 1.67V Pull UP Resistance: 252.94ohms
Pull up LDR: 1.67V Pull UP Resistance: 252.94ohms
```

Pull up Mode:

When light is incident on Pull-up mode LDR, then the output voltage will reach near Zero value as the LDR resistance decreases drastically. And so, the LED connected to the Digital PIN3 turns LOW.

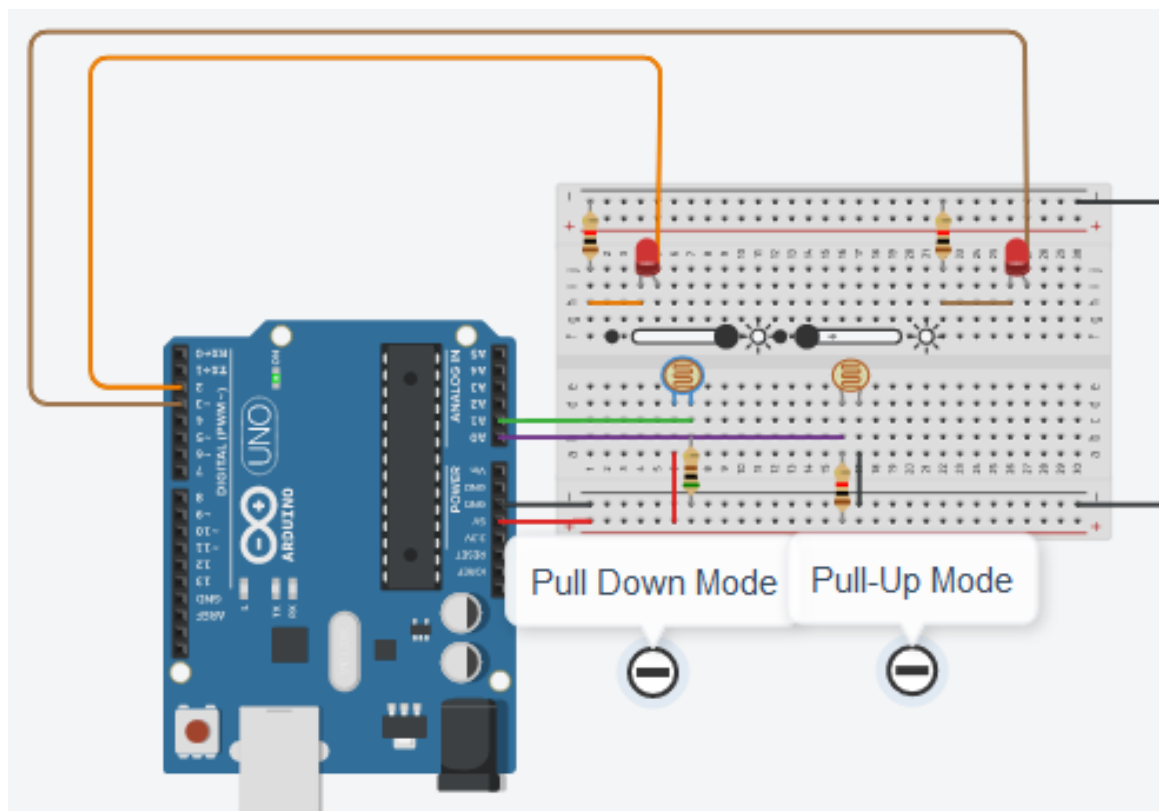
Resistance of the LDR will decrease as more light is incident on it.

Pull down Mode:

When No light is incident on LDR, then the output voltage will be nearly zero as the impedance of the LDR is very high and very minimal current flows through it. And so, the LED connected to the Digital PIN2 turns LOW.

Resistance of the LDR will also be very high as no light is incident on it.

Case 3: When Pull-down LDR alone has Light incident on it.



Pull Down LDR: 0.01V	Pull Down Resistance: 340333.34ohms	Pull up LDR: 4.96V	Pull UP Resistance: 72642.85ohms
Pull Down LDR: 11.99V	Pull Down Resistance: 3179.59ohms	Pull up LDR: 4.96V	Pull UP Resistance: 72642.85ohms
Pull Down LDR: 11.99V	Pull Down Resistance: 3179.59ohms	Pull up LDR: 4.96V	Pull UP Resistance: 72642.85ohms
Pull Down LDR: 1.72V	Pull Down Resistance: 1892.65ohms	Pull up LDR: 4.96V	Pull UP Resistance: 72642.85ohms
Pull Down LDR: 1.91V	Pull Down Resistance: 1612.24ohms	Pull up LDR: 4.96V	Pull UP Resistance: 72642.85ohms
Pull Down LDR: 1.98V	Pull Down Resistance: 1522.16ohms	Pull up LDR: 4.96V	Pull UP Resistance: 72642.85ohms
Pull Down LDR: 2.10V	Pull Down Resistance: 1375.87ohms	Pull up LDR: 4.96V	Pull UP Resistance: 72642.85ohms
Pull Down LDR: 2.48V	Pull Down Resistance: 1015.74ohms	Pull up LDR: 4.96V	Pull UP Resistance: 72642.85ohms

Pull up Mode:

When No light is incident on LDR, then the output voltage will be nearly high as the input voltage as the internal impedance of the microcontroller is very high. And so the LED connected to the Digital PIN3 turns HIGH.

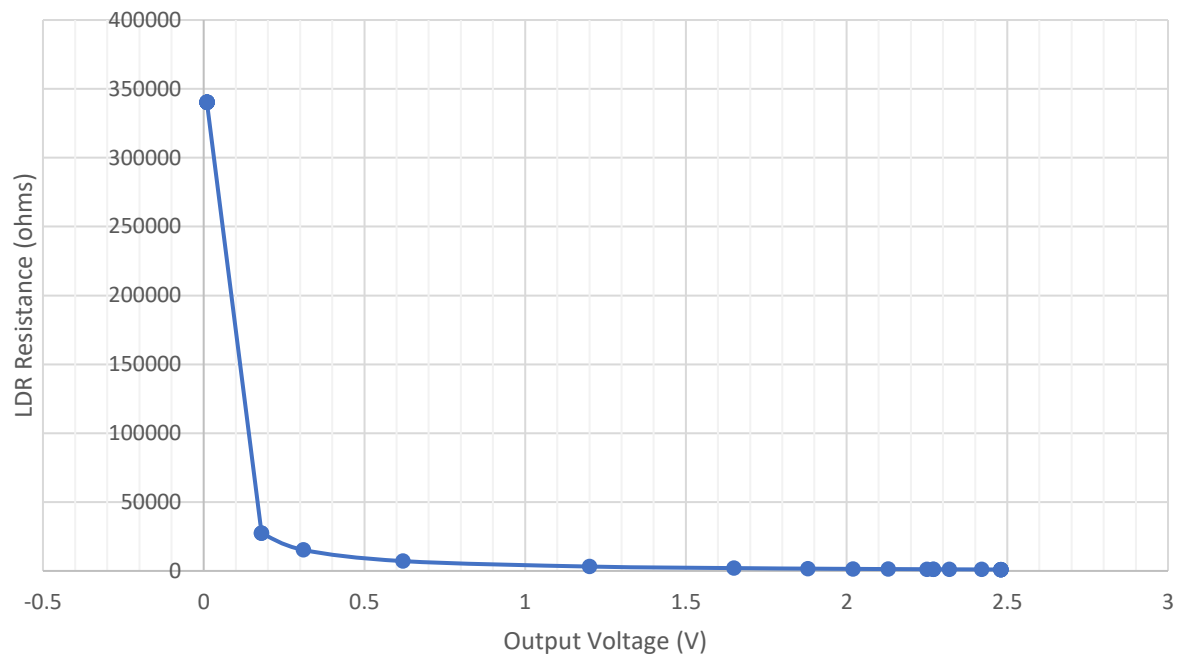
Resistance of the LDR will also be very high as no light is incident on it.

Pull down Mode:

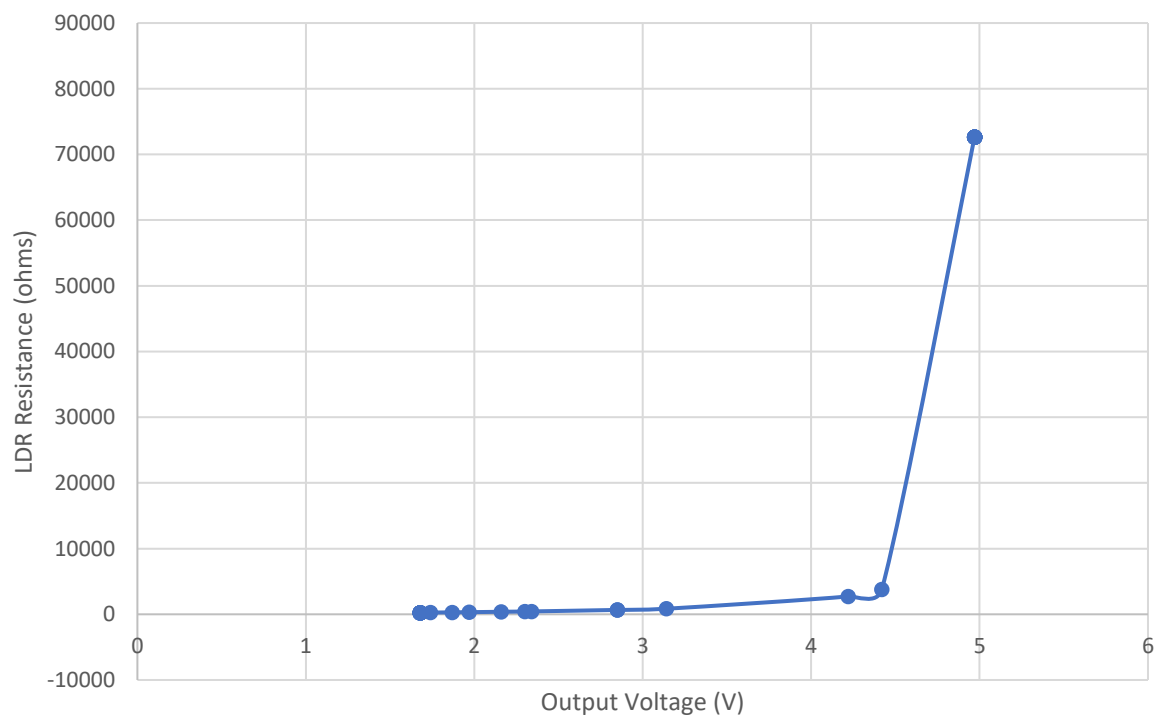
When light is incident on Pull-down LDR, the output voltage will increase as the resistance of the LDR will be very minimal. And so, the LED connected to the Digital PIN2 turns HIGH.

Resistance of the LDR will decrease as more light is incident on it.

Pull Down Configuration on incidence of Light



Pull up Configuration on incidence of Light



Code:

```
/*
@author: Theivaprakasham H
@title: LDR
*/

// Initialize Pins
int pulldownled=2;
int pullupled=3;
float Pull_up_LDR, Pull_down_LDR;

// Setting up pins

void setup()
{
  pinMode(pullupled, OUTPUT);
  pinMode(pulldownled, OUTPUT);
  Serial.begin(9600);
}

// Custom function to calculate resistance of LDR in Pullup mode
float resistance_up(float Vout, float rs, float Vin)
{
  float r1;
  r1 = Vout * rs / (Vin - Vout);
  return r1;
}

// Custom function to calculate resistance of LDR in Pulldown mode

float resistance_down(float Vout, float rs, float Vin)
{
  float r2;
  r2 = (rs*Vin - rs*Vout)/Vout;
  return r2;
}

// Custom function to map AnalogRead values into Voltages
float map1(float x, float in_min, float in_max, float out_min, float out_max)
{
  return (x - in_min) * (out_max - out_min) / (in_max - in_min) + out_min;
}

void loop()
{
```



```

// Reading analog values of Pullup LDR

Pull_up_LDR = map1(analogRead(A0),0,1024, 0.00,5.00);

// Reading analog values of Pulldown LDR

Pull_down_LDR = map1(analogRead(A1),0,1024, 0.00,5.00);

// Printing the Output Voltages and LDR Resistances in Serial monitor

Serial.print((String)"Pull Down LDR: " + Pull_down_LDR + (String)"V " + (String)"Pull Down
Resistance: " + resistance_down(Pull_down_LDR, 1000,5 ));
Serial.print("\t");
Serial.println((String)"Pull up LDR: " + Pull_up_LDR + (String)"V " + (String)"Pull UP Resistance: " +
resistance_up(Pull_up_LDR, 500,5 ));

// Lighting up an LED using conditions

if(analogRead(A0)>500)
    digitalWrite(pullupled,1);
else
    digitalWrite(pullupled,0);

if(analogRead(A1)>500)
    digitalWrite(pulldownled,1);
else
    digitalWrite(pulldownled,0);
}

```