Solar Server
experimentation session 2

Microcontroller: A programmable processor that can measure inputs and produce outputs. It can be controlled by uploading code. A common microcontroller is Arduino, which is different from a Raspberry Pi. Microcontrollers aren't computers.
Analog: An analog signal can come in a range of numbers, for our purposes, lets say it can be anywhere from 0-1023.
Digital: A digital signal is either ON or OFF, 1 or 0.

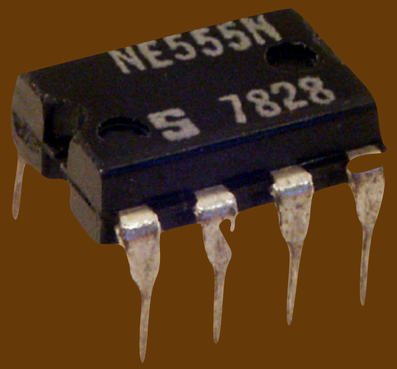
Terminology

Electricity can be used to power something, but also as a signal that can be analyzed to control something. We can think of this as being an “input”, data, or control. This session explores some ways we can use solar panels as data rather than power, although some circuits allow us to use it both ways.

Signals

555

The 555 is a common IC (integrated circuit) that creates an oscillating signal. We can use other components to modulate the signal, even the input from a solar panel!

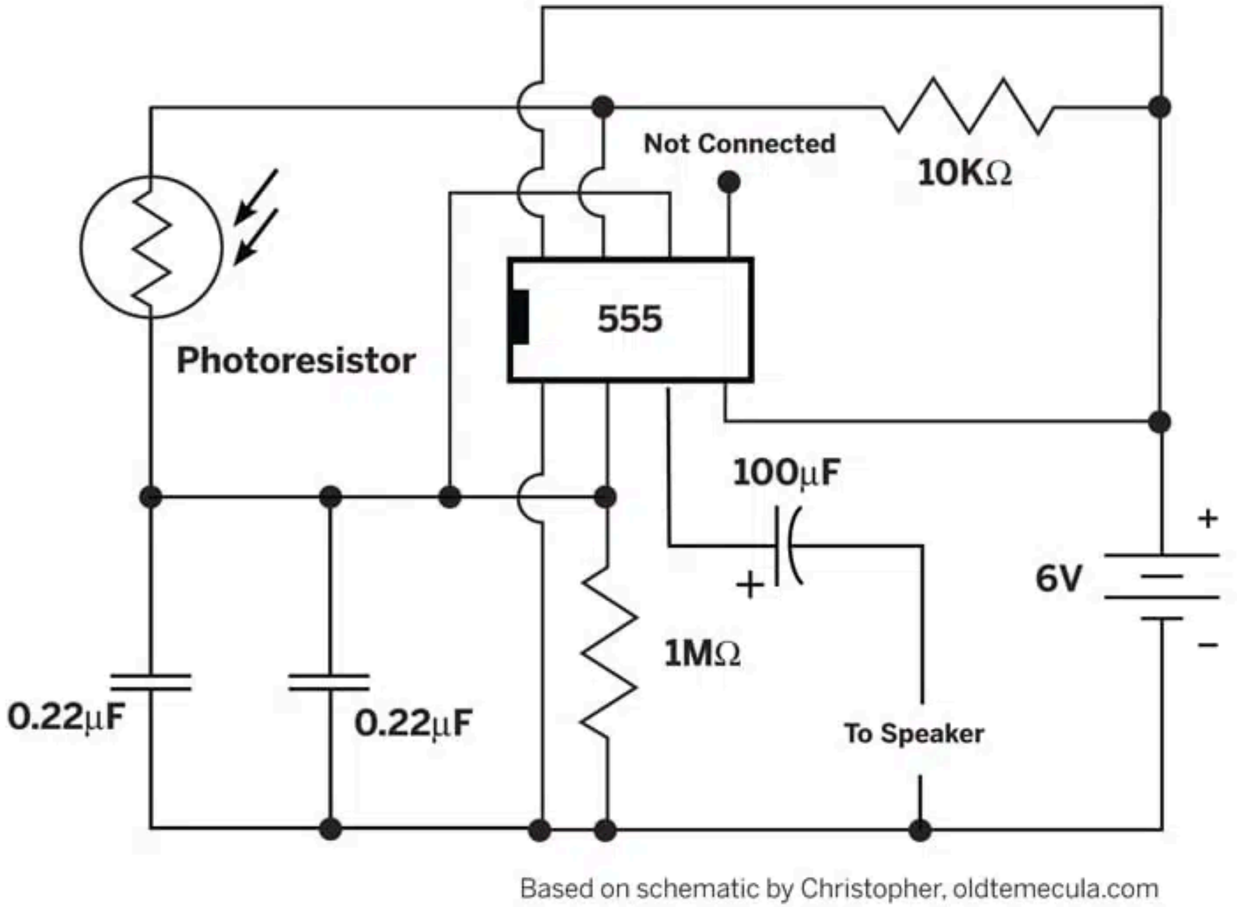


555 Circuit

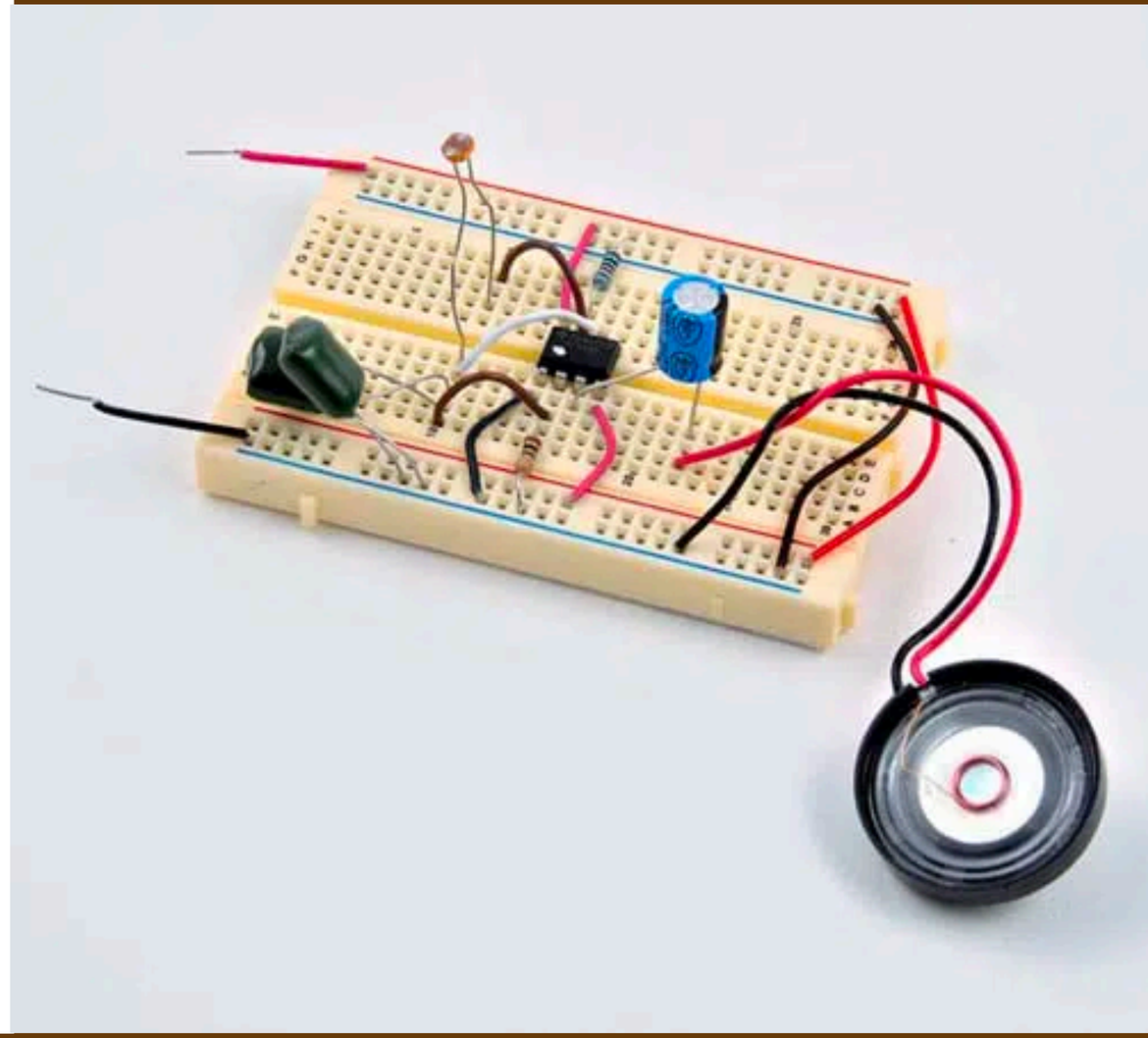
Solar panel, which can be replaced with a photocell

Speaker

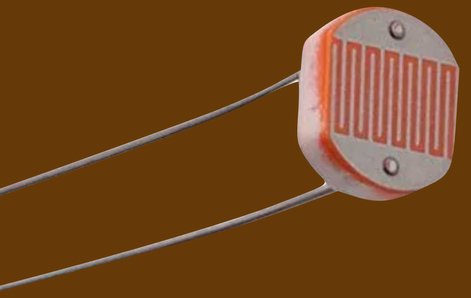
555 Light Insttument



Based on schematic by Christopher, oldtemecula.com

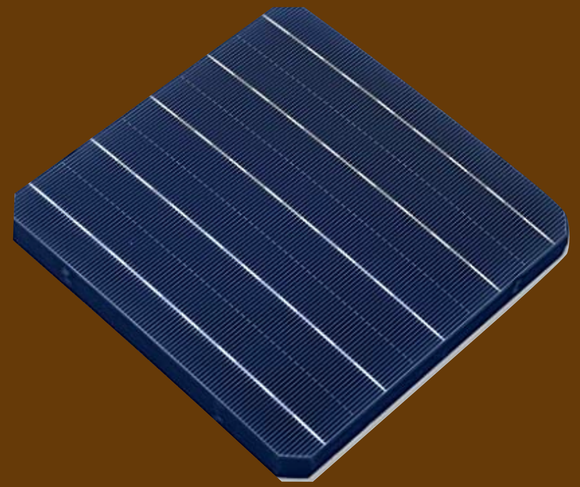


Solar as data



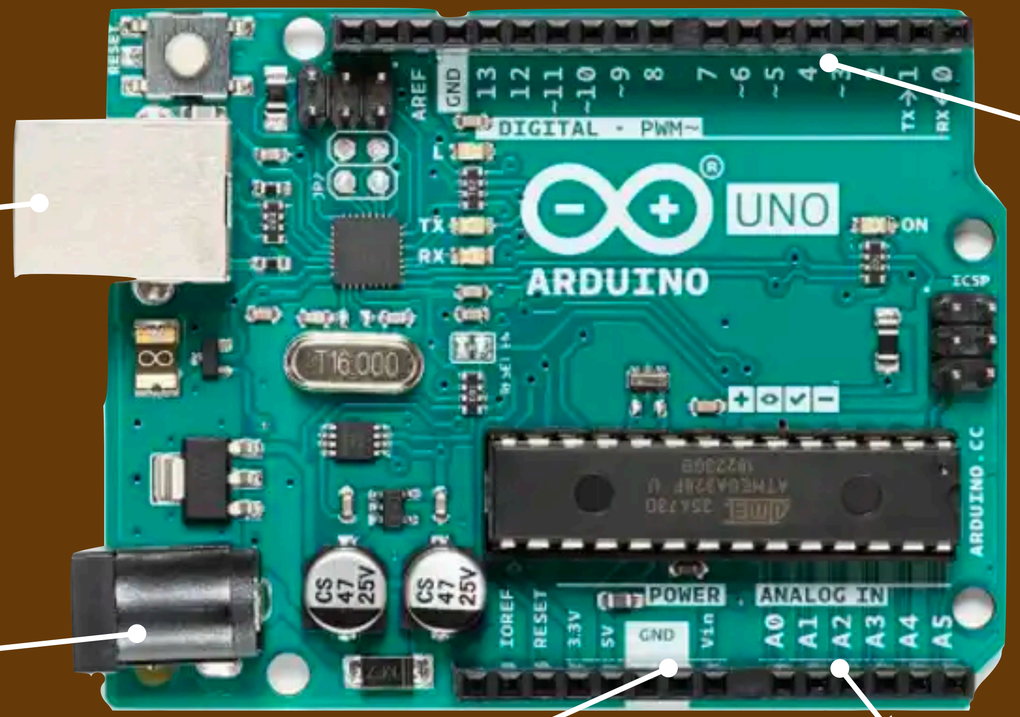
Photocells don’t generate power, they change **resistance** as they hit light (not a specific kind of light)

Solar cells generate **power** / voltage when specific wave lights of light are applied.



Photocell vs Solar cell

Arduino Layout



USB

Used to program your Arduino, connected to computer.

Power

Can go to wall plug, or in our case, a solar panel!

Power stuff

Easy access to power, ground, and different voltages output by your Arduino

Digital Pins

Good for reading or writing digital signals

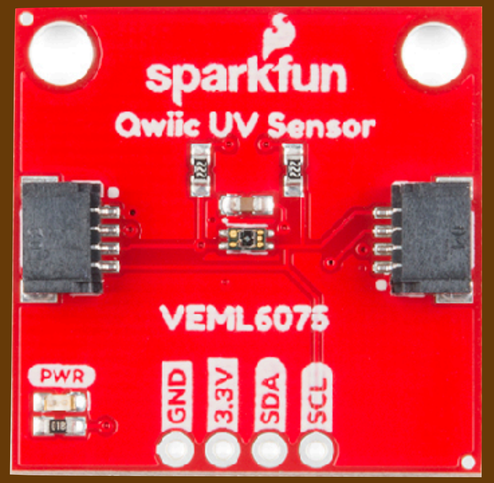
Analog Pins

Good for reading analog signals

Using an Arduino is the easiest way to get information about the environment or a circuit, and transfer it into your computer, but there are tons of other solutions.

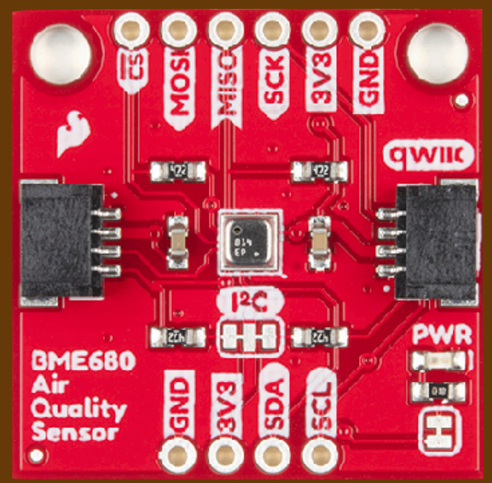
Types of light sensor

UV Light Sensor



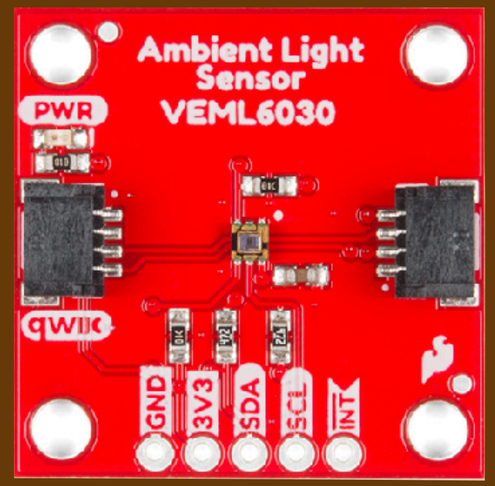
UV light sensor, ideal for sensing sun

Environmental Sensor

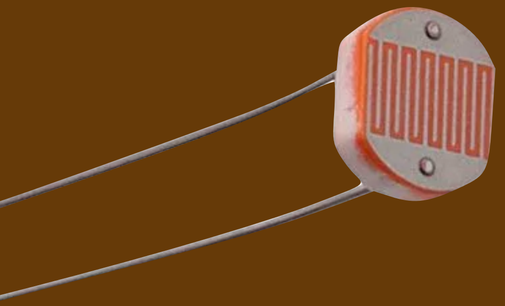


gas sensor with temperature, humidity and barometric pressure sensing

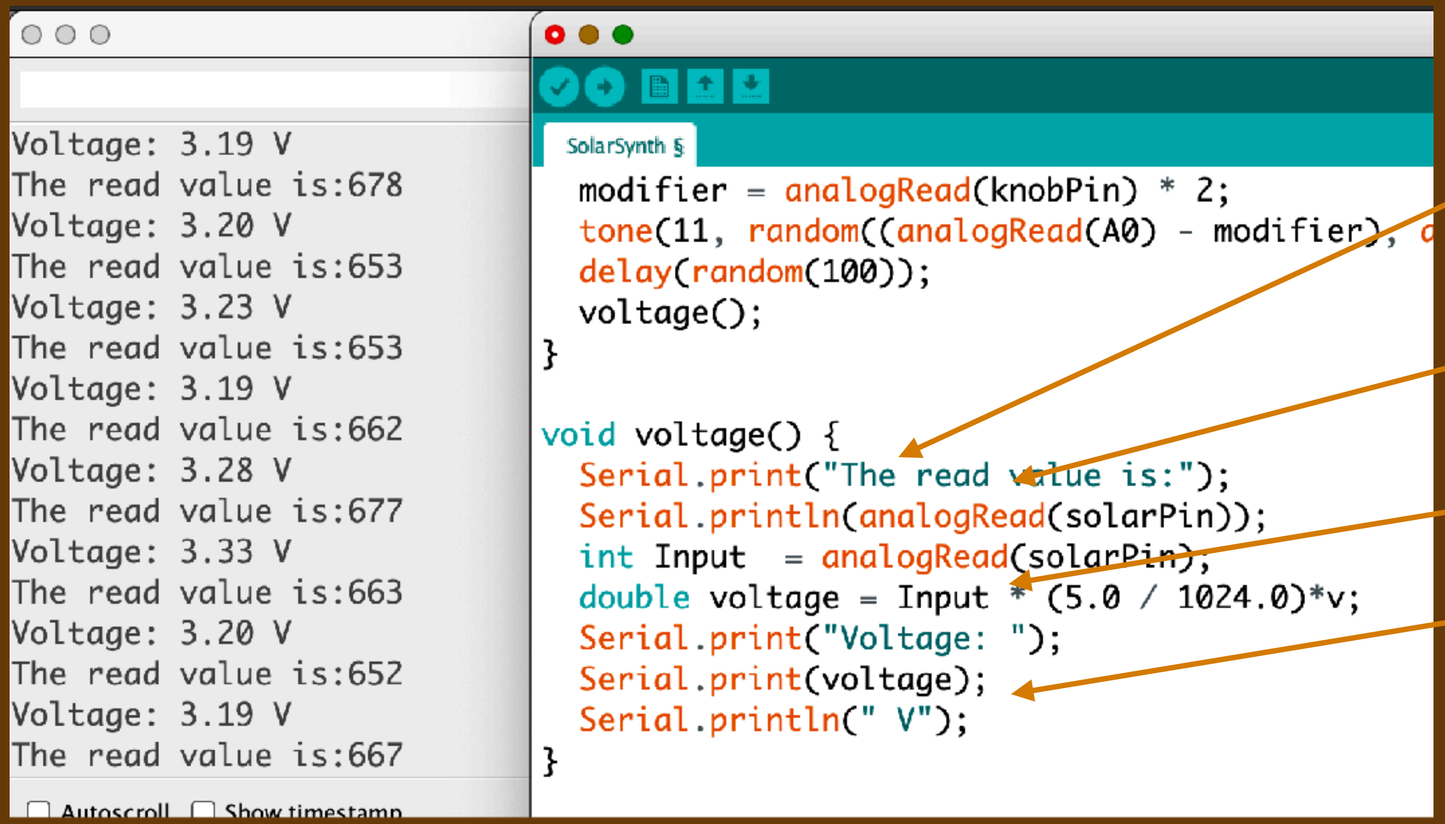
Ambient Light Sensor



Ideal for sensing light, which may or may not be UV light



Photocells are a very common way to sense ambient light, they are also super cheap and can be used like a variable resistor



Print text to the serial monitor

Print a sensor reading from A0

Calculate the reading into voltage

Print it

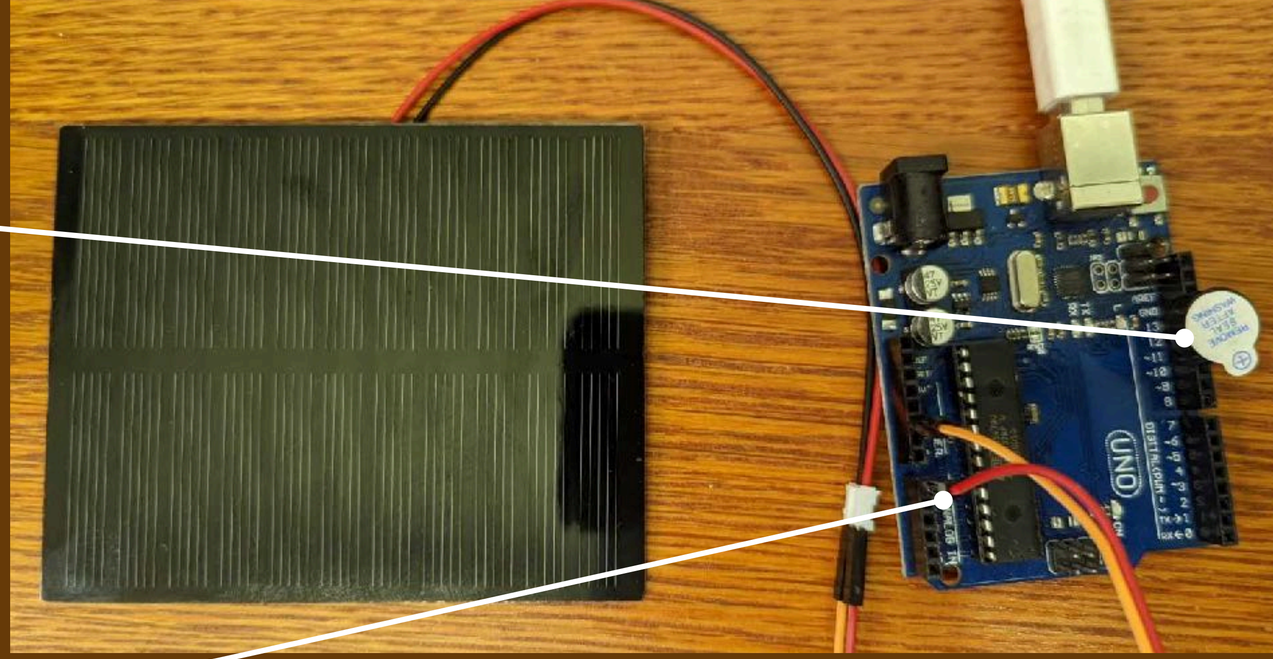
Arduino >> Serial

```ino
void setup()
{
 Serial.begin(9600);
}
void loop() {
int Input  = analogRead(A0); // Read the analog  value
double voltage = Input * (5.0 / 1024.0) * 10; //convert the value to volts
Serial.print("Voltage: ");
Serial.print(voltage);
Serial.println(" V");
delay(2500);
}
```

How to measure Current, Voltage, and Resistance on an Arduino

Converting reading to voltage

```
modifier = analogRead(knobPin) * 2;
tone(11, random((analogRead(A0) - modifier), analogRead(A0)
+ modifier), random(0, analogRead(A0)));
delay(random(100));
```



```
The read value is:678
Voltage: 3.20 V
The read value is:653
Voltage: 3.23 V
The read value is:653
Voltage: 3.19 V
The read value is:662
Voltage: 3.28 V
The read value is:677
Voltage: 3.33 V
The read value is:663
Voltage: 3.20 V
The read value is:652
Voltage: 3.19 V
```

```
Serial.print("The read value is:");
Serial.println(analogRead(solarPin));
int Input  = analogRead(solarPin);
double voltage = Input * (5.0 / 1024.0)*v;
Serial.print("Voltage: ");
Serial.print(voltage);
Serial.println(" V");
```

How it works

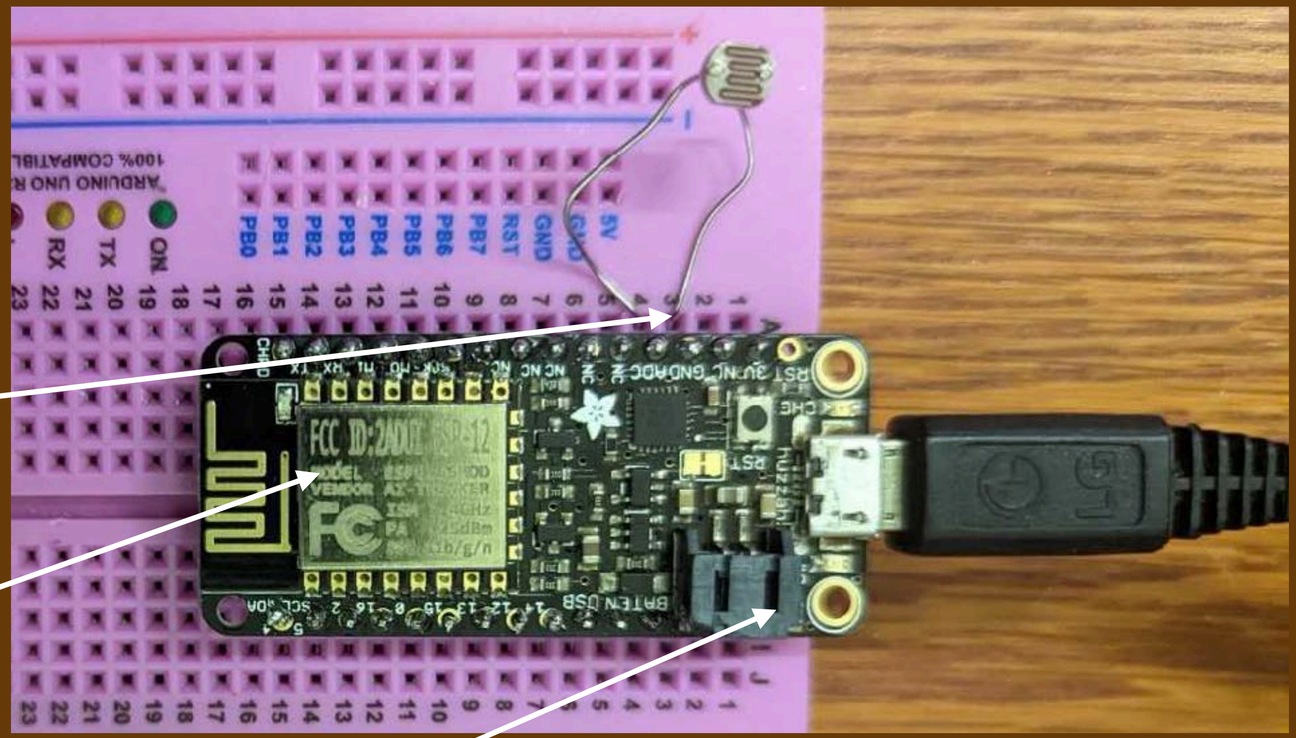
*This code takes data from the Analog 0 pin with **analogRead(A0)** and outputs it through pin 11 using **Tone()** and prints it with **Serial.println()***

Full code here

Do things with the numbers

Tutorials on Feather Huzzah here

Feather Huzzah is a type of Arduino made for connecting to the internet over wifi



Take it online

Adafruit IO

A platform used to display, translate, or transfer data from your Arduino around the internet.

HTTP Requests

*Are a protocol used to communicated through *the internet*. Think of it like a handshake.*

AdafruitIO HTTP API

Arduino >> Website

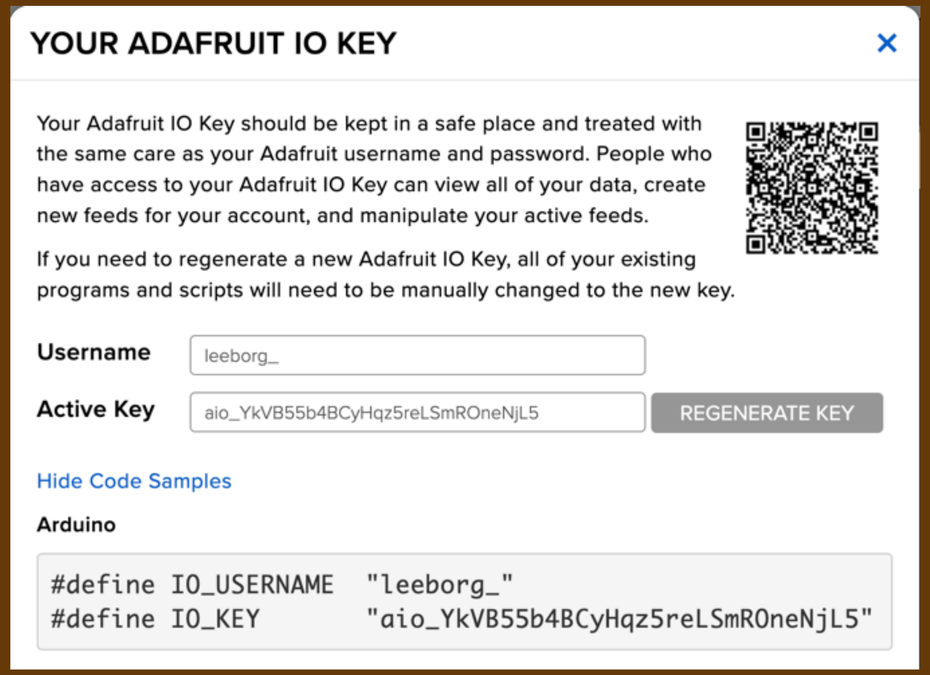
Arduino > Send HTTP Request >> Internet Magic >> Receive HTTP Request > Website

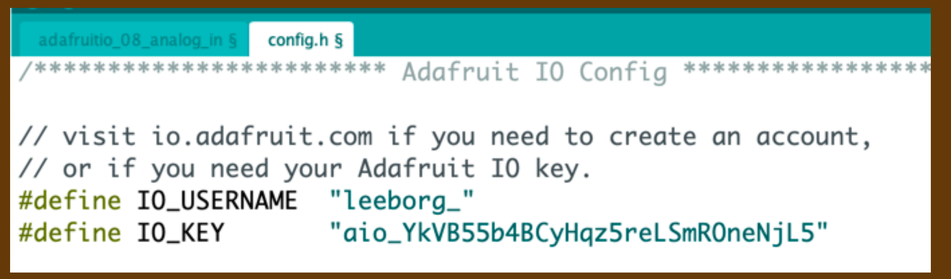
Test Dashboard

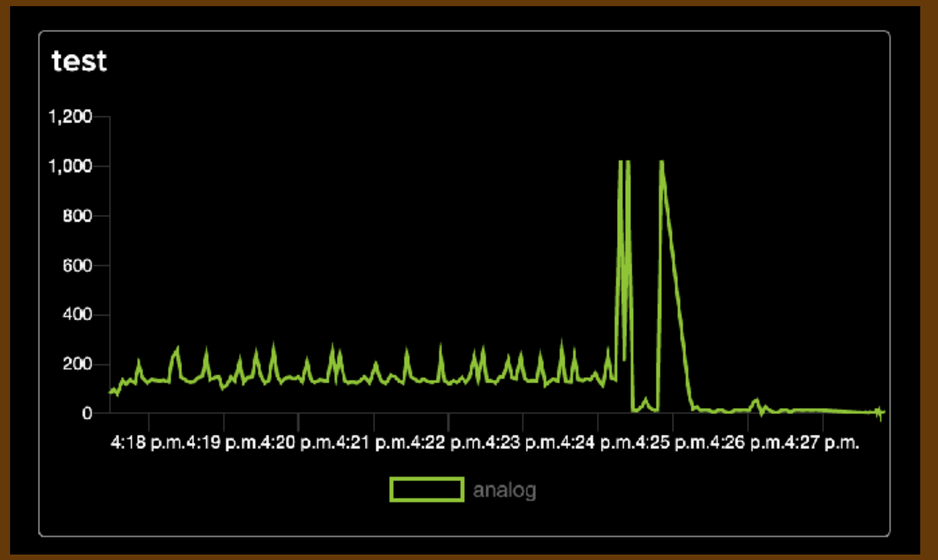
Your account has a“key” that you put into your Arduino code so that you can publish to Adafruit IO. You can then access the variables and display them on a dashboard.

Tutorial here

Don’t forget to add your SSID (wifi name) and password to the code. Can’t use Concordia Wifi! Try my phone!







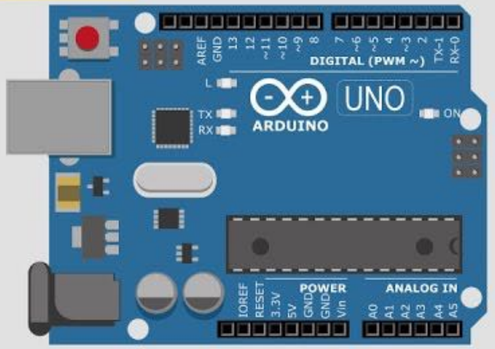

```
#define WIFI_SSID "Pixel_4960"
#define WIFI_PASS "potato124"
```

Arduino >> Website

COMET'S VR

HOW TO CONNECT

unity



ARDUINO TO UNITY

COMET'S VR

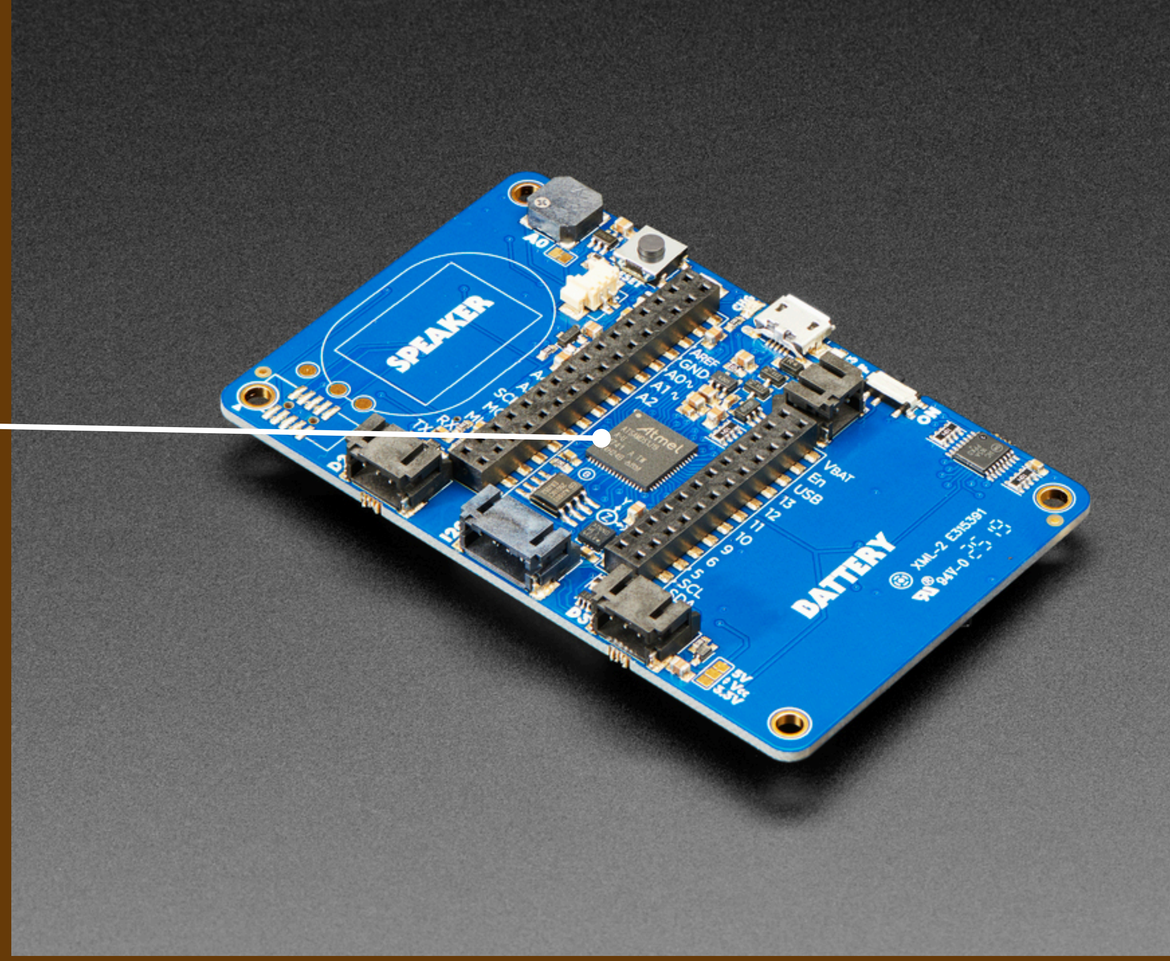
Stable Serial Communication between Arduino and Unity

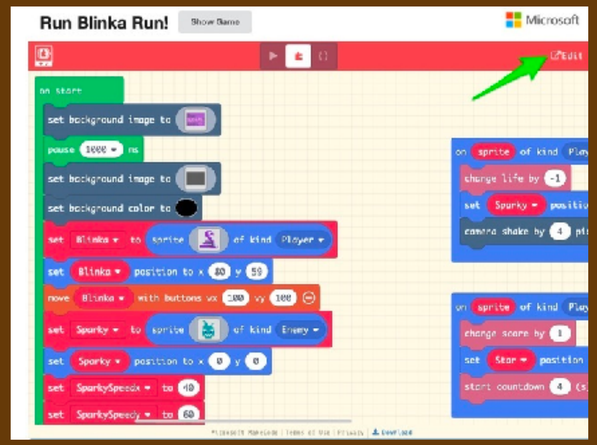
Arduino >> Unity

Circuit Python

Circuit python is a vision of Python used for circuits :) Tutorials above, it is used on the PyBadge / handheld gaming device.

Feather Huzzah goes here, so you can connect to sensors and use the data in the game





maker code

You can also use this block programmer to make games for your PyBadge including accessing sensor data

PyBadge