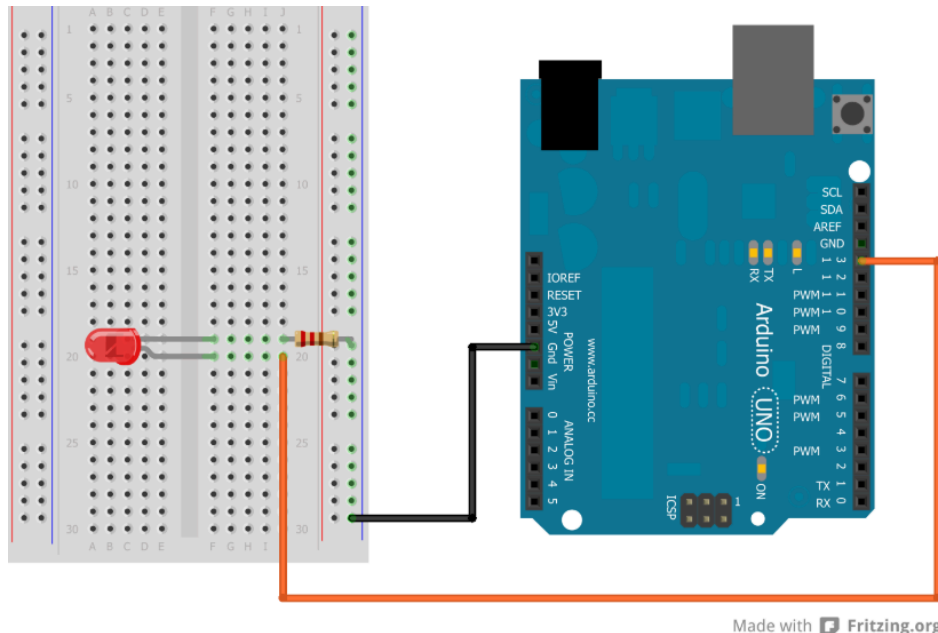


Activity 1L: Using a LED as a Light Detector

Purpose: Normally LEDs are used as a light source. This challenge uses the LED in reverse to detect light, similar to a solar cell. The LED will then be able to measure the intensity or brightness of a light source which will be displayed on the serial monitor. This measured value will be used as a switch to light another LED.

Materials: Computer, Arduino Uno, 2x LED

Circuit: Ready to start hooking everything up? Check out the Fritzing diagram and hookup table below, to see how everything is connected.



LED 1	LED 2
+ve in pin 2	+ve in pin 9
-ve in pin 3	-ve in GND

Code

Copy and paste the following code into the Arduino IDE.

```
// LED as Light Sensor
//
// Description:
// Demonstration of how to use an LED as a light sensors. Cover
// up the LED plugged into pin 2/3 to light up the output LED
// plugged into pin 9. Note that you might have to change the
// THRESHOLD parameter. Connect a Serial terminal to get raw
// readings of the light value.

// Any reading over this value will turn on the output LED const unsigned int THRESHOLD = 2200;

// Stop counting after this value (we can assume it is total darkness)

const unsigned int MAX_T = 20000;

// Pin definitions

const int P_JNCT_PIN = 2;// P junction of sensing LED
const int N_JNCT_PIN = 3;// N junction of sensing LED
const int OUT_LED_PIN = 9;// Output LED pin (P junction pin)

// Global variables

unsigned int sen_time;// Time it takes to discharge LED

void setup() {

  Serial.begin(9600);

  // Set P junction pin to output low (GND)
  pinMode(P_JNCT_PIN, OUTPUT);
  digitalWrite(P_JNCT_PIN, LOW);

  // Set output LED pin to output

  pinMode(OUT_LED_PIN, OUTPUT);

}

void loop() {

  // Read the amount of light falling on the LED

  readLED();

  // Print out the raw discharge time
```

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```

Serial.println(sen_time);

// If the light is below a certain level (discharge time is over the
// threshold), turn on the output LED

if ( sen_time > THRESHOLD ) {
digitalWrite(OUT_LED_PIN, HIGH);
} else {
digitalWrite(OUT_LED_PIN, LOW);
}
}

void readLED() {

unsigned int t;

// Reset global LED discharge time
sen_time = 0;

// Apply reverse voltage to charge the sensing LED's capacitance
pinMode(N_JNCT_PIN, OUTPUT);
digitalWrite(N_JNCT_PIN, HIGH);

// Isolate N junction and turn off pull-up resistor
pinMode(N_JNCT_PIN, INPUT);
digitalWrite(N_JNCT_PIN, LOW);

// Count how long it takes for the LED to discharge

for ( t = 0; t < MAX_T; t++ ) {
if ( digitalRead(N_JNCT_PIN) == 0 ) {
break;
}
}

sen_time = t;
}

```

5. Copy the Arduino Code into the [Codebender website](#). To paste the code into the website be sure to use ctrl "v." Hook up your arduino to your computer using the USB cable.
6. Save your sketch as "LED Light Detector."

7. Upload your program to the arduino. Make sure the Arduino Uno board is hooked up using the supplied USB cord to your computer and click the green “upload” button.

Your program is now loaded.

Test

Turn on the serial monitor. You should notice a reading of about 2000. Cover the LED in pin 2 and 3 and notice the value increase. When this value exceeds 2200, the LED in pin 9 is turned on.

You might have to adjust the THRESHOLD = 2200 value to a different value if your sensor is not activating the LED.

Troubleshooting: If your circuit is not working!

1. Double check your code! Did you put in every block? Are the settings correct?
2. Refresh the website and reload the code.
3. The next step is to check your circuit!
 - a. Check your wiring! Is it the same as the circuit diagram? Does the circuit go from the positive numbered pin to the ground?
 - b. Next check each component. Check the leds, is the long positive arm connected by wires to the correct pins?
 - c. It may be wise to test the led by turning them it on. Open a new blocklyduino window and create this test code. The block should look like this:



- d. LEDs still not working? Next inserting the LED directly into pin 13 and the adjacent ground. Does it light when you try this test code?



- e. Next check the wires in the circuit. This can be done by connecting the LED to pin 13 only then using the wire to ground the short pin. **Do not connect the pin to the ground directly. (Shorting the wires) This will damage the UNO.**
- f. For further information on using the serial monitor see [Activity 4A Using a Serial Monitor Display](#).

Extension Challenges:

1. Experiment with the Threshold value and observe readings as you cover sensor, or shine a light on the sensor.
2. Modify your program so the the LED turns on when a bright light is shined on the sensor.
 - a. Hint: swap HIGH and LOW
3. Use a second UNO to blink a LED. Program your UNO to replicate the pattern when they are held together.