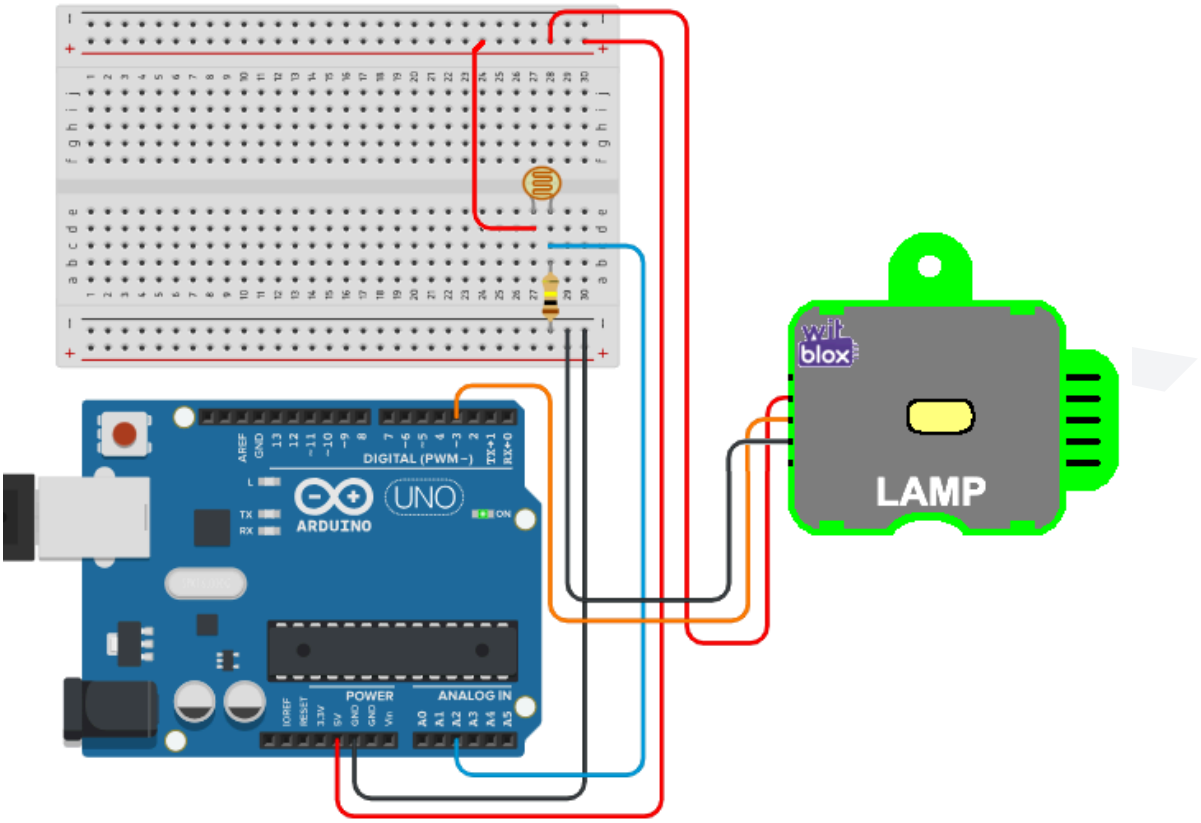
Activity: Make an Automatic LED Street Lamp

Objective:

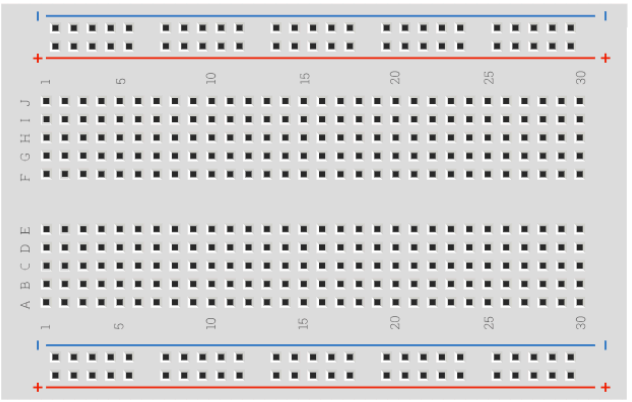


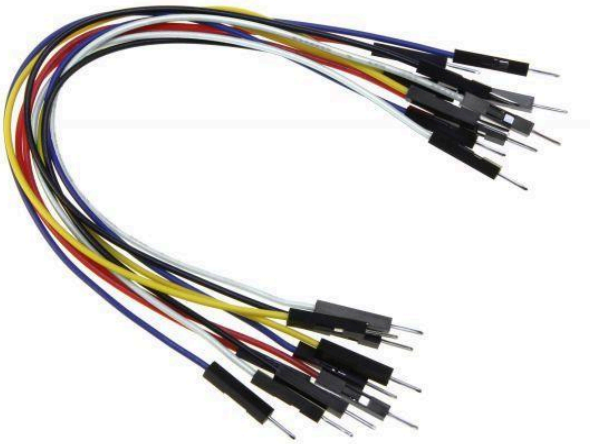
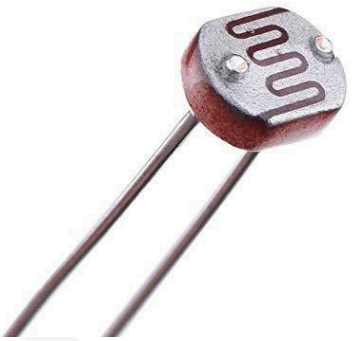
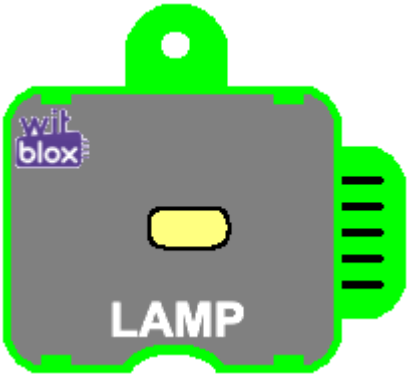
An automatic LED street lamp using LDR, white LEDs, and Arduino is a system that uses a light-dependent resistor (LDR) to detect the presence of light and turn on or off the LED street lamp accordingly. The LDR is a resistor whose resistance changes depending on the amount of light it receives. When the LDR is exposed to light, its resistance decreases. When the LDR is in the dark, its resistance increases.

In this activity, the Arduino will be programmed to turn on the LED street lamp when the LDR's resistance decreases below a certain threshold value, and to turn off the LED street lamp when the LDR's resistance increases above a certain threshold value. The white LEDs are used to provide light at night. The activity uses the Lamp blox in place of white LED and is connected to the Arduino, and the Arduino controls the switching of the white LED in the Lamp blox.

So, in today's activity we will learn how to make an automatic LED street lamp which will be controlled by the LDR light sensor and an Arduino. The street Lamp itself will be the Lamp blox.

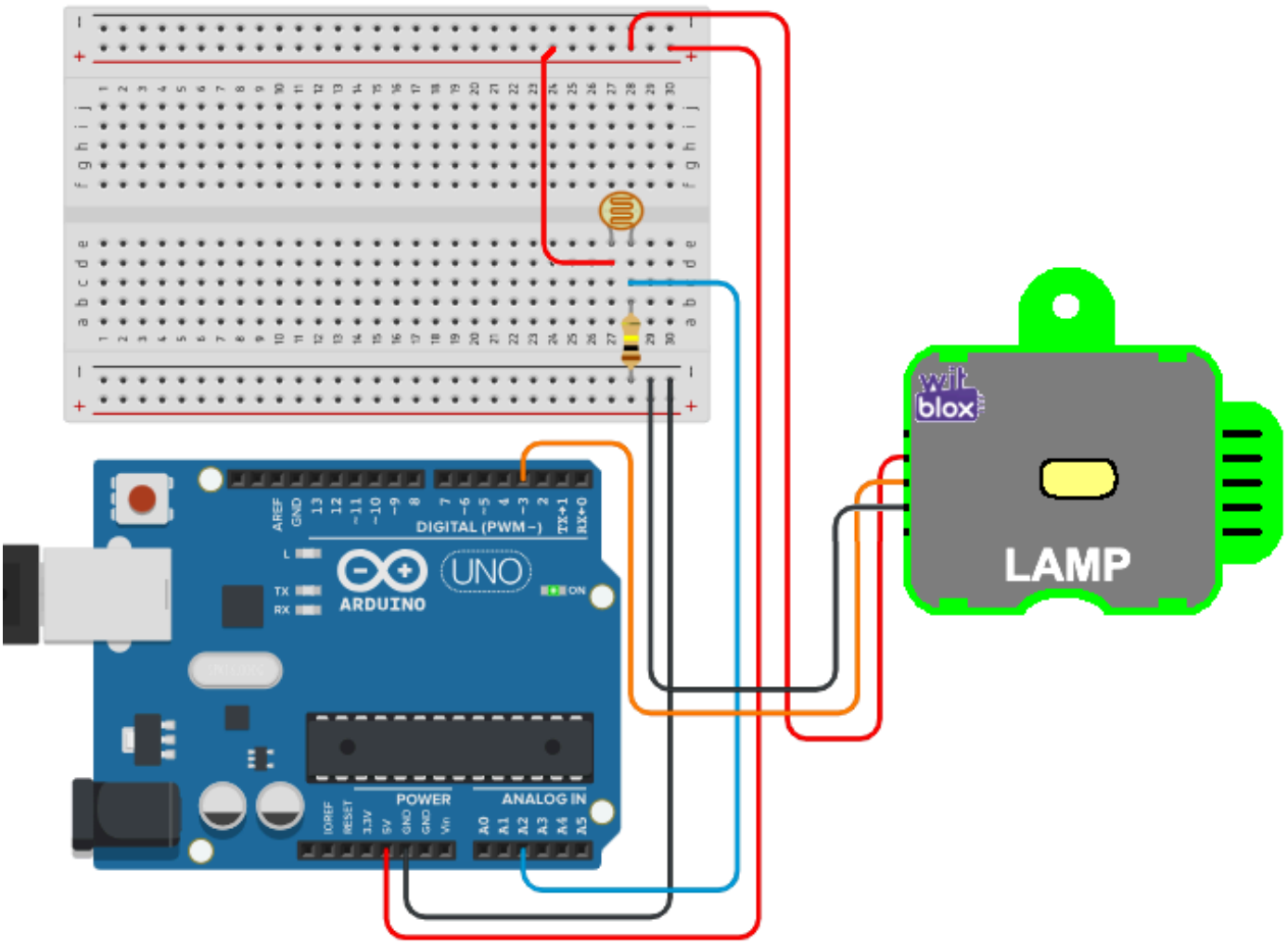
Materials Required:

S.no.	Part	Qty	Image
1	Arduino (Nano / UNO)	1	
2	Breadboard	1	
3	USB cable for Arduino	1	

4	Connection Wires (M - M)	10	
5	LDR Light Sensor	1	
6	100k resistor (Brown Black Yellow Golden)	1	
7	Lamp Blox	1	

Connection Diagram:

The connection diagram shown in the image below is based on the Arduino UNO.



Explanation:

The connection diagrams shown in both the images show the connections between the Arduino, the Input and the Output. The LDR, which is the analog light sensing component, is the Input for the Arduino while the Lamp blox is the Output for the Arduino.

When we closely observe the connection diagrams, it becomes quite clear that:

1. The LDR is connected such that its one end is connected to the +ve of the breadboard and the other end is connected to one side of the 100k resistor.

2. The 100k resistor is connected such that its one end is connected to the LDR while the other side is connected to the -ve of the breadboard.

3. The junction, where the LDR meets the 100k resistor, is where the Arduino analog input pin 2 (A2) is connected with a connection wire for sensing the analog changes in Light intensity.

4. The Lamp blox is connected such that its +ve power pin (2nd pin from the top) is connected to the +ve of the breadboard and its -ve power pin (4th pin from the top) is connected to the -ve of the breadboard. The Data input pin of the Lamp blox (3rd pin from the top) is connected to Arduino digital pin 3 (D3).

5. The 5v pin of the Arduino is connected to the +ve of the breadboard and the Gnd pin of the Arduino is connected to the -ve of the breadboard.

6. Finally, the USB cable from the Arduino is connected to the Computer's USB. This cable serves for providing power, program uploading, as well as bi-directional serial data communication.

Arduino Code:

Here is the complete Arduino code for making an automatic LED street Lamp using an Arduino , a Lamp blox and an LDR.

```
#define Lamp 3
#define ldr A2

int ldr_value;

void setup()
{
 pinMode(Lamp, OUTPUT);
 pinMode(ldr, INPUT);
}
```

```
void loop()
{
  ldr_value = analogRead(ldr);

  if(ldr_value < 500)
    {
      digitalWrite(Lamp,HIGH);
    }

  if(ldr_value > 500)
    {
      digitalWrite(Lamp,LOW);
    }
}
```

Explanation:

```
#define Lamp 3
#define ldr A2

int ldr_value;
```

Here, we are declaring that analog pin 2 (A2) will be referred to as “ldr” and digital pin 3 (D3) will be referred to as “Lamp” and then we take an integer type variable and call it “ldr_value” for storing the analog value of the light intensity.

```
void setup()
{
 pinMode(Lamp, OUTPUT);
 pinMode(ldr, INPUT);
}
```

Here, inside the setup function, we are declaring that the “ldr” pin will be used as an Input pin and the Lamp pin will be used as an Output pin. These need to be done just once.

```
void loop()
{
  ldr_value = analogRead(ldr);

  if(ldr_value < 500)
    {
      digitalWrite(Lamp,HIGH);
    }

  if(ldr_value > 500)
    {
      digitalWrite(Lamp,LOW);
    }
}
```

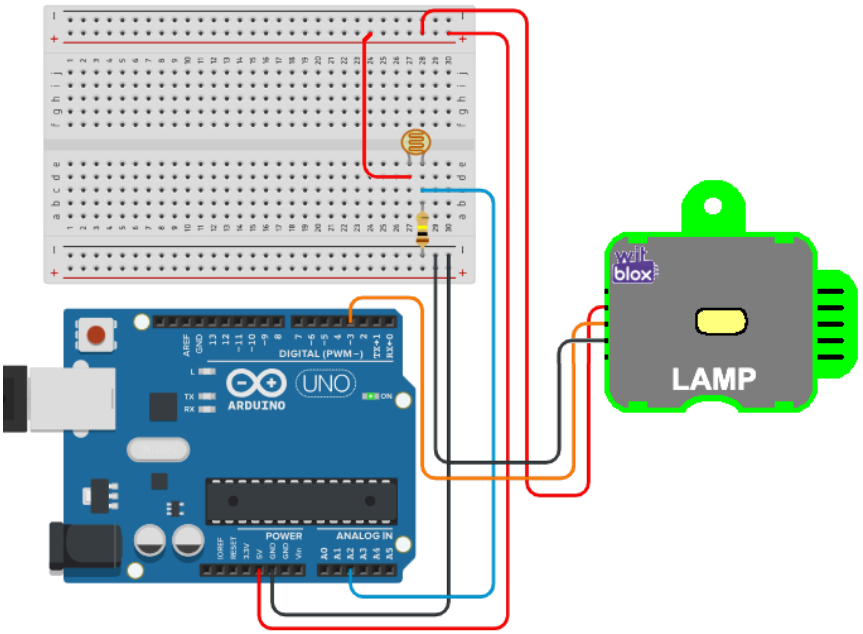
Here, in the loop function, first the light intensity is stored in the “ldr_value” variable using an “analogRead()”.

Then this stored value is compared against a threshold value. Here, we have chosen the threshold value for comparison to be 500 because it is roughly the mid value for the overall range of 0 to 1023 for Arduino analog readings.

If the reading from the LDR light sensor is found to be less than the threshold of 500, then it is considered as Dark and the Lamp is turned On.

If, however, the reading from the LDR light sensor is found to be more than the threshold of 500, then it is considered as Bright and the Lamp is turned Off.

Outcome and Observations:

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  if(ldr_value < 500)
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  if(ldr_value > 500)
    {
      digitalWrite(Lamp,LOW);
    }
}
```

1. Once the Arduino code is compiled and uploaded, place the setup in a brightly lit room or outdoors.

2. If we keep moving our hand such that it casts a shadow on the LDR light sensor, the closer we get our hand to the LDR light sensor, the smaller is the amount of Light falling on the LDR light sensor.

   At some point this value will be low enough to cross the threshold of 500. As soon as the value goes below the threshold, the Lamp blox is turned On and we get bright white light.

3. Now, if we keep moving our hand farther and farther away from the LDR light sensor, the larger is the amount of Light falling on the LDR light sensor.

   When we have moved our hand sufficiently away and crossed over the threshold of 500 again, this time going more than 500, the Lamp blox is turned Off.