CEC Continuing Education Center

DesignNews

Developing WiFi IoT ESP8266-Arduino Based Devices

DAY 3 : Wireless Light Sensor

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Don Wilcher

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Course Kit:
Osoyoo ESP8266 Arduino IoT Kit

Agenda:

- Light Sensor Basics
- Basic Light Sensor Circuits
- Osoyoo ESP8266 Arduino Kit Overview
- Lab: Wireless Light Sensor

Internet of Things :

" The Internet of Things (IoT) is a concept in which the virtual world of information technology integrates seamlessly with the real world of thing." (Uckelman, Harnson & Michahelles, 2011, p.2).

Light Sensor Basics

What is a light sensor? Definitions and descriptions

- A light Sensor generates an output signal indicating
  a) intensity of light by measuring the radiant energy
  b) that exists in a very narrow range of frequencies basically called light
  c) frequencies range from
    i. infra-red to
    ii. Visible up to the ultraviolet light spectrum
- A light sensor is a passive device that converts light energy into an electrical signal output.

Source: ElectronicsTutorial. (2021). *Light sensors. https://www.electronics-tutorials.ws/io/io_4.html#:~:text=The%20light%20sensor%20is%20a,)%20into%20electricity%20(electrons)*

Question 1

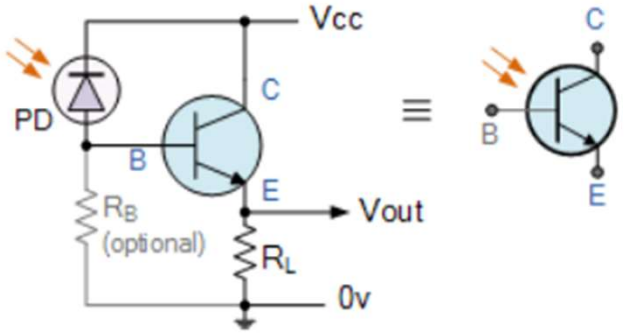
A light sensor is_____

a) a passive device
b) an active device
c) a semiconductor device

Light Sensor Basics. . .

What is a light sensor? Definitions and descriptions

Light sensors are also known as photoelectric devices or photo sensors because they convert light energy (photons) into electricity (electrons).



Source: ElectronicsTutorial. (2021). *Light sensors. https://www.electronics-tutorials.ws/io/io_4.html#:~:text=The%20light%20sensor%20is%20a,)%20into%20electricity%20(electrons)*

Question 2

A photon is.

a) a light energy
b) electrical energy
c) an electron

Light Sensor Basics. . .

Photoelectric devices can be grouped into two main categories

a) Photo-voltaic or Photo-emissive – generate electricity when illuminated
b) Photo-resistive or Photo-conductive – Change electrical properties when illuminated

Source: ElectronicsTutorial. (2021). *Light sensors. https://www.electronics-tutorials.ws/io/io_4.html#:~:text=The%20light%20sensor%20is%20a,)%20into%20electricity%20(electrons)*

Light Sensor Basics. . .

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Light Sensor Basics. . .

Photoelectric devices can be grouped into two main categories

Photo-voltaic or Photo-emissive:
Electrical Symbol

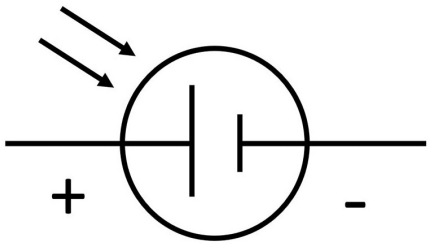
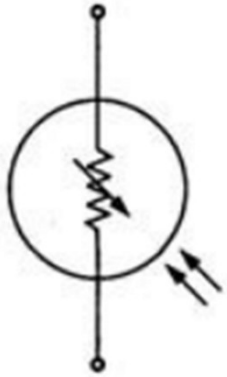


Photo-resistive or Photo-conductor:
Electrical Symbol



Source: ElectronicsTutorial. (2021). *Light sensors. https://www.electronics-tutorials.ws/io/io_4.html#:~:text=The%20light%20sensor%20is%20a,)%20into%20electricity%20(electrons)*

Light Sensor Basics. . .

Speaking of Photo-resistive or Photo-conductive components:

- The commonly used material to manufacture photo-resistive or photo-conductive components is Cadmium Sulfide (CdS). The main reasons:
  a) spectral response matches the human eye
  b) can easily be detected using a simple light source like a light bulb.
  c) CdS has a peak sensitivity wavelength (λp) of 560nm to 600nm.
- The light dependent resistor (LDR) is a CdS based photo-conductive resistor commonly used as a basic light sensor.

Source: ElectronicsTutorial. (2021). *Light sensors. https://www.electronics-tutorials.ws/io/io_4.html#:~:text=The%20light%20sensor%20is%20a,)%20into%20electricity%20(electrons)*

Question 3

A light-dependent resistor (LDR) is

a) CdS based photoconductive component

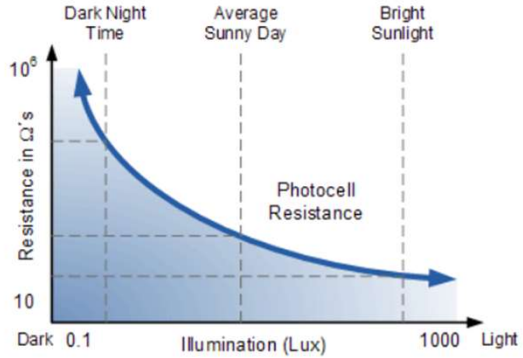
b) CdS based photovoltaic component

c) CdS based photoelectric component

Light Sensor Circuits

Speaking of Photo-resistive or Photo-conductive components:

LDR characteristic curve, substrate material, and electrical symbol elements

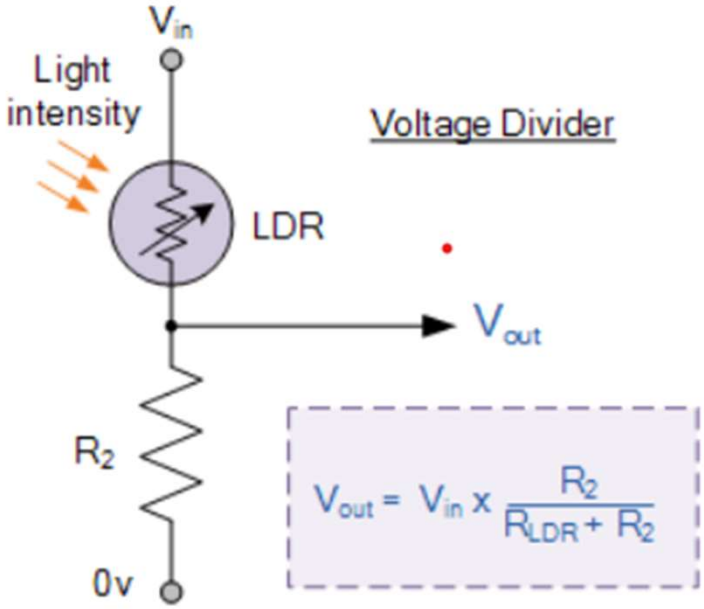


Source: ElectronicsTutorial. (2021). *Light sensors. https://www.electronics-tutorials.ws/io/io_4.html#:~:text=The%20light%20sensor%20is%20a,)%20into%20electricity%20(electrons)*

Light Sensor Circuits

A Basic Light Detection Circuit

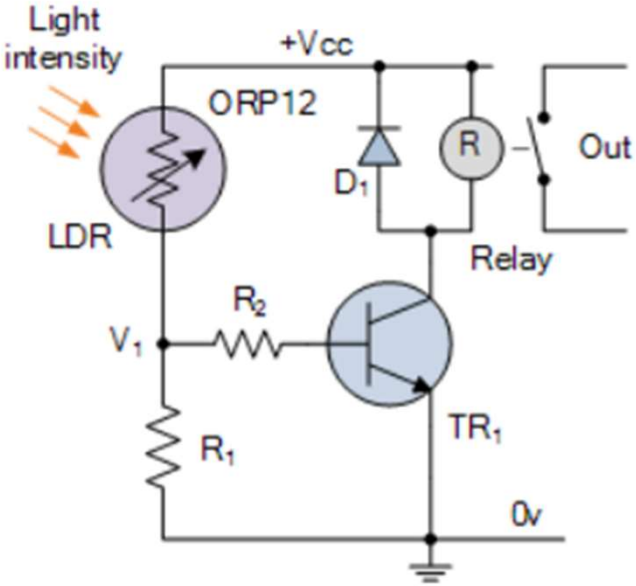
Basic Circuit Operation:
Low Light Intensity → <Vout
High Light Intensity → >Vout



Source: ElectronicsTutorial. (2021). *Light sensors. https://www.electronics-tutorials.ws/io/io_4.html#:~:text=The%20light%20sensor%20is%20a,)%20into%20electricity%20(electrons)*

Light Sensor Circuits

A Basic Light Detection Switch Circuit

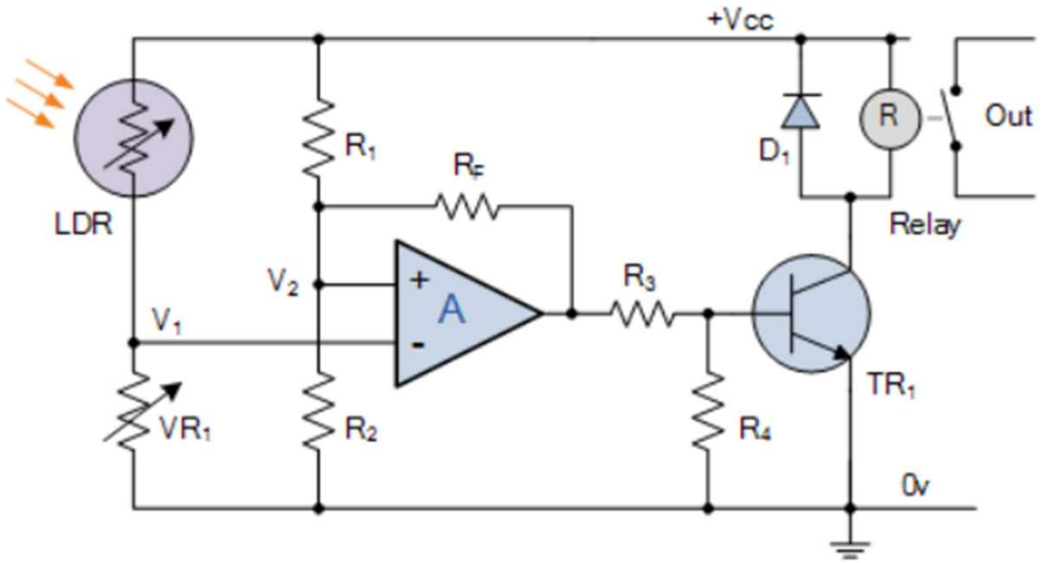


Basic Circuit Operation:
Low Light Intensity → TR Switch is OFF
High Light Intensity → TR Switch is ON

Source: ElectronicsTutorial. (2021). *Light sensors. https://www.electronics-tutorials.ws/io/io_4.html#:~:text=The%20light%20sensor%20is%20a,)%20into%20electricity%20(electrons)*

Light Sensor Circuits

A Light Level Sensing Circuit

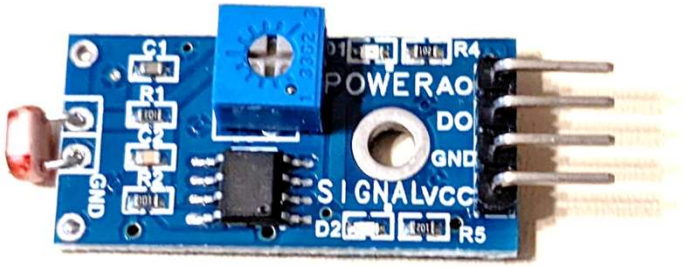


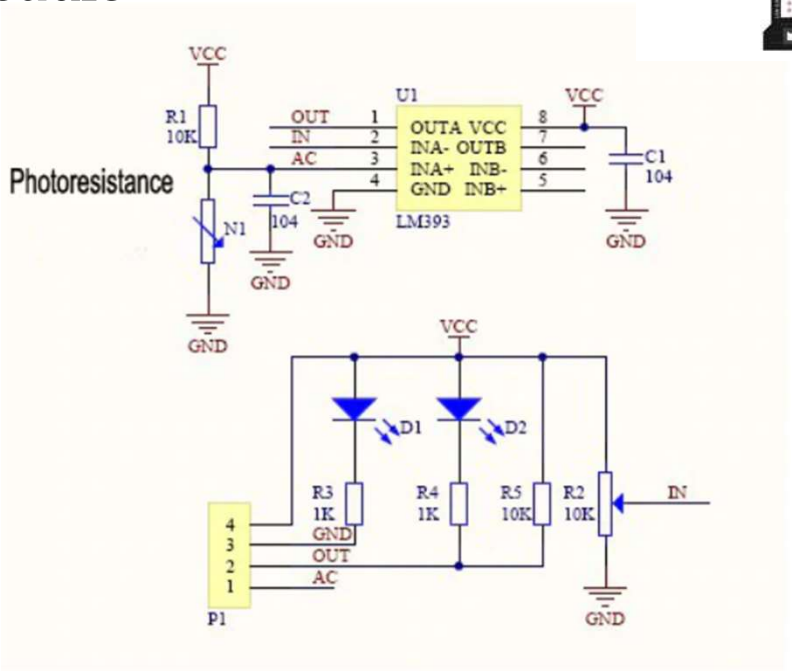
Basic Circuit Operation:
When the light level sensed by the LDR and its output voltage falls below the reference voltage set at V2, the output from the op-amp changes state, activating the relay and switching the connected load.

Source: ElectronicsTutorial. (2021). *Light sensors. https://www.electronics-tutorials.ws/io/io_4.html#:~:text=The%20light%20sensor%20is%20a,)%20into%20electricity%20(electrons)*

Light Sensor Circuits

Photoresistor Sensor Module





Basic Circuit Operation:

The photoresistor sensor module behaves like a typical light-level sensing circuit. The sensitivity of the Photoresistor Sensor Module can be adjusted with the potentiometer (N1).

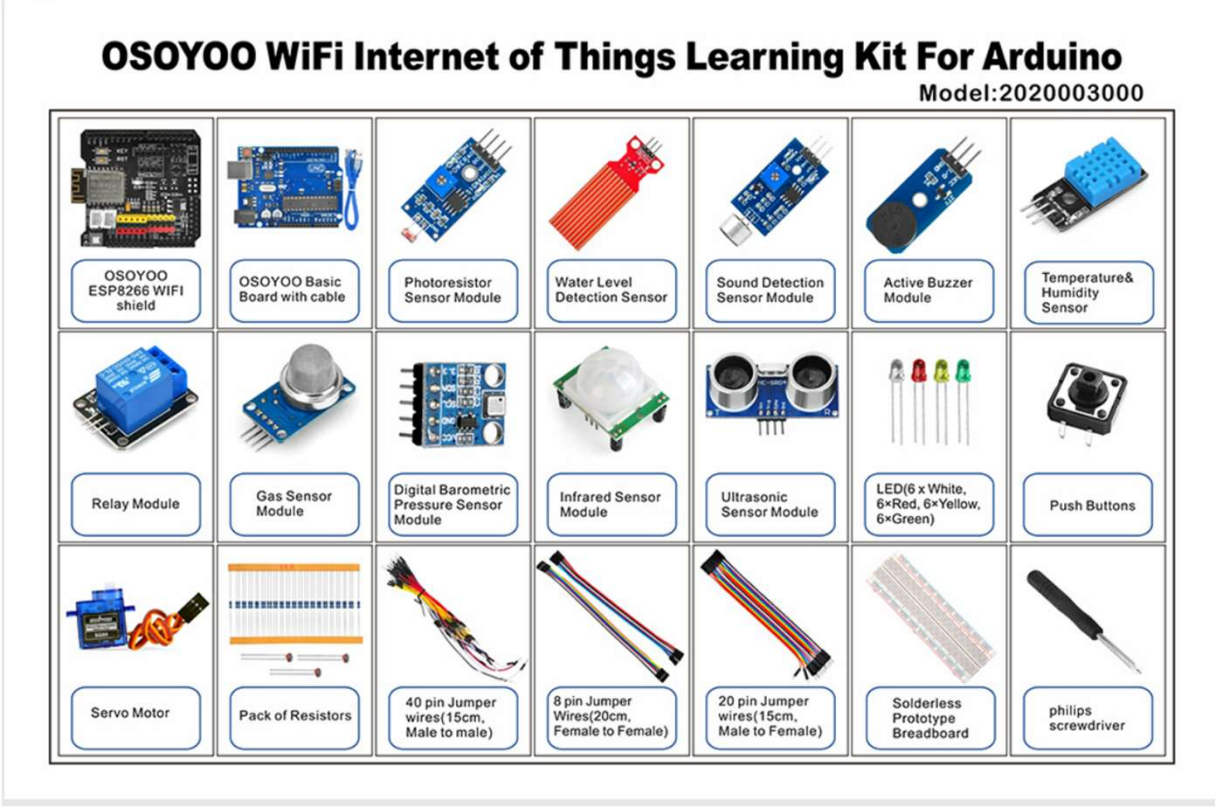
Question 4

In reviewing slide 20, what component is used to adjust the photoresistor sensor module's sensitivity?

a) (R1) 10KΩ resistor
b) (U1) LM393 comparator
c) (N1) potentiometer

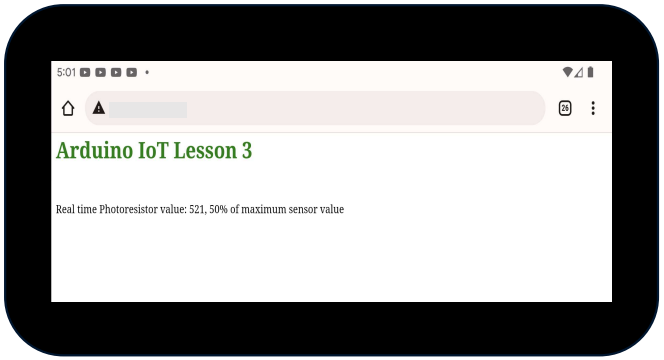
Osoyoo ESP8266 Arduino Kit Overview

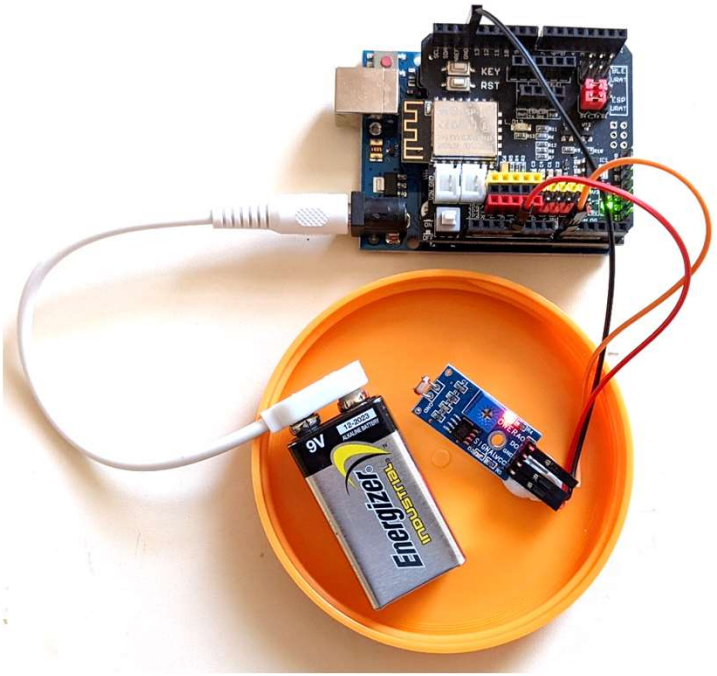
Osoyoo ESP8266 Arduino Kit Overview



https://osoyoo.com/2020/05/30/wifi-iot-learning-kit-for-arduino/

Lab: Wireless Light Sensor





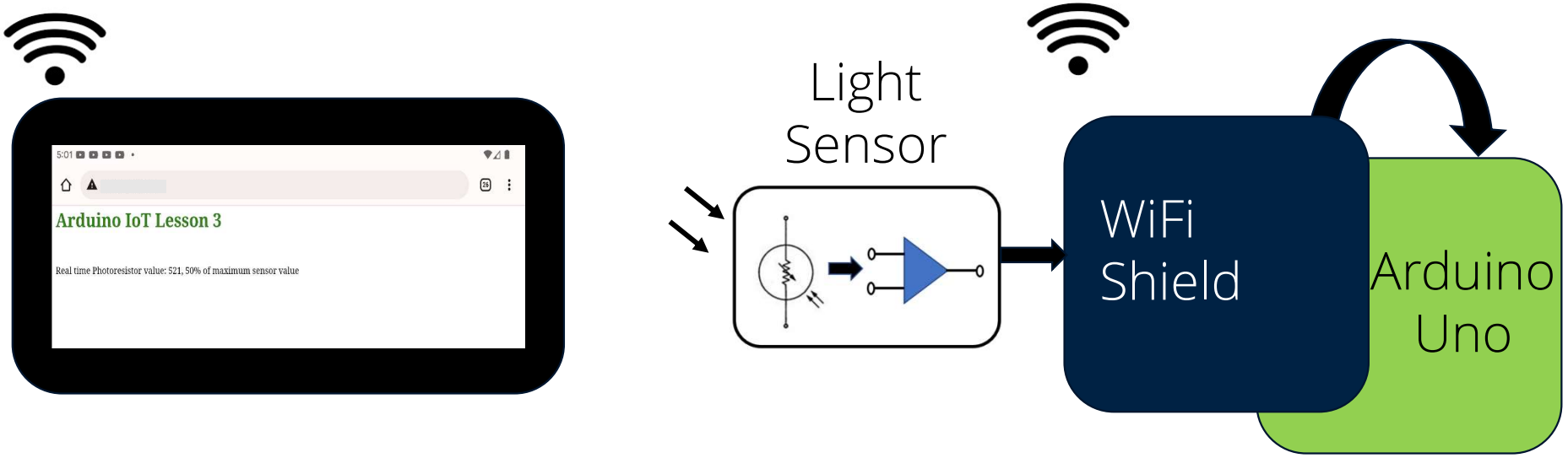
Lab: Wireless Light Sensor . . .

Learning Objectives:

- You will learn how to use a WiFi Shield with an Arduino Compatible.
- You will learn how to use an Arduino Compatible as a wireless light sensor.
- You will learn how to adjust a light sensor to behave in analog mode.

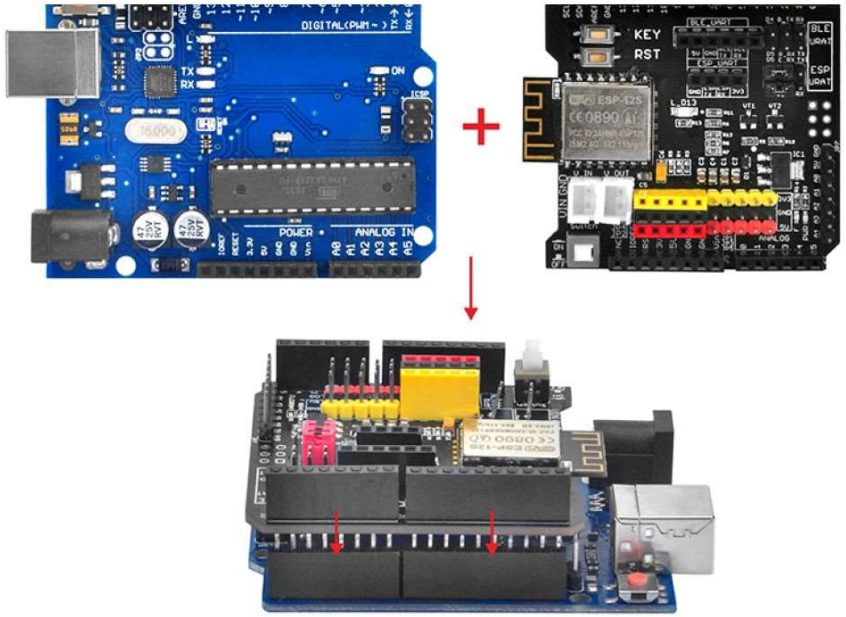
Lab: Wireless Light Sensor. . .

Lab Setup Concept



Lab: Wireless Light Sensor. . .

Lab Setup: Attaching WiFi Shield to the Arduino Compatible



Notes:

a) Attach IoT unit to your development machine

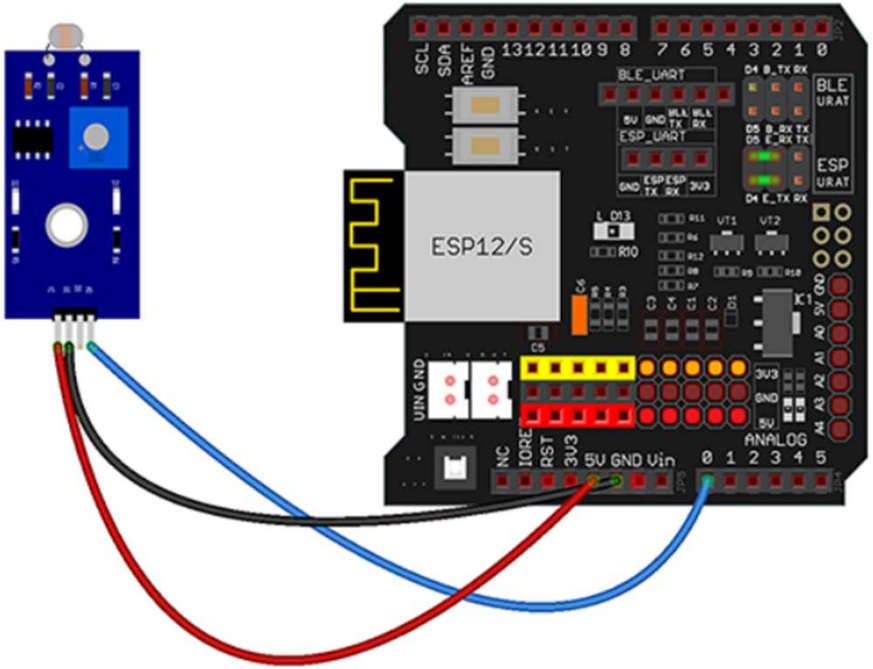
b) Connect your Arduino Compatible to the correct COM port

Lab: Wireless Light Sensor . . .

Lab Setup: Wiring the Light Sensor to the IoT unit

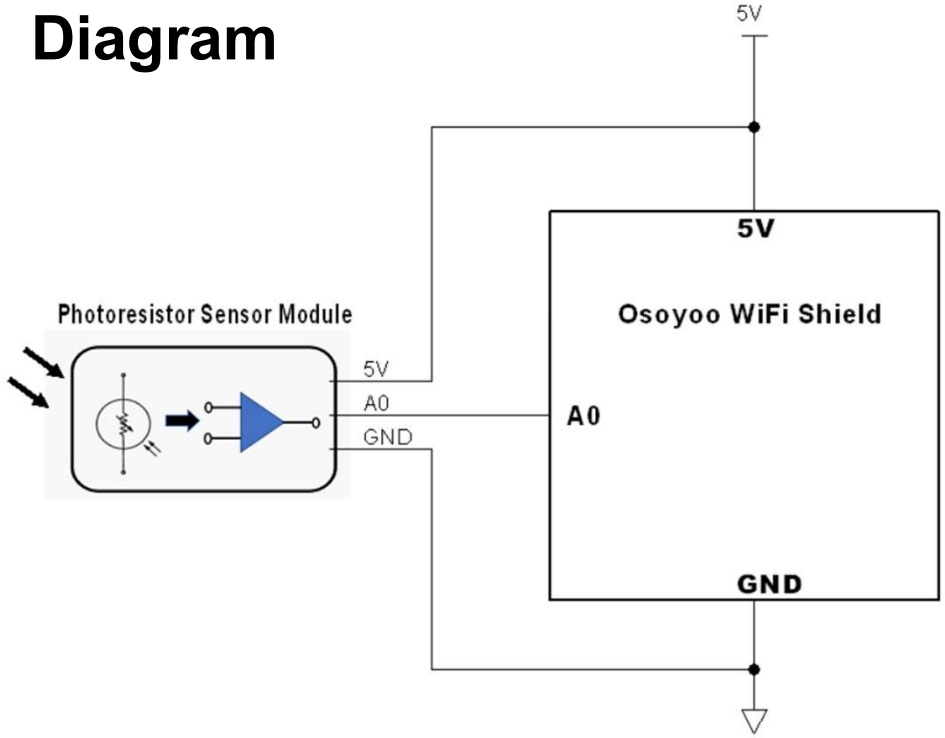
Note:

The photo-resistor sensor module is the light sensor.



Lab: Wireless Light Sensor . . .

Lab Setup: IoT Receiver Electronic Circuit Schematic Diagram

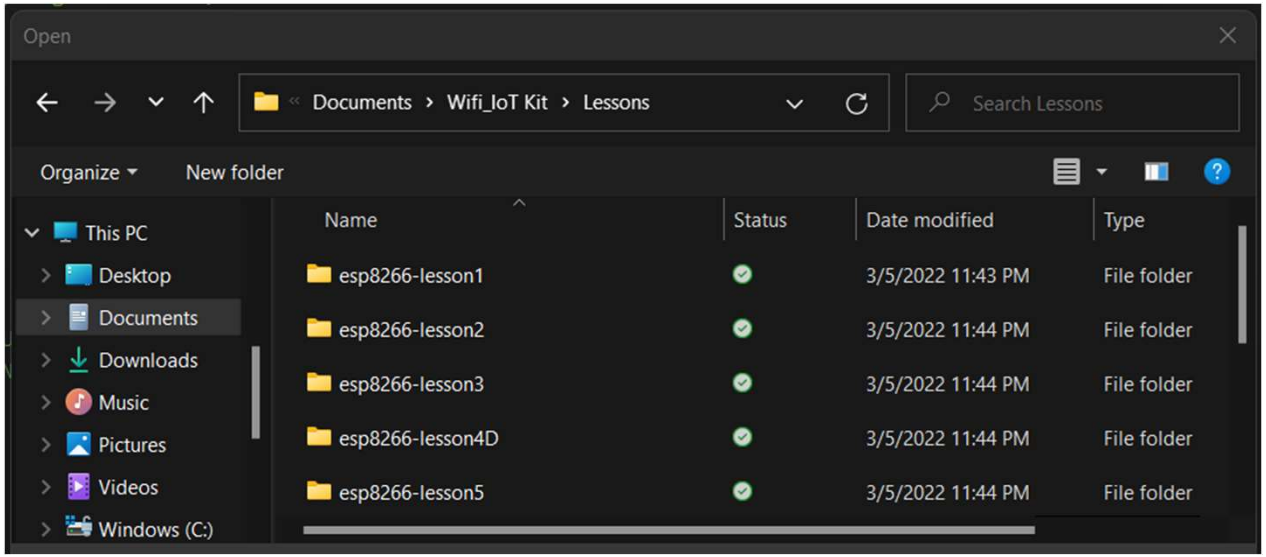


Lab: Wireless Light Sensor . . .

Lab Setup: Upload Lesson 3 code to Arduino Compatible

Download the code from here!

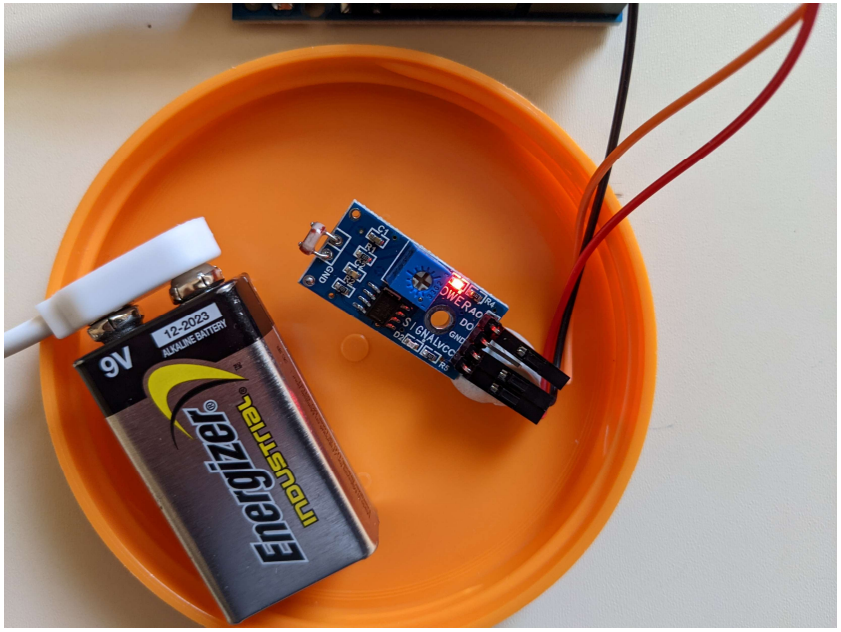
WiFi Internet of Things Learning Kit for Learn Coding with Arduino IDE 3: Photoresistor Sensor « osoyoo.com



Lab: Wireless Light Sensor . . .

Lab Setup: Adjust the Photoresistor sensor module's potentiometer

Adjust the potentiometer with a screwdriver until the green LED turns off.



Lab: Wireless Light Sensor . . .

Lab Setup: Upload Lesson 3 code to Arduino Compatible

Arduino IoT Lesson 3

Light Detection Reading

Real time Photoresistor value: 125, 88% of maximum sensor value

Lab: Wireless Light Sensor . . .

Lab Setup: Upload Lesson 3 code to Arduino Compatible

Arduino IoT Lesson 3

Dark Detection Reading

Real time Photoresistor value: 979, 5% of maximum sensor value

Lab: Wireless Light Sensor . . .

Play with the Code!

```
Line 25:Change the analog Pin
const int analogInPin = A0;  // Analog input pin that the photoresistor is attached to

Line 79: Change the Header and Font size
msg +="<HTML><head><meta http-
equiv=\"refresh\" content=\"5\"></head><BODY><H1 style=\"color:green;\">Arduino IoT Lesso
n 3</H1><br>";
```

Question 5

In reviewing slide 34, what line of instruction would allow attaching an external sensor to another analog pin?

a) Line 25

b) Line 79

Thank you for attending

Please consider the resources below:

ESP8266 Hardware Design Guidelines (www.expressif.com)

Osoyoo Website.(2022). WiFi iot learning kit. https://osoyoo.com/2020/05/30/wifi-iot-learning-kit-for-arduino/

ElectronicsTutorial. (2021). *Light sensors. https://www.electronics-tutorials.ws/io/io_4.html#:~:text=The%20light%20sensor%20is%20a,)%20into%20electricity%20(electrons)*

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