SnoCo MAKERSPACE

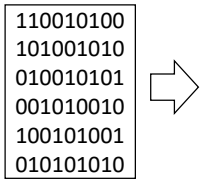
IoT 101

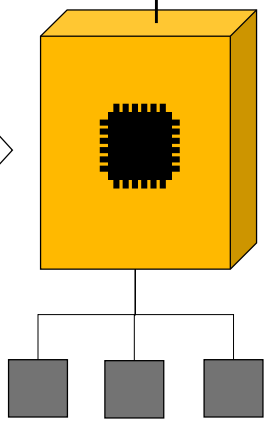
1

A thing:

((( ))) Internet connectivity

Run software





Processing capability

Sensors + actuators (interact with the world)

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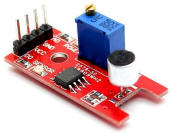
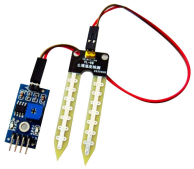
Sensors

Button/Keypad	Temperature & Humidity	Sound	Light	Color	Motion
					
Soil Moisture	**Distance**	**Smoke**	**GPS**	**Water Level**	**Accelerometer**
					

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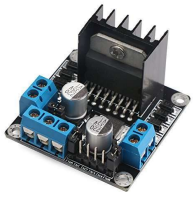
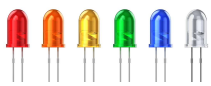
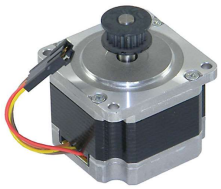
Actuators

Motor Driver	OLED Screens	NeoPixels	LCD Screens	Buzzer
				
Water Valve	**Water Pump**	**LEDs**	**Motors**	**Relays**
				

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Smart things….

Enable business scenarios
Save lives
Optimize costs
Minimize environment impact
Support your health

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Save your living room plant!!!

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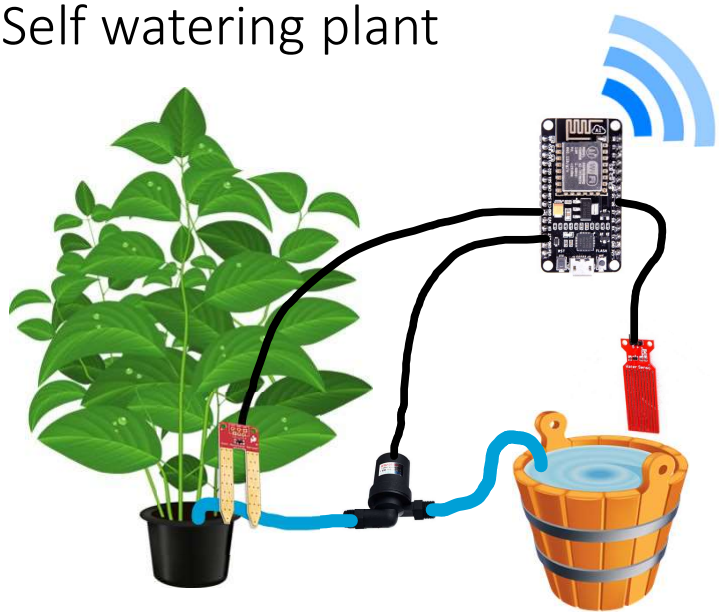
Self watering plant



I'm gonna DIE!!!!!

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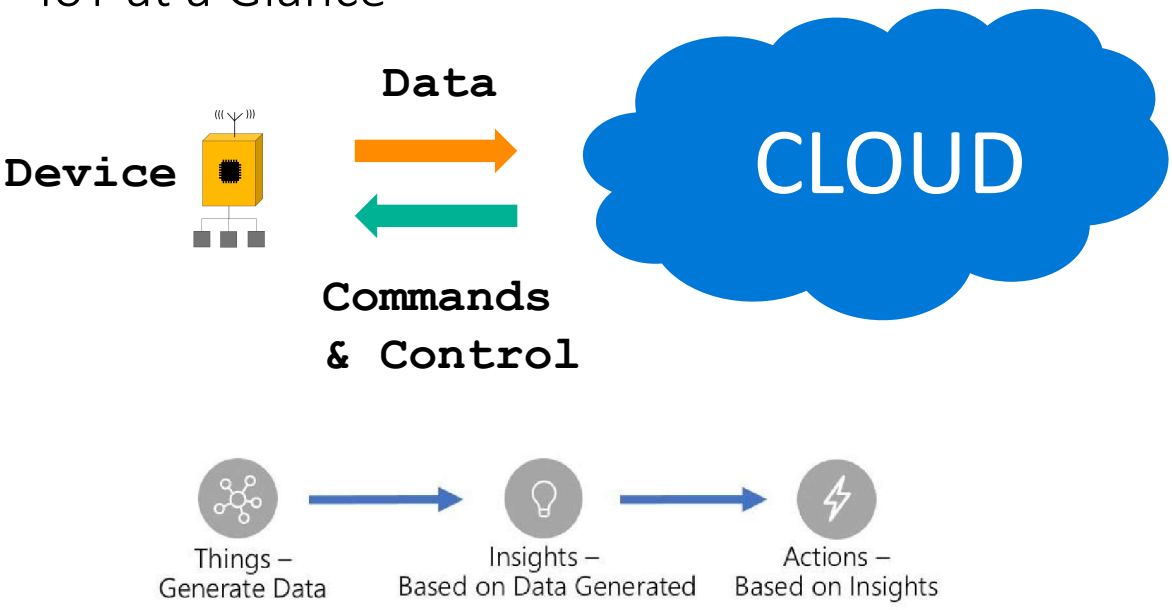
IoT at a Glance



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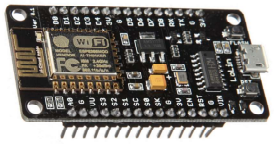
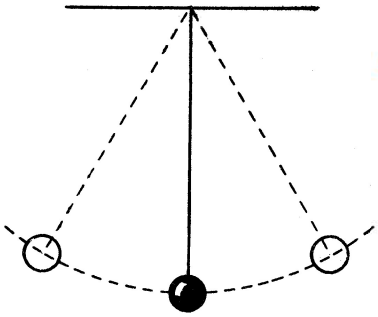
What to expect from this workshop?





- Free online message broker
- Cheap MCU board
- Hacker / Learning

- Industry grade solutions
- Implements all 7 properties of highly secure devices

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PROPERTIES OF HIGHLY SECURE DEVICES

Galen Hunt, George Letey, and Edmund B. Nightingale
Microsoft Research NExT Operating Systems Technologies Group

Property	Examples and *Questions to Prove the Property*
Hardware-based Root of Trust	Unforgeable cryptographic keys generated and protected by hardware. Physical countermeasures resist side-channel attacks.
	Does the device have a unique, unforgeable identity that is inseparable from the hardware?
Small Trusted Computing Base	Private keys stored in a hardware-protected vault, inaccessible to software. Division of software into self-protecting layers.
	Is most of the device's software outside the device's trusted computing base?
Defense in Depth	Multiple mitigations applied against each threat. Countermeasures mitigate the consequences of a successful attack on any one vector.
	Is the device still protected if the security of one layer of device software is breached?
Compartmentalization	Hardware-enforced barriers between software components prevent a breach in one from propagating to others.
	Does a failure in one component of the device require a reboot of the entire device to return to operation?
Certificate-based Authentication	Signed certificate, proven by unforgeable cryptographic key, proves the device identity and authenticity.
	Does the device use certificates instead of passwords for authentication?
Renewable Security	Renewal brings the device forward to a secure state and revokes compromised assets for known vulnerabilities or security breaches.
	Is the device's software updated automatically?
Failure Reporting	A software failure, such as a buffer overrun induced by an attacker probing security, is reported to cloud-based failure analysis system.
	Does the device report failures to its manufacturer?

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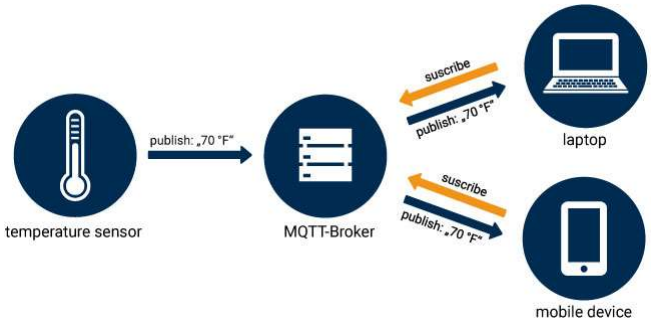
MQTT Broker



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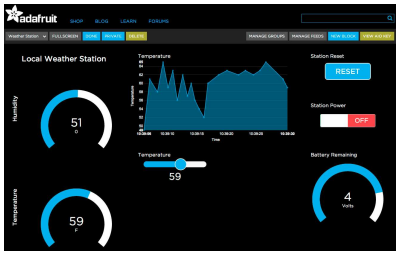
MQTT Broker:

- MQTT Broker: IO.adafruit.com
- Free service
- 30 data points per minute
- 30 days of storage
- Up to 5 feeds
- Up to 5 dashboards



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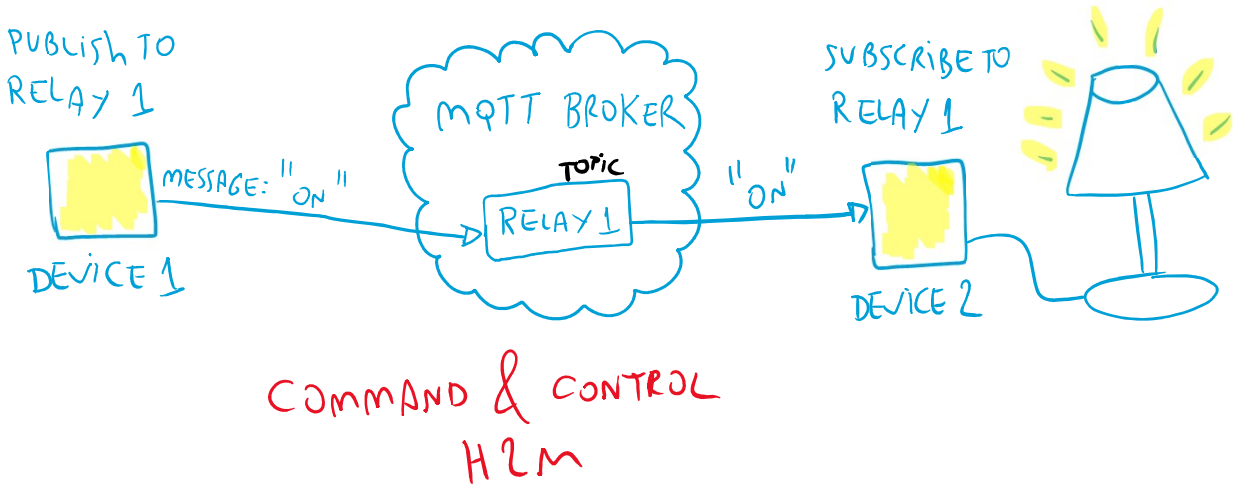
Making it real:



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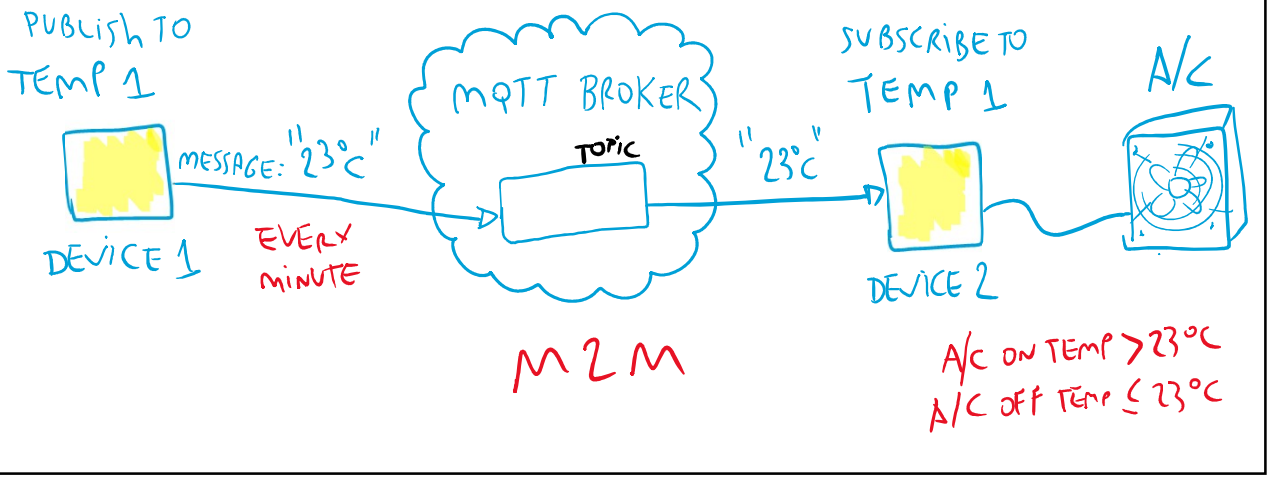
Making it real:



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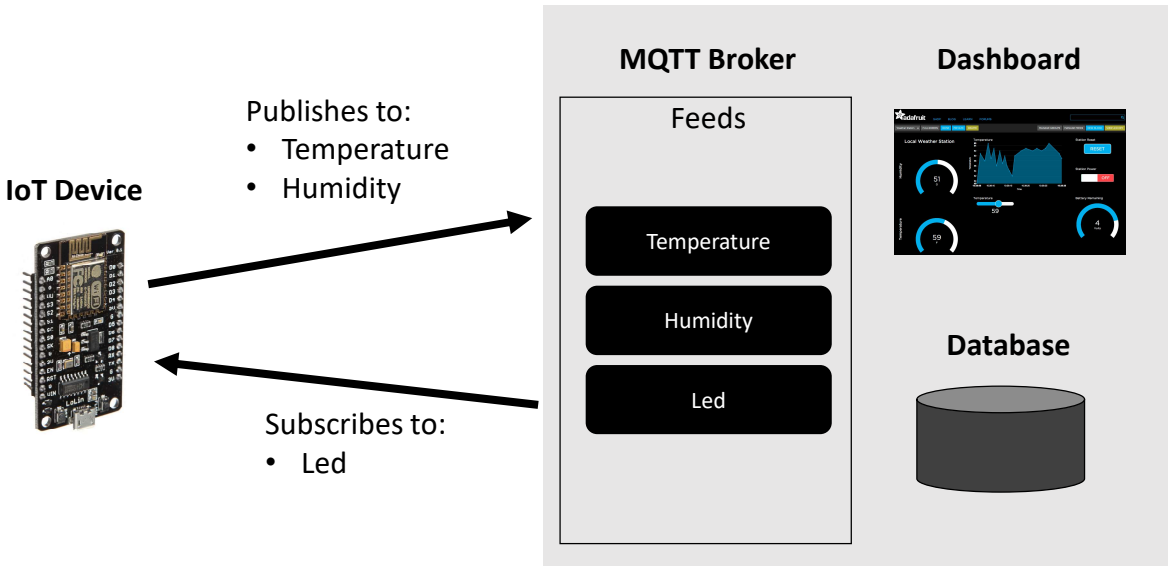
Hands-on time!!!



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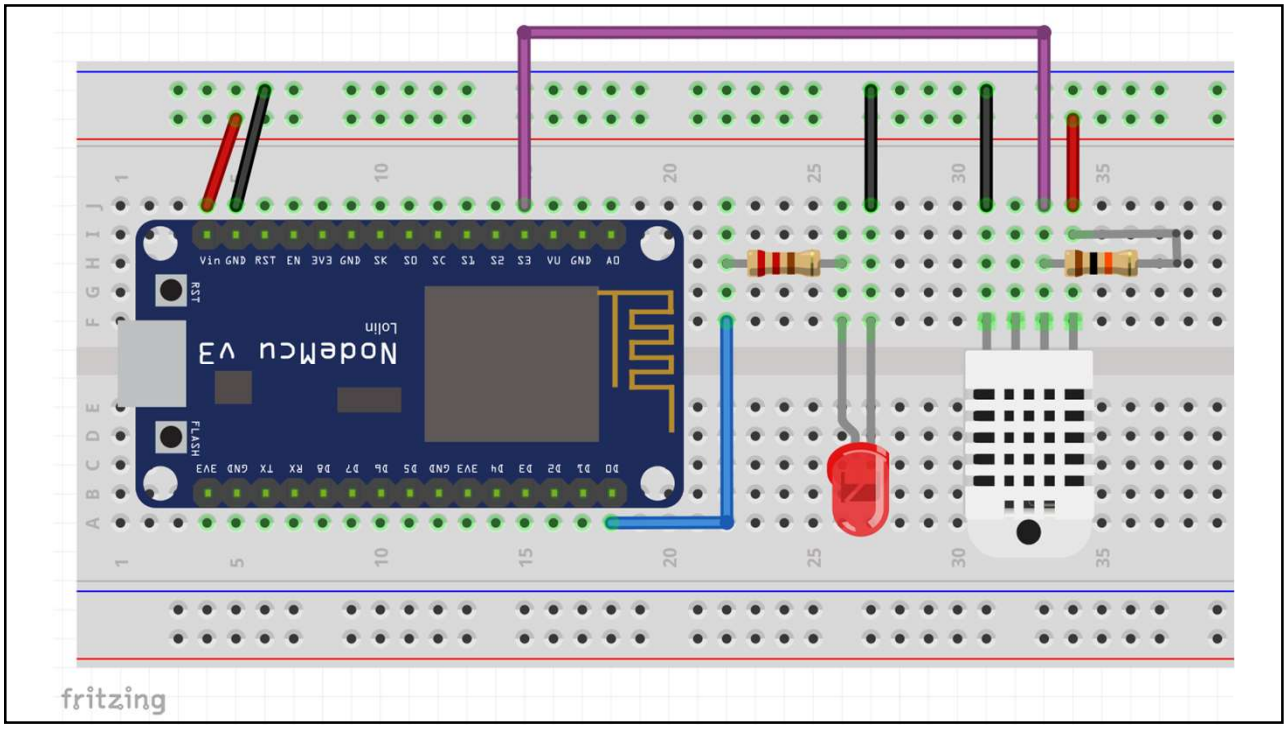

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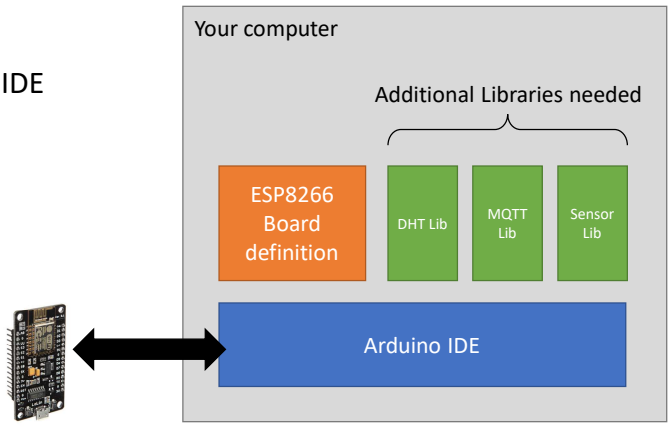
IoT end to end: Hands-on (DEVICE)

Setup the toolchain needed for IoT Projects (these steps need to be performed only once)

Step 1 – Install Arduino IDE

Step 2 – Install Board support on Arduino IDE

Step 3 – Install Libraries



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ESP8266 Board Support

1. Open Arduino IDE → File/Preferences
2. Find a text box called “Additional board manager URLs” and type:

```
http://arduino.esp8266.com/stable/package_esp8266com_index.json
```

3. Under the “Show verbose output during” configuration mark the checkboxes “compilation” and “upload”. This is important as this will give us clear error messages, we can use to identify future problems
4. Click OK
5. Now go to menu Tools/Board/Boards Manager
6. Type **ESP8266** in the search box and wait until the board manager finds “esp8266 by ESP8266 Community”
7. Select the latest version
8. Click “Install”
9. Be patient, this process can take several minutes under slower connections

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Libraries

1. On the Arduino IDE go to menu Sketch/Include Library/Manage Libraries
2. Type **DHT11**, wait to see the results, click on **DHT Sensor Library by Adafruit**, select the highest version in the "Select Version" dropdown list, and then click Install.
3. Follow the same procedure to install 2 additional libraries:

What to type	Library name
MQTT	Adafruit MQTT Library by Adafruit
Adafruit unified sensor	Adafruit unified sensor by Adafruit

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IoT end to end: Hands-on (CLOUD + Device)

Step 1 – Create an IO.Adafruit.com account (free)

Step 2 – Create the necessary feeds / topics

Step 3 – get your credentials

Step 4 – download the sample code from GitHub

Step 5 – find and replace the credentials in the code

Step 6 – Load the code into the device and open the serial Monitor

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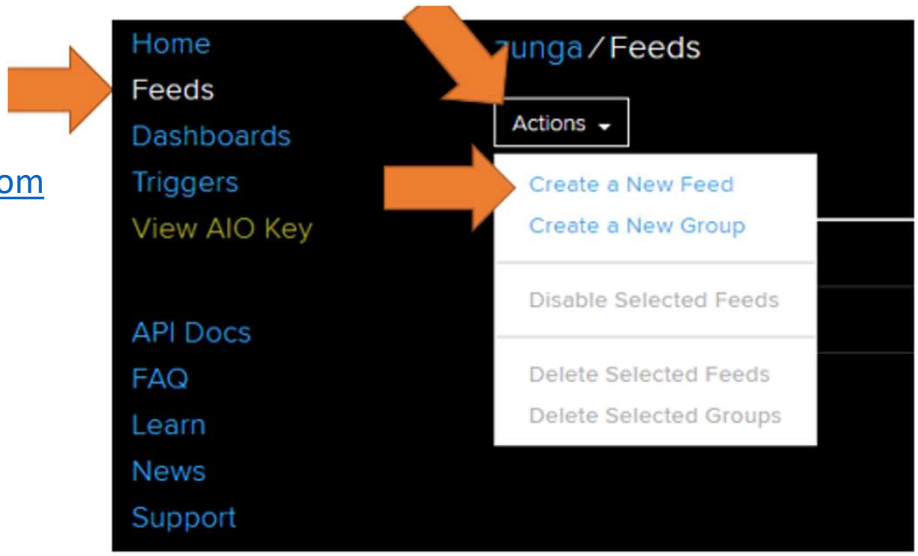
Create Account and Feeds

http://io.adafruit.com

Create 3 new Feeds:

- Temperature
- Humidity
- LED



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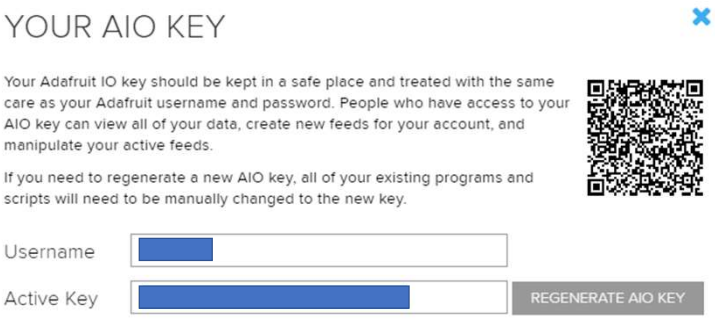
Get your credentials

Top Right menu: Key icon



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Get sample code

https://github.com/wduraes/Workshops
IoT 101 for Makers/ IoT_101_Online

Copy / Paste that code into Arduino IDE, find and replace the credentials

```
#define WLAN_SSID "WIFI NAME“          ”YOUR WIFI NAME”
#define WLAN_PASS "WIFI PASSWORD“      ”YOUR WIFI Password”
#define AIO_SERVER "io.adafruit.com"
#define AIO_USERNAME                   ”YOUR ADAFRUIT USERNAME”
#define AIO_KEY                        "YOUR ADAFRUIT ID"
```

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TEST!!!

Serial Monitor information OK?

Sending data?

Go back to IO.Adafruit.com and open the feeds to see data flowing to:

1. Temperature
2. Humidity
3. Light

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IoT end to end: Hands-on (CLOUD – refining)

Step 1 – Go to IO.Adafruit.com
Step 2 – Create a Dashboard
Step 3 – add Blocks

Block Type	Feed	Block title	Obs
Stream	Temperature	Temperature	
Stream	Humidity	Humidity	
Toggle	Led	Led	
Line Chart	Temperature + Humidity	Temperature + Humidity	Select 2 feeds for this block

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Thank you!!!

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