Motion Triggered Sconce Light – Circuit Construction

This document describes how to build the circuit for a motion triggered sconce light. It uses a PIR motion detector, a transistor and some resistors. It was decided to build the circuit as simple as possible to reduce the cost and the number of parts.

There are two parts to this project :-

1. breadboard, which is not reliable but reduces the need for a solderstation, etc.
2. vero board with soldered parts, the result is not much bigger than the PIR.

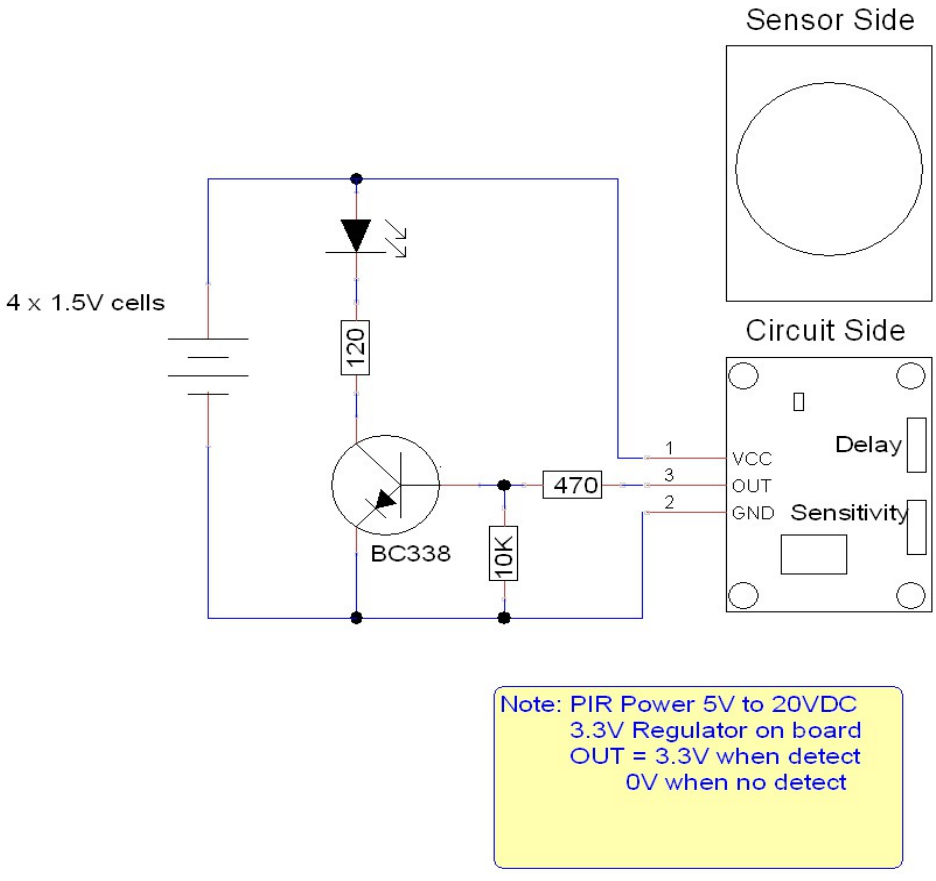
This document describes only the breadboard version.

Design

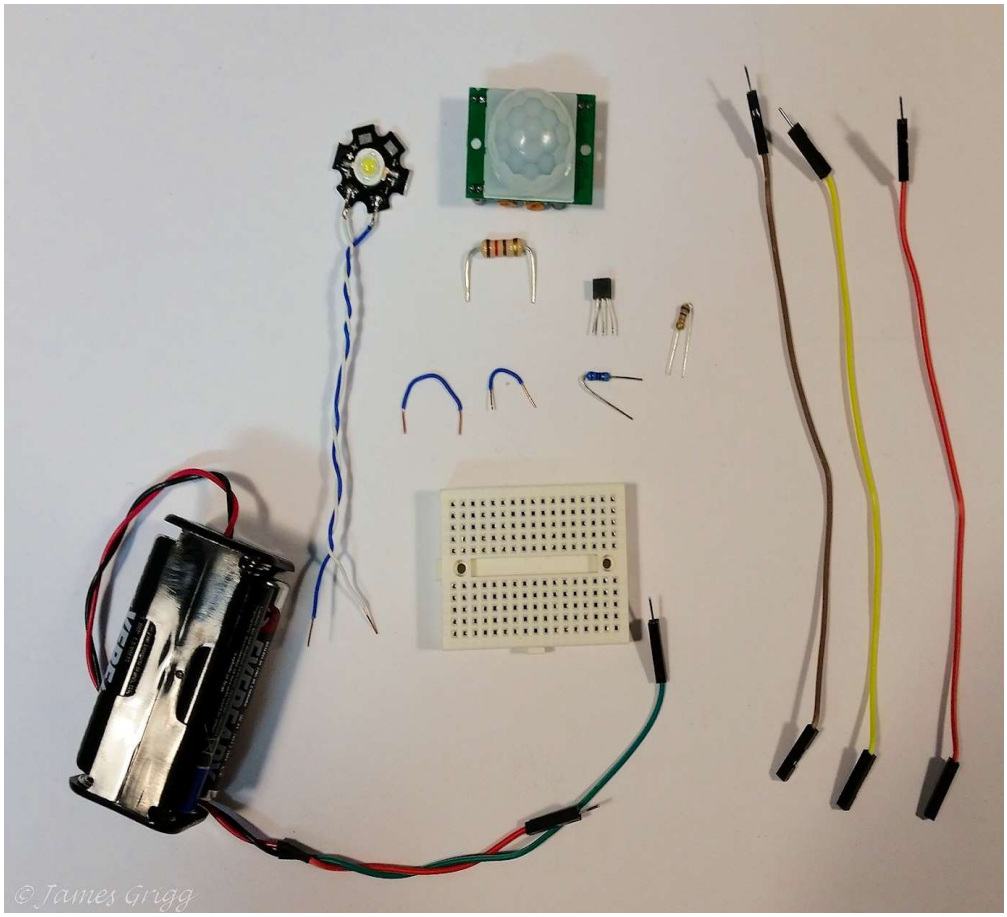
The PIR outputs a voltage level when triggered. This voltage level is held for a number of seconds set by a potentiometer (pot). Adjusting for a specific number of seconds is not possible as the pot adjustment is not fine enough. If the PIR had used a multi turn pot it would be better. The range was from 2 seconds to a number of minutes.

The output of the PIR is used to trigger a transistor which then turns on the light. The transistor is a BC338 which is capable of driving up to 200mA. If a higher power light is used the transistor could be changed to a 2N5191G which is capable of up to 4A, with a heat sink.

Power is provided by 4 AA cells. When the circuit is off it draws about 68uA ensuring the life of the batteries is related only to the time the light is on.,



Parts List



Note: the light shown in the picture is a 1W Cool White LED that was rattling around in my parts bin. In the circuit above it is as bright as a normal LED, but if you reduce the 120 ohm load resistor to around 40 ohms it is too bright to look at.

Some parts were sourced from Core Electronics, some parts from my parts bin. The list below contains all items needed to build the circuit; if you were to buy it all.

- PIR Infrared Motion Sensor (HC-SR501) SKU: CE05786 $4.78
- 170 Tie Point Mini White Solderless Breadboard SKU: CE05142 $3.78
- 2x2 AA Battery Holder with Premium Jumper Header Wires SKU: ADA3905 $6.07
- LED - Super Bright White SKU: COM-00531 $1.33
- Transistor - NPN (BC337) SKU: COM-13689 $0.82
- 600 Pack of 1/4 Watt 1% Resistors (30 values, 20 of each) SKU: CE05092 $6.90
- Premium Female/Male Extension Jumper Wires - 20 x 12 SKU: ADA1952 $8.10
- Jumper Wire Kit for Solderless Breadboard 140 pcs SKU: CE05631 $7.49

Alternative LED for greater light.

- LED - 3W Aluminum PCB (5 Pack, Cool White) sKU: COM-13105 $14.04

Purchased from local supermarket.

- 4 x 1.5V AA cells

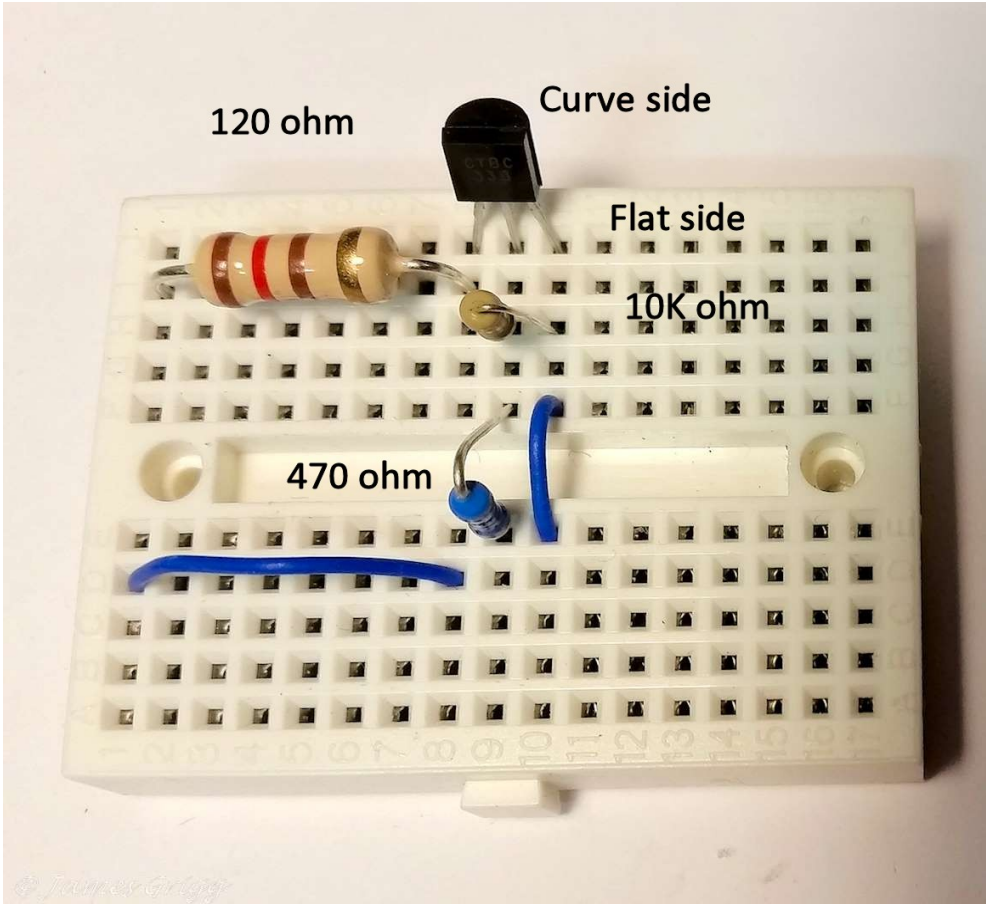
Construction

The construction will be covered in two parts.

1. Transistor switching LED on / off.
2. PIR switching LED on / off.

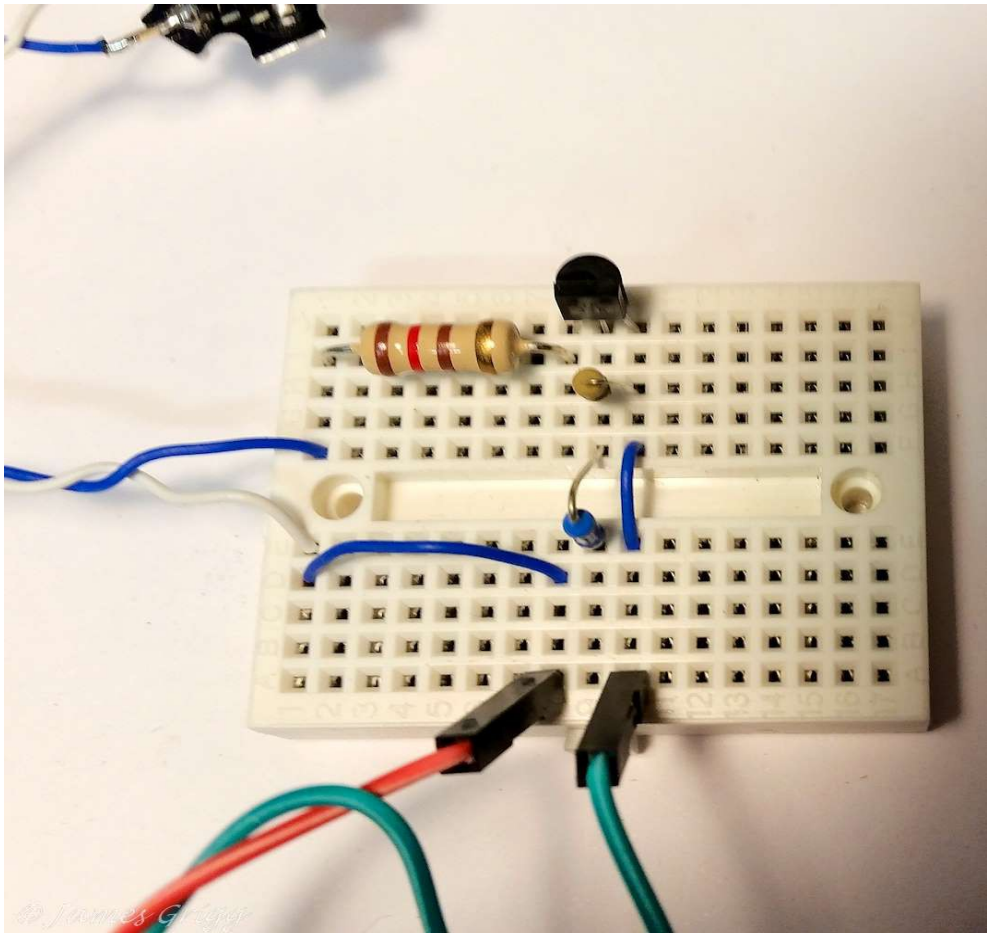
Note: component leads have been cut to a shorter length so they would not short out on the breadboard.

Build the circuit shown in the picture below. The large 120 ohm resistor was in my parts bin. This size resistor is not needed for our circuit. If a higher wattage LED (1Watt or 3 Watt) was to be used with a lower value resistor (10 to 40 ohms) then one of this size would be needed.



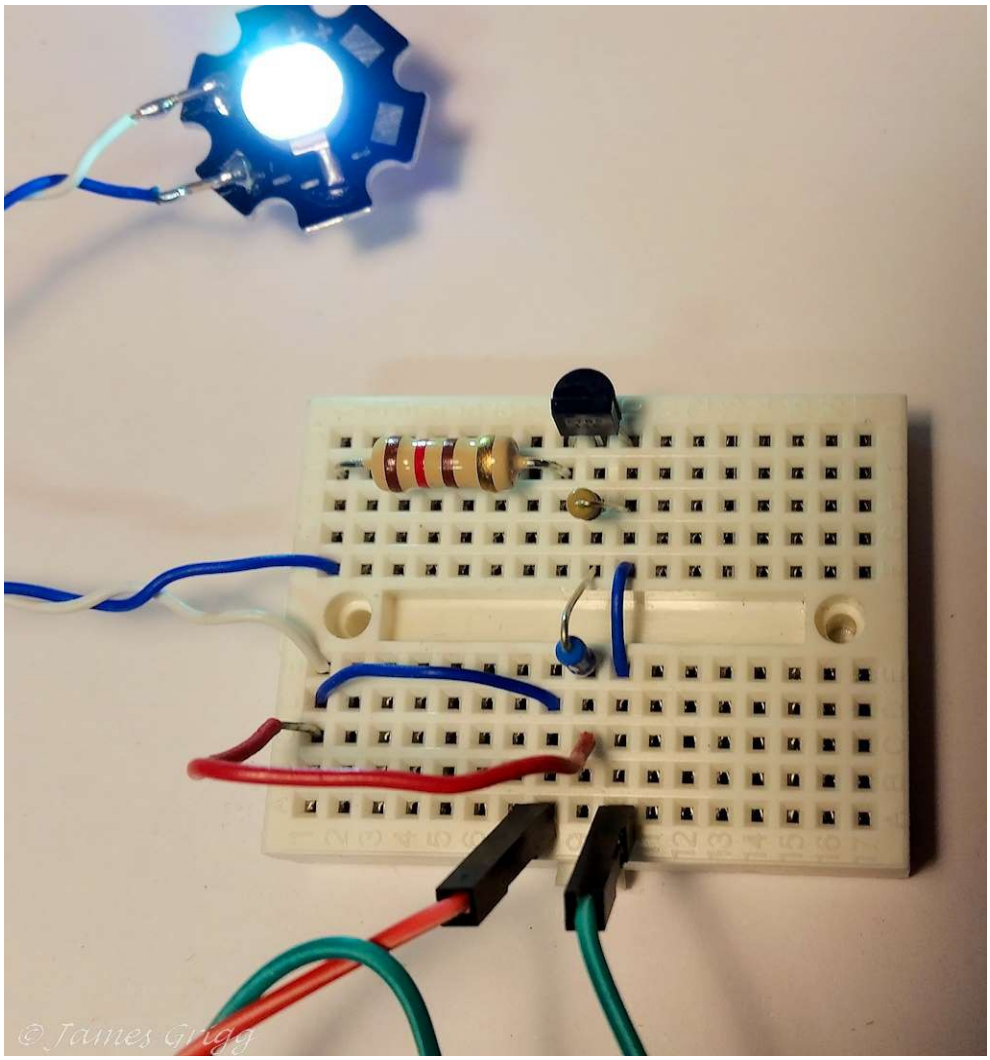
The battery pack has two wires attached. The red one is + volts, the black one ground. In my pics the green wire to my battery pack is the same as the black one the battery pack. The LED shown is 1 Watt and had wires already attached. The LED from the parts list will have one lead shorter than the other. This lead goes to the 120 ohm resistor the other to the horizontal blue wire (+volts from battery pack).

Attach the battery pack and LED as shown in the picture. The blue lead to the LED represnts the short lead on the LED from the list.

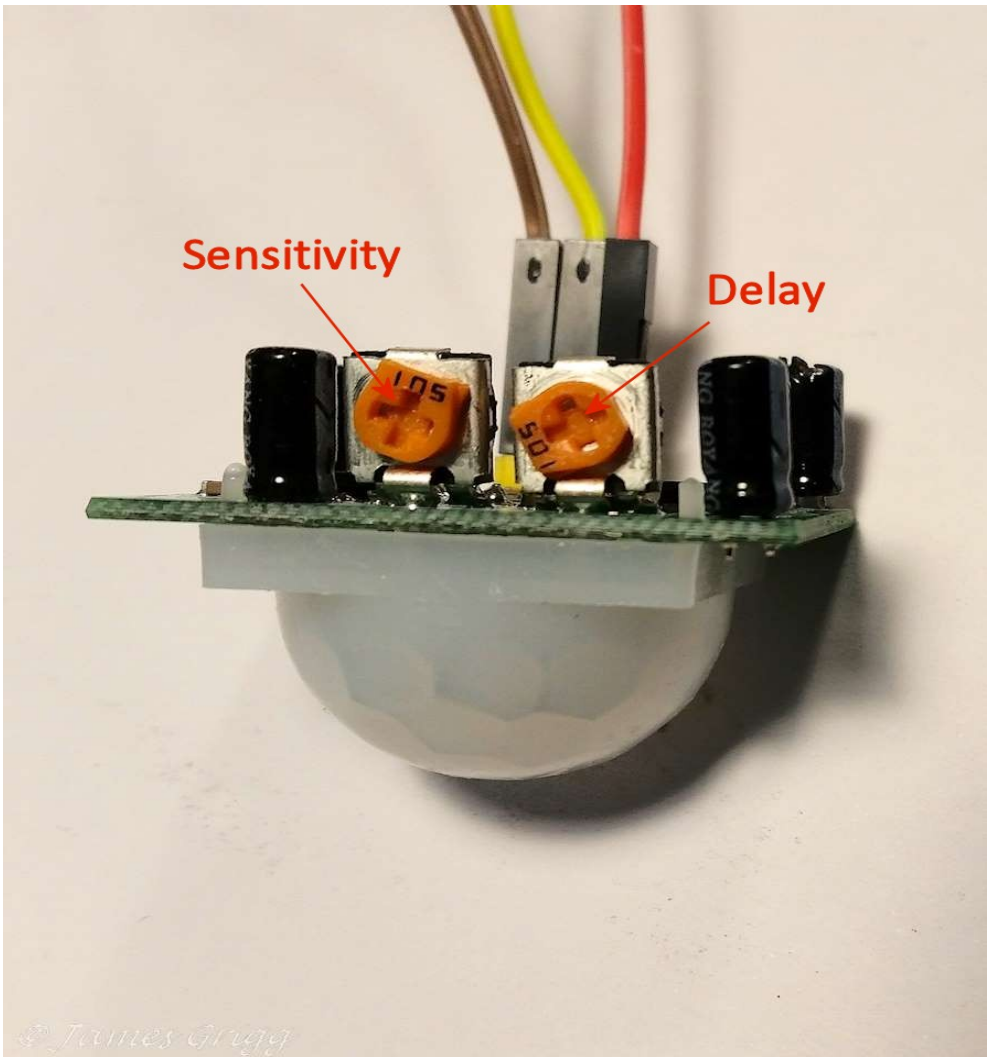


Now the circuit can be tested.

Use a short jumper wire to make a connection as shown and the LED should light up. Remove the jumper and it should go off. If this happens we can move on to using the PIR. If not check the circuit wiring, especially the orientation of the transistor, then the LED and battery connections.



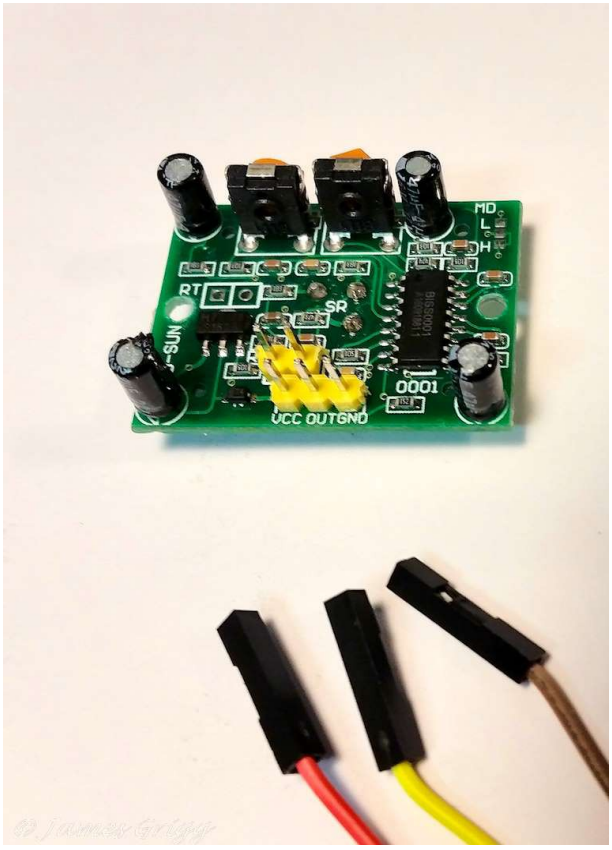
The PIR has two trim pots, one for delay and one for sensitivity. Adjust them as shown in the pic. This should give about 2 seconds on time and high sensitivity. Later they can be adjusted for longer delay and different sensitivity to suit the situation.

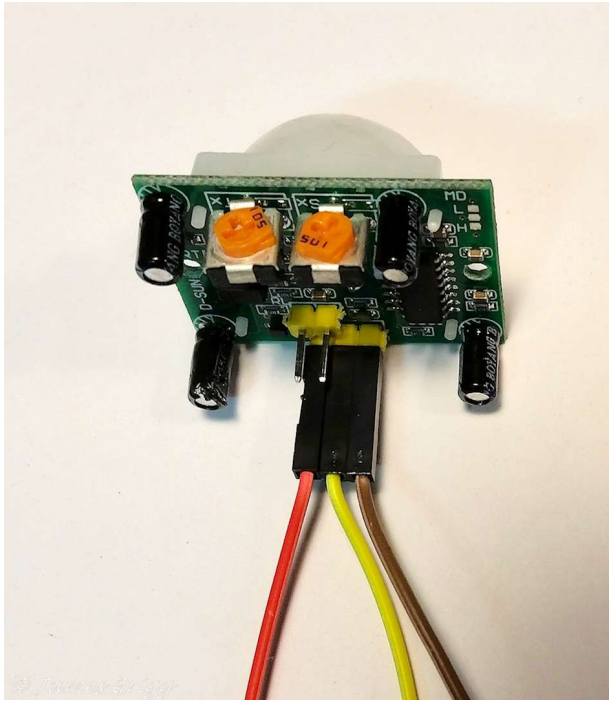


The PIR has 3 pins labelled, VCC, OUT, & GND. They must be connected correctly or the PIR wont work or could be damaged.
3 jumper wires are used:

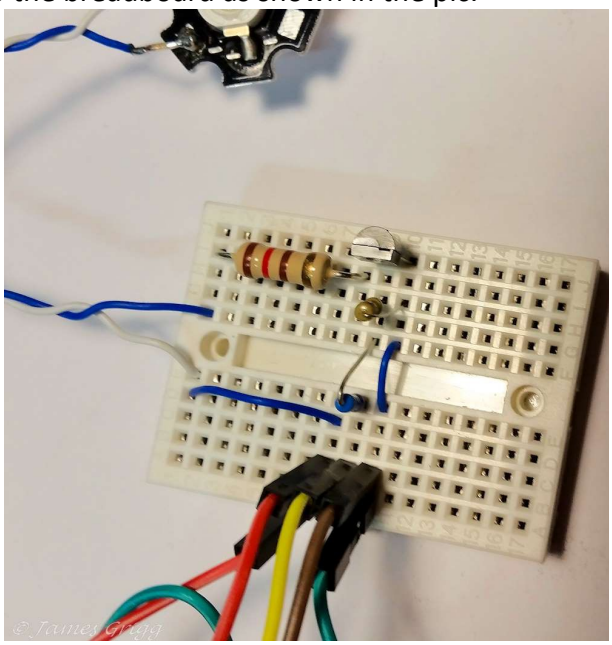
- red = + volts (VCC)
- yellow = PIR Output (OUT)
- brown = ground (GND)

Connect the jumper wires to the PIR as shown in the pic.





Connect the other ends to the breadboard as shown in the pic.



When you apply power, wait about a 1 minute or so for the PIR to stabilize. After that the LED should turn on when you wave your hand in front of the PIR lens and off after about 2 seconds. If it doesn't work check the jumper connections. If necessary remove the PIR and go back to the previous step to confirm the transistor still works.

Conclusion

When it is all working nicely you can experiment with different settings for delay and sensitivity to suit the situation. If the LED light level is too bright, change the 120 ohm to a higher value. The breadboard allows easy removal and replacement of the resistor.

Warning: Always remove the battery connection before making changes.

If the LED light level is too low, change the 120 ohm to a lower value. **BUT ....**
The resistors from the list are 1/4 Watt, if too low a value is used they will burn out. The current rating of the LED is 20mA and should not be exceeded or it be damaged. The transisitor could be damaged if too much current is passed through it.

The following list shows resistor values, wattage and current.

Note: calculations assume 1.2Volts across the LED when ON
battery voltage assumed to be 5Volts
Current = Volts / Resistance
*Power = Volts * Current*

Resistor	**Current**	**Wattage**
470 ohm	8.0mA	0.030 watt
120 ohm	31.7mA	0.120 watt
100 ohm	38.0mA	0.144 watt
80 ohm	63.3mA	0.180 watt
1/2 Watt resistors		
60 ohm	83.3mA	0.240 watt
40 ohm	95mA	0.361 watt
1 Watt resistor		
20 ohm	190mA	0.722 watt

Warning:
Do not use lower than 120 ohm with the Super Bright White LED SKU: COM-00531.
It is rated at only 20mA.
Use the alternate 3 watt LED for high level brightness.