Crowdsourcing Control with the ESP8266 Thing

Toni Klopfenstein

Twitter/Hackaday.io/GitHub: @ToniCorinne

Pete Dokter

Hackaday.io: @pete.o

Twitter: @PeteDokter

Mike Hord

Hackaday.io: @uptownmaker

GitHub: @mhord

ESP8266

- Small form factor (11.5 mm x 11.5 mm)
- 80 MHz
- System-On-Chip
  - 64K instruction RAM
  - 64K data RAM
  - 64K boot ROM
- 10-bit ADC
- SPI
- I2C
- UART

- 2.4 GHz Wi-Fi
- 082.11 b/g/n
- Integrated TCP/IP protocol stack
- Integrated TR switch, balun, LNA, power amplifier
- Supports WPA/WPA2
- Standby power consumption < 1.0mW
- Deep sleep power <10uA
- Power down leakage <5uA
- Wake-up/Transmit packets <2ms

Form Factor Options

WiFi Module - ESP8266

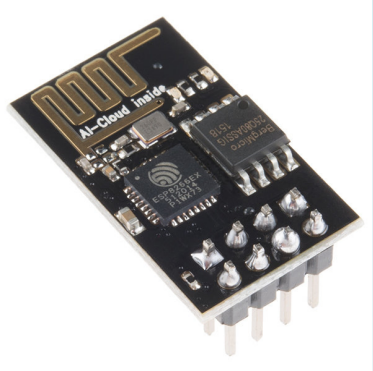
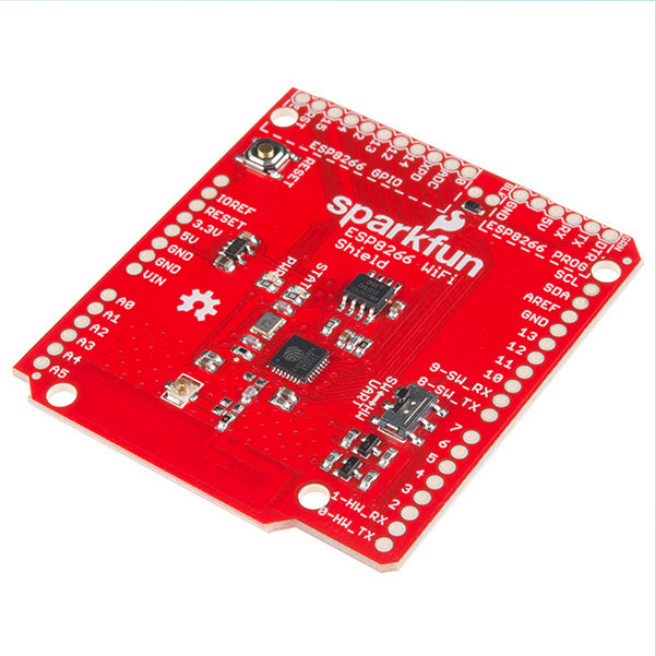


Image Source: SparkFun Electronics (CC-By-NC-SA 3.0)

adafruit HUZZAH ESP8266 Breakout

Image Source: adafruit (CC-By-SA 3.0)



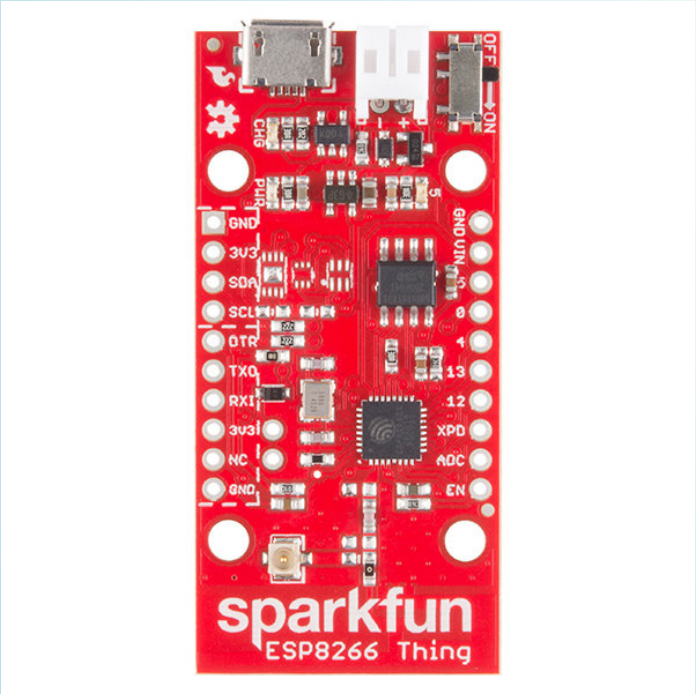
SparkFun WiFi Shield- ESP8266

Image Source: SparkFun Electronics (CC-By-NC-SA 3.0)

What's up with this Thing?

- Small Form Factor
- IoT Friendly
- Low Cost
- Arduino IDE Integrated

- Community Supported
- App-Compatible
  - Blynk
  - IFTTT



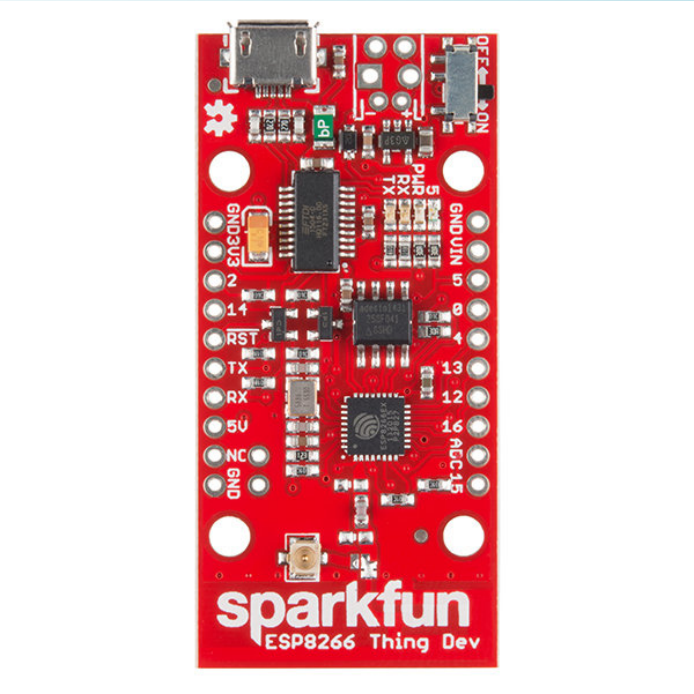


Image Sources: SparkFun Electronics (CC-By-NC-SA 3.0)

Features

- Breadboard compatible
- Auto reset enabled
- IC footprints*
  - ATECC108A ECSDA engine
  - TMP102 12-bit digital temperature sensor
  - TSL2561 Luminosity/Light Sensor
- Decoupling caps footprints*
- FTDI IC*

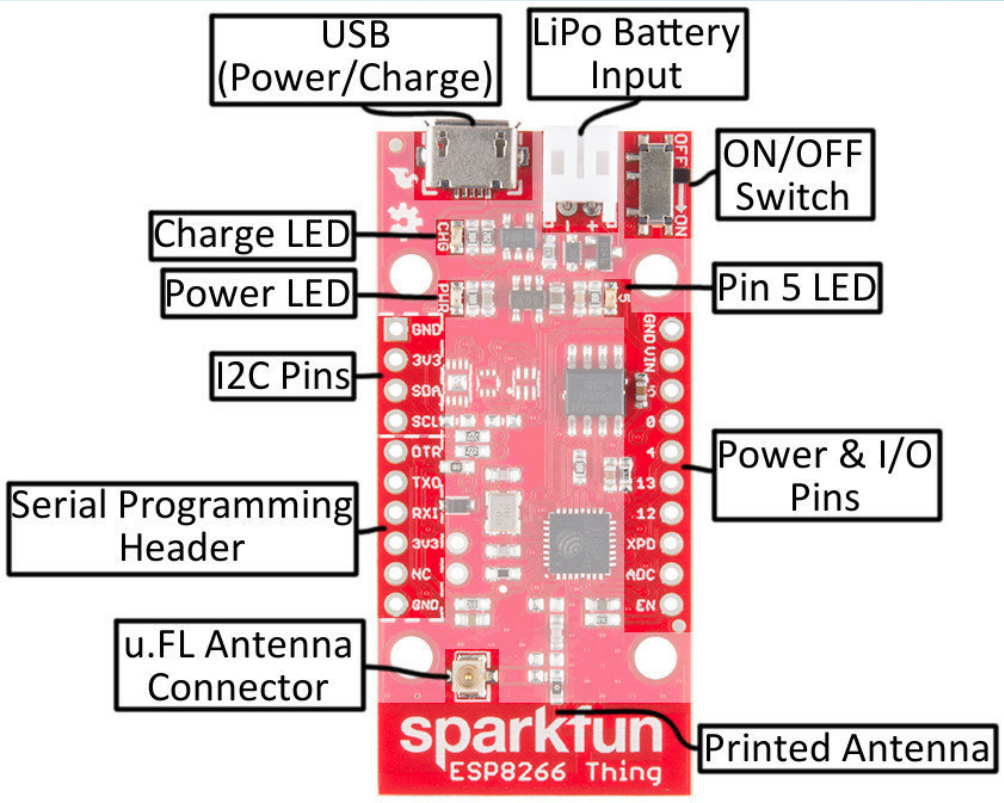


Image Source: SparkFun Electronics (CC-By-NC-SA 3.0)

Time to Internet All the Things

What You Need

Hardware

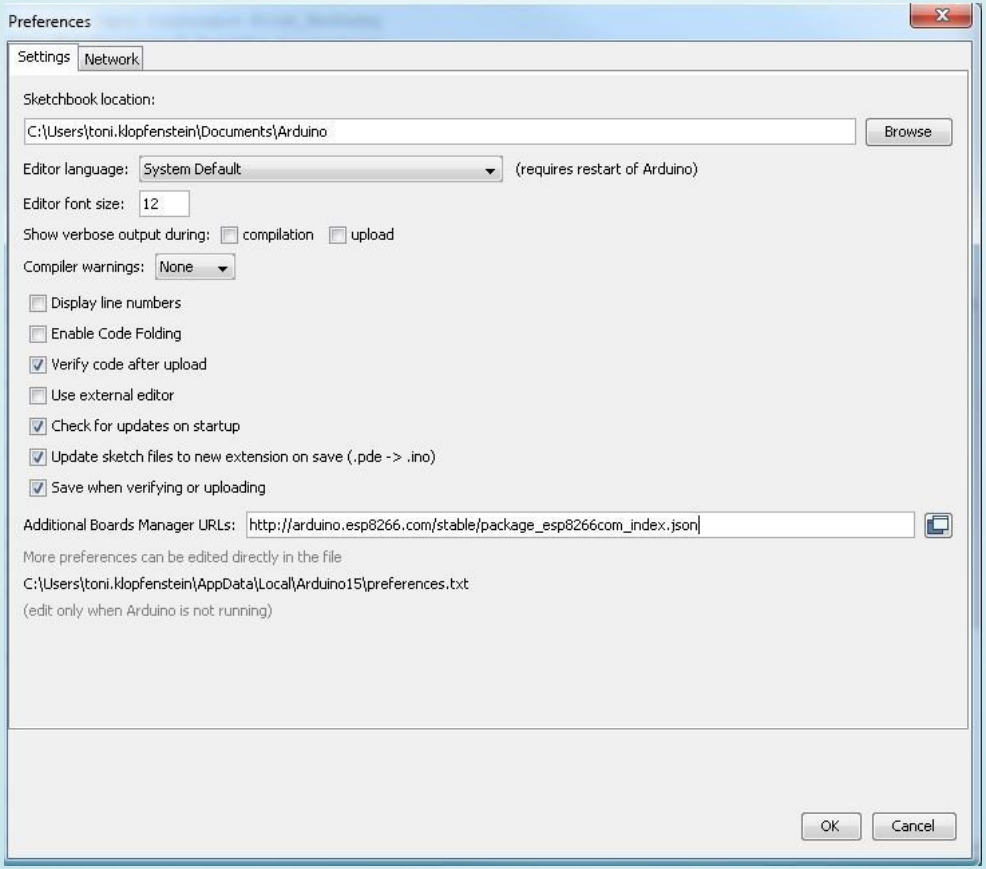
- ESP8266 Thing with Headers
- Cerberus Cable
- FTDI Breakout
- Breadboard
- Jumper wires
- Buttons
- LEDs

Software

- Arduino IDE (1.6.5+)
- ESP8266 Add-on
- Example sketches
- Blynk Library
- FTDI Driver
- Phant Library

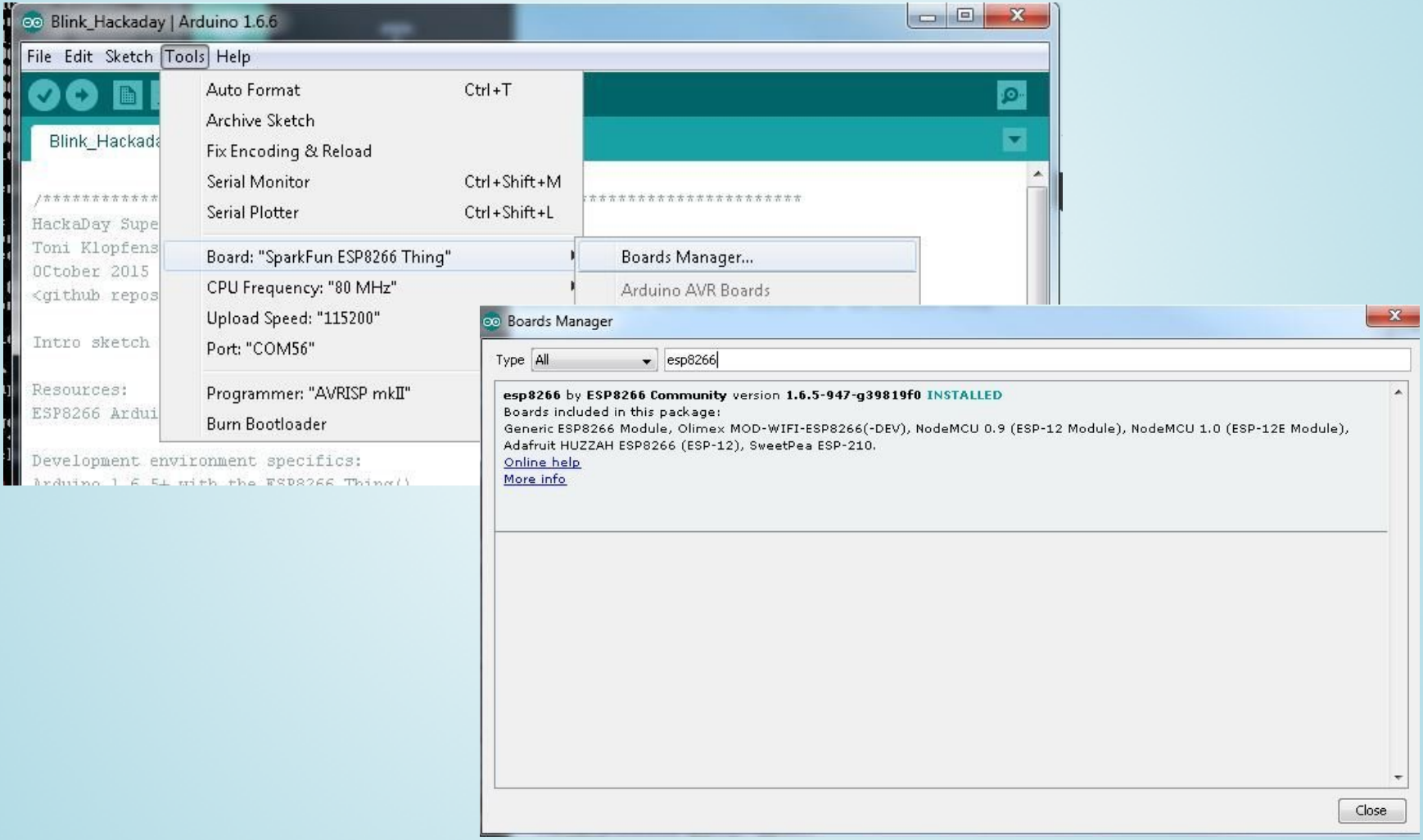
Arduino Setup

- Add ESP8266 Add-on to Preferences
  - http://arduino.esp8266.com/stable/package_esp8266com_index.json



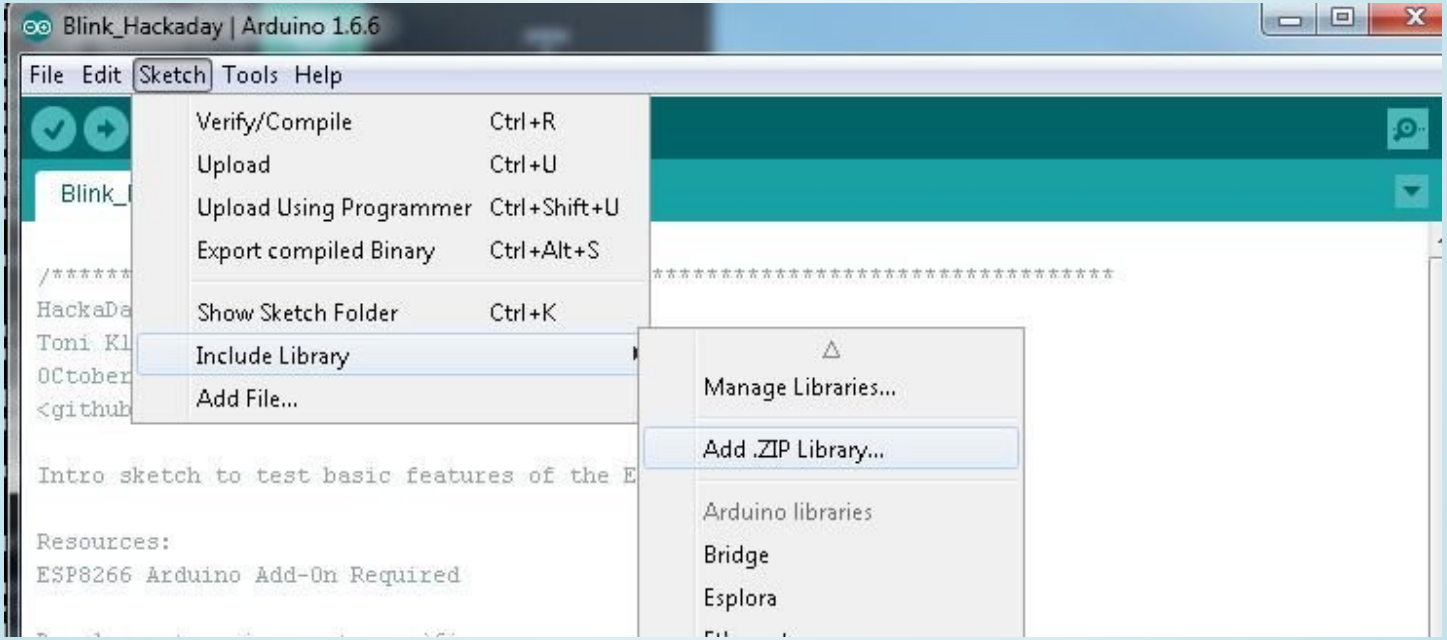
Arduino Setup(2)

- Update Boards Manager



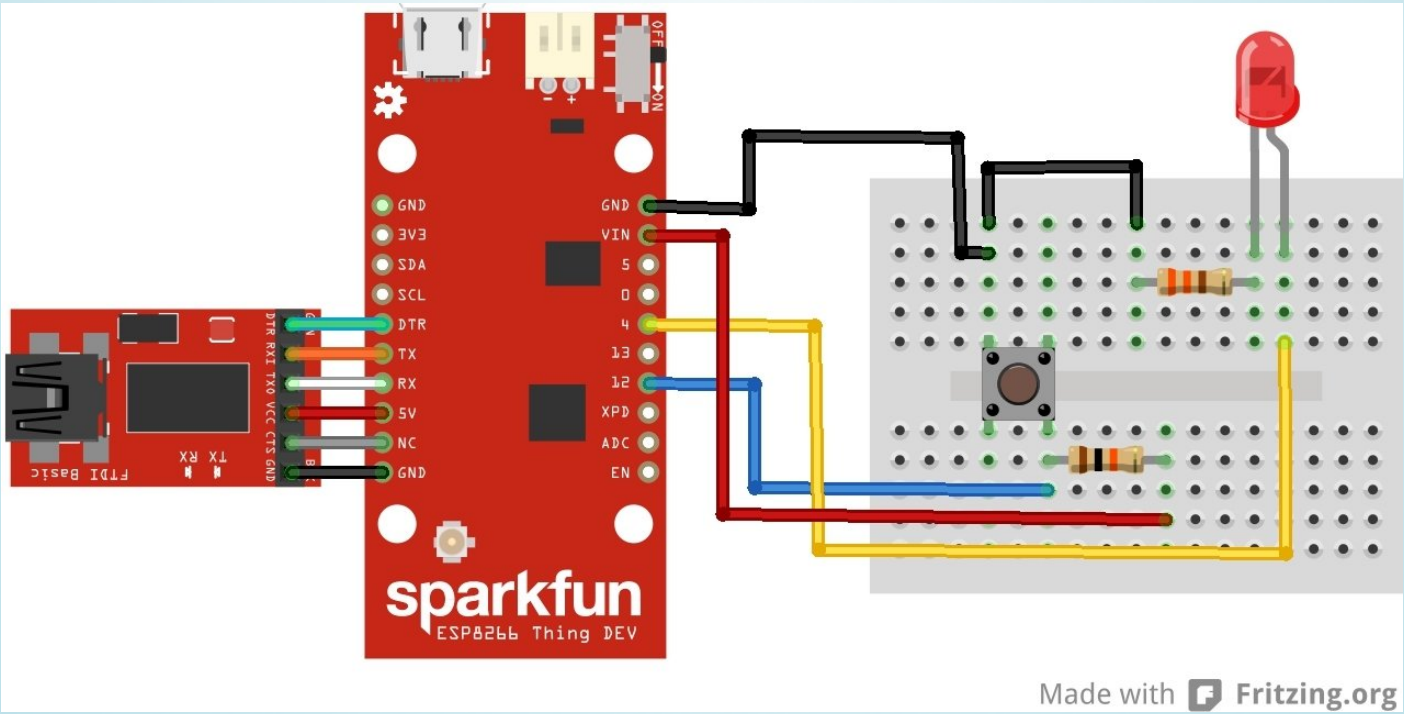
Arduino Setup (3)

- Install Blynk library
- Install Phant library
- Install FTDI driver (if necessary)

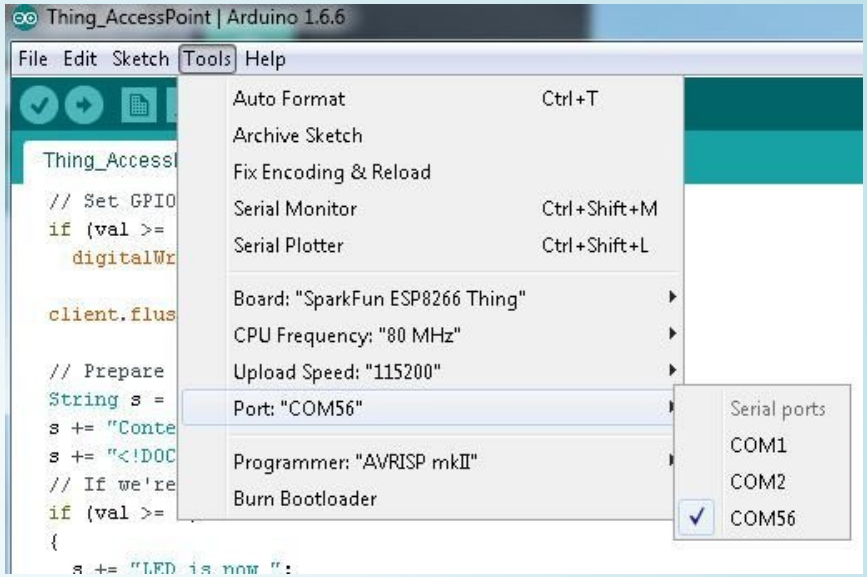


Build your circuit!

- LED to Pin 4
  - 330 Ohm Resistor
- Button to Pin 12
  - 10k Ohm Resistor



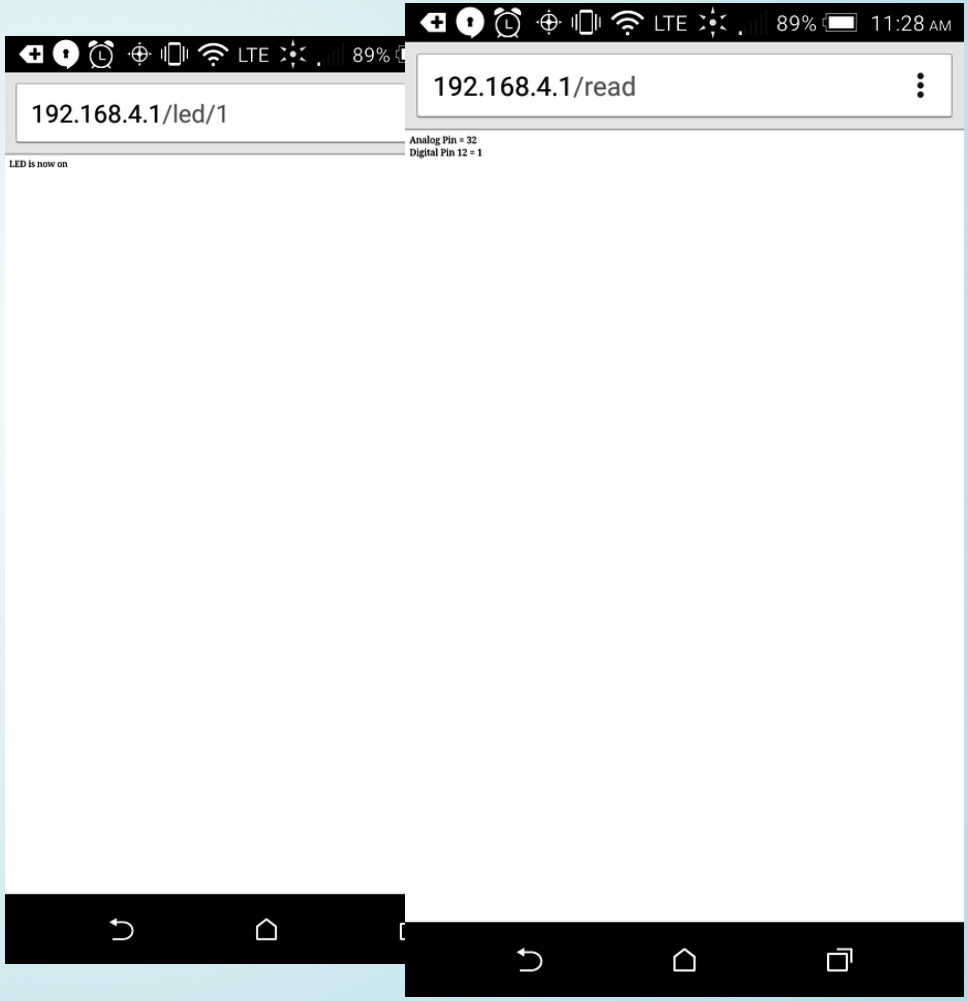
Sketch 1: Blink



- Blink_Hackaday.ino
- Test digital I/O
  - Button read
  - On board LED on/off
- Test analog read
- PWM output to external LED

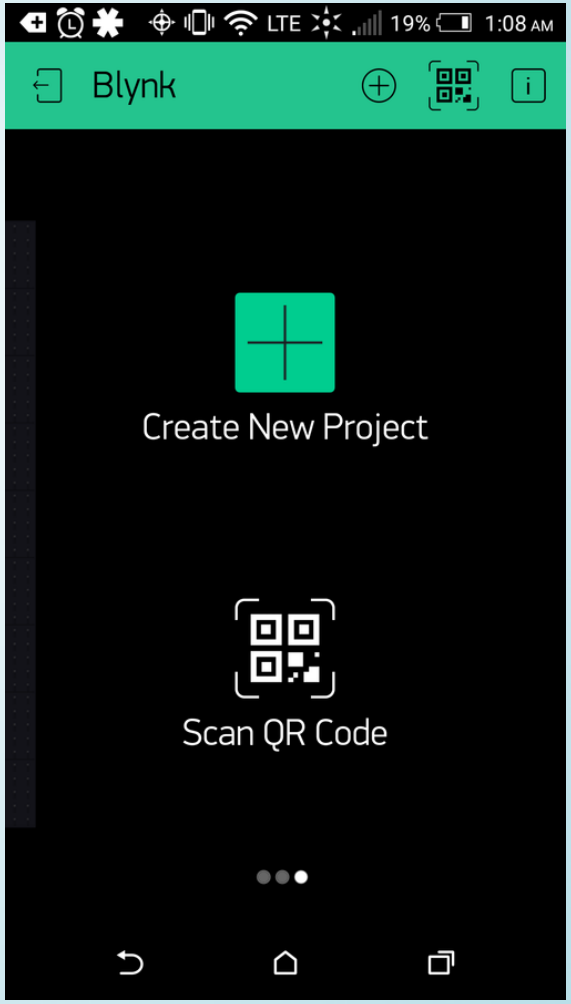
Sketch 2:
Thing as an Access Point

- Thing_AccessPoint.ino
- Set up basic web server
  - Serves three pages
  - LED 0 (/led/0)
  - LED 1 (/led/1)
  - Analog Read
- Create local wifi network
  - Connect your wifi-device to access the webserver
  - 192.168.4.1



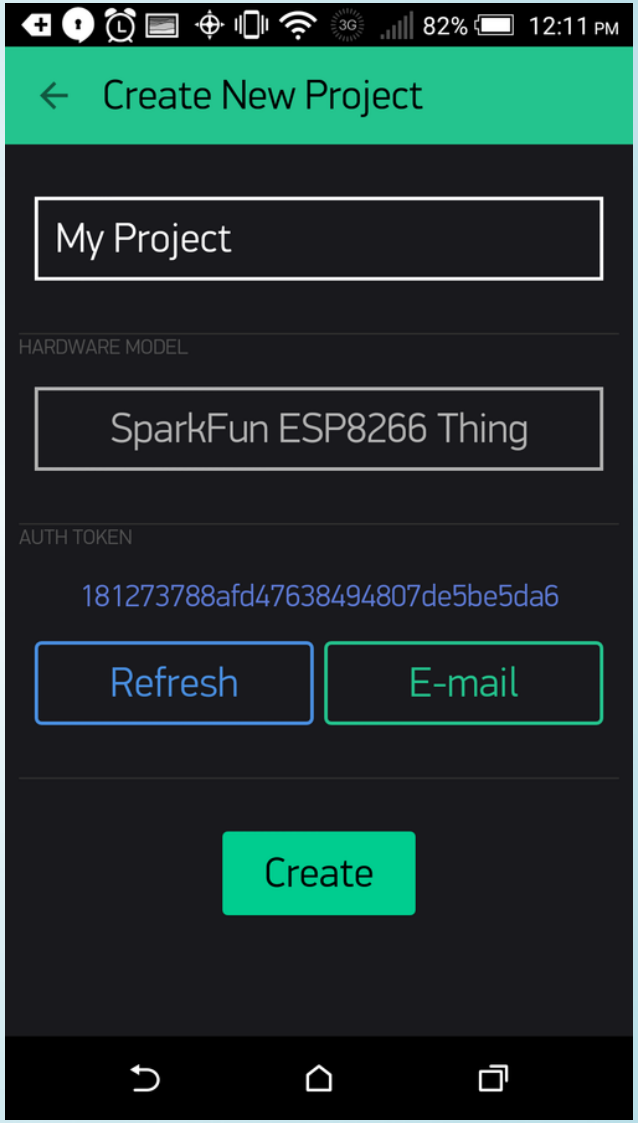
Control Things the Smart Way: Blynk

- Mobile app
  - Works on iOS & Android
- Blynk Library for Arduino
- Built-in compatibility with numerous boards:
  - Raspberry Pi
  - Intel Edison/Galileo
  - Photon
  - Arduino family

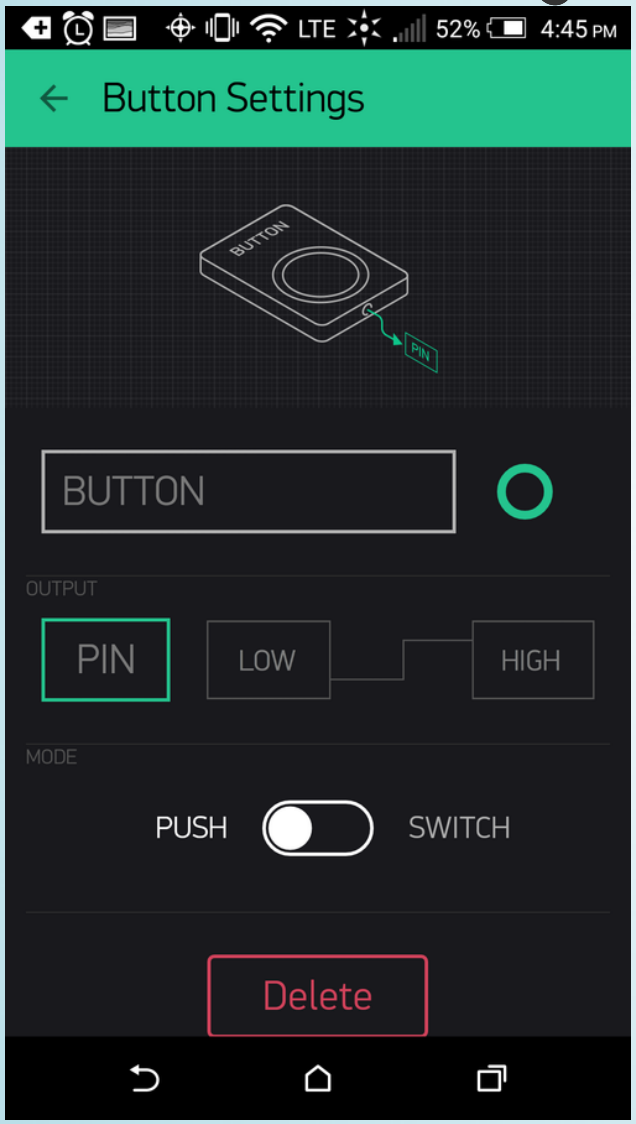


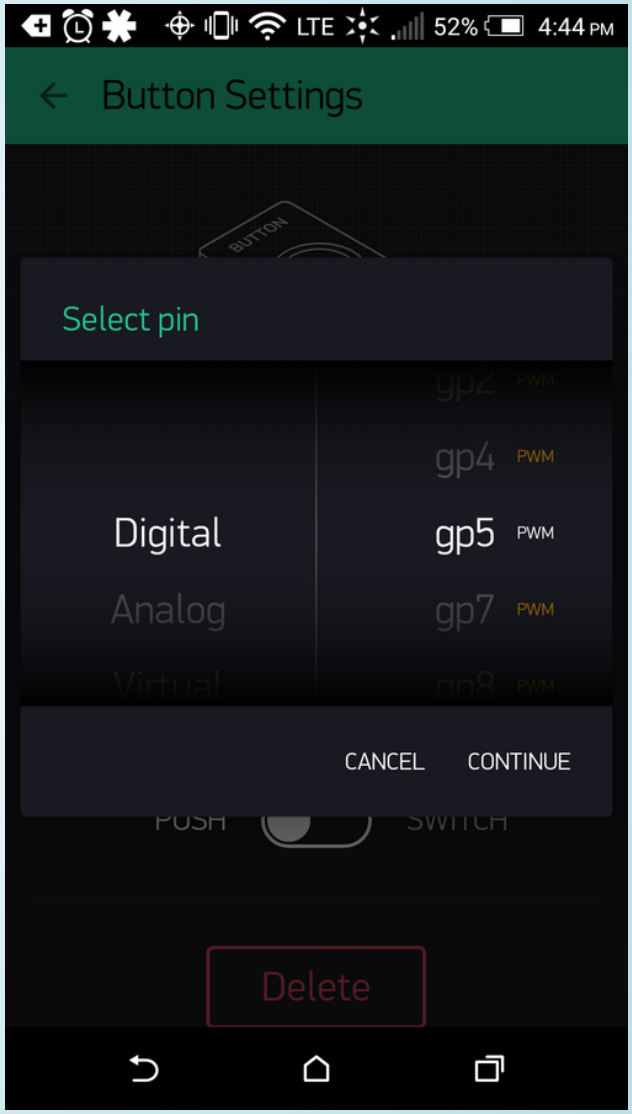
Sketch 3: Blynk Demo

- Blynk_Demo.ino
- Code on ESP8266 is minimal
  - Connect to WiFi
  - Begin Blynk sketch
- Everything else runs on smart device

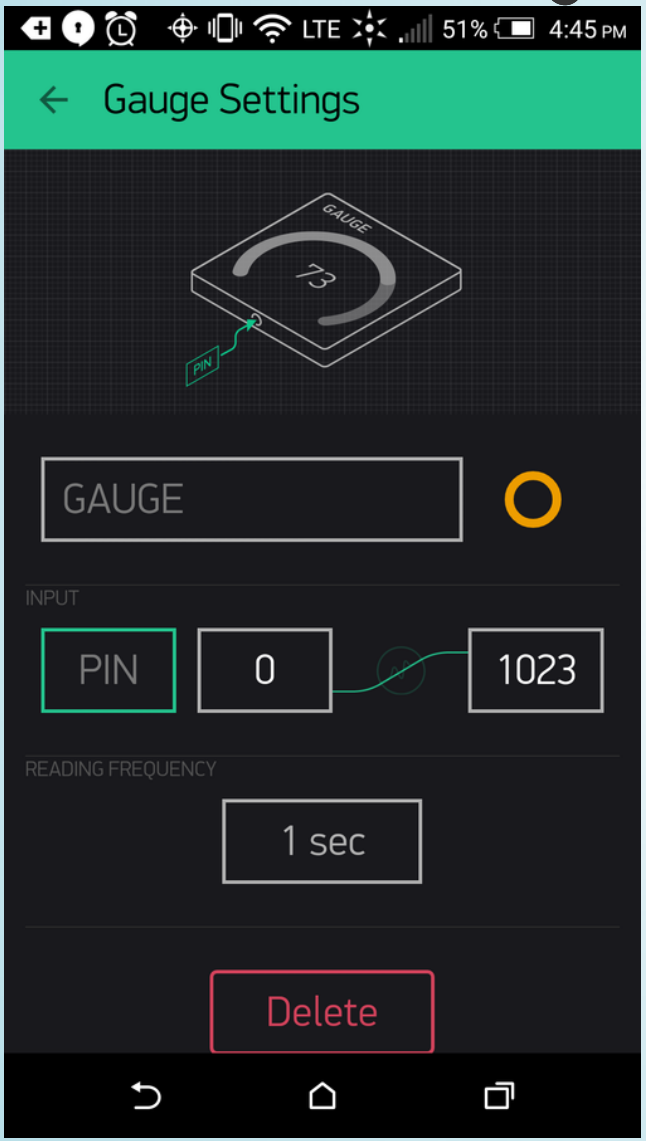


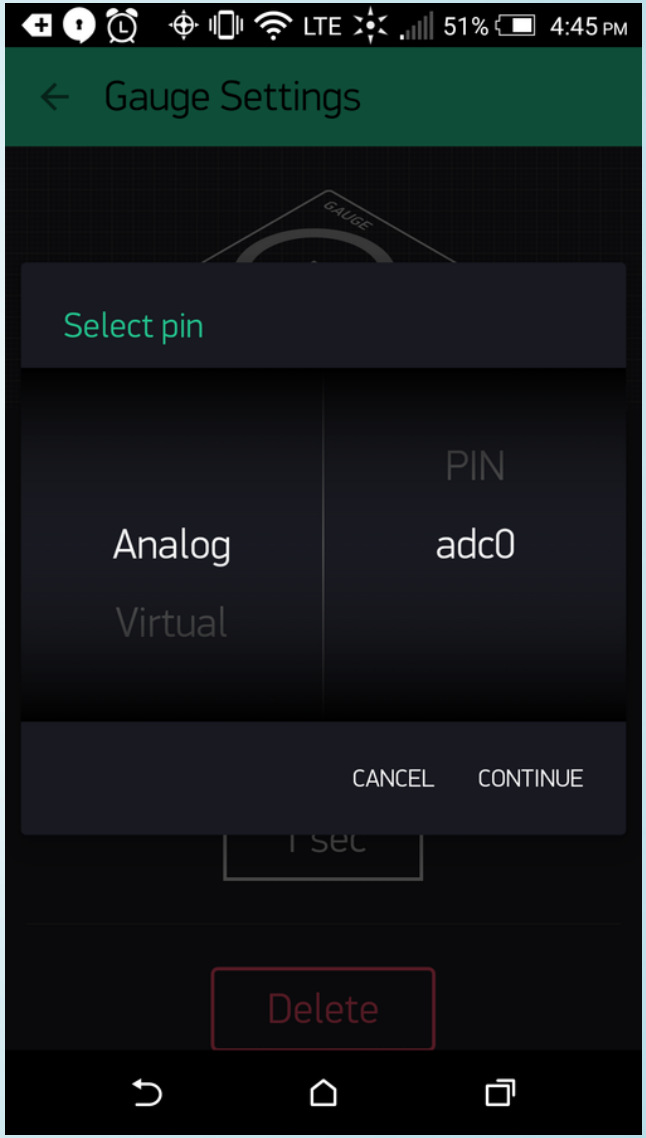
Blynk (cont.)


LTE 52% 4:45 PM
Button Settings
BUTTON
PIN
BUTTON
OUTPUT
PIN
LOW
HIGH
MODE
PUSH
SWITCH
Delete

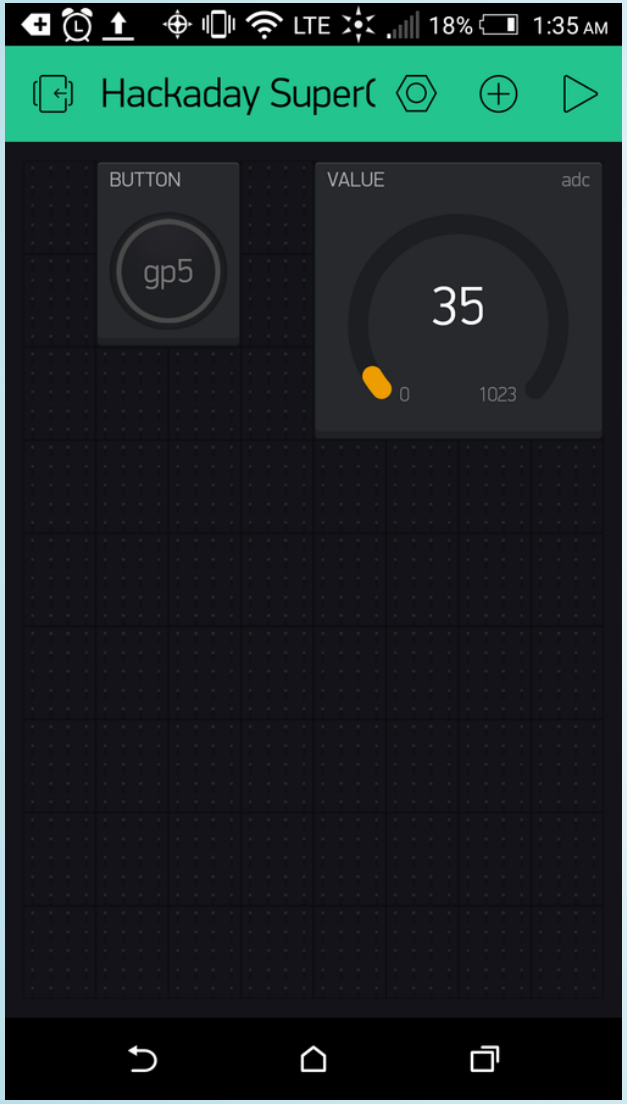

LTE 52% 4:44 PM
Button Settings
Select pin
Digital
Analog
Virtual
gp4 PWM
gp5 PWM
gp7 PWM
CANCEL
CONTINUE
Delete

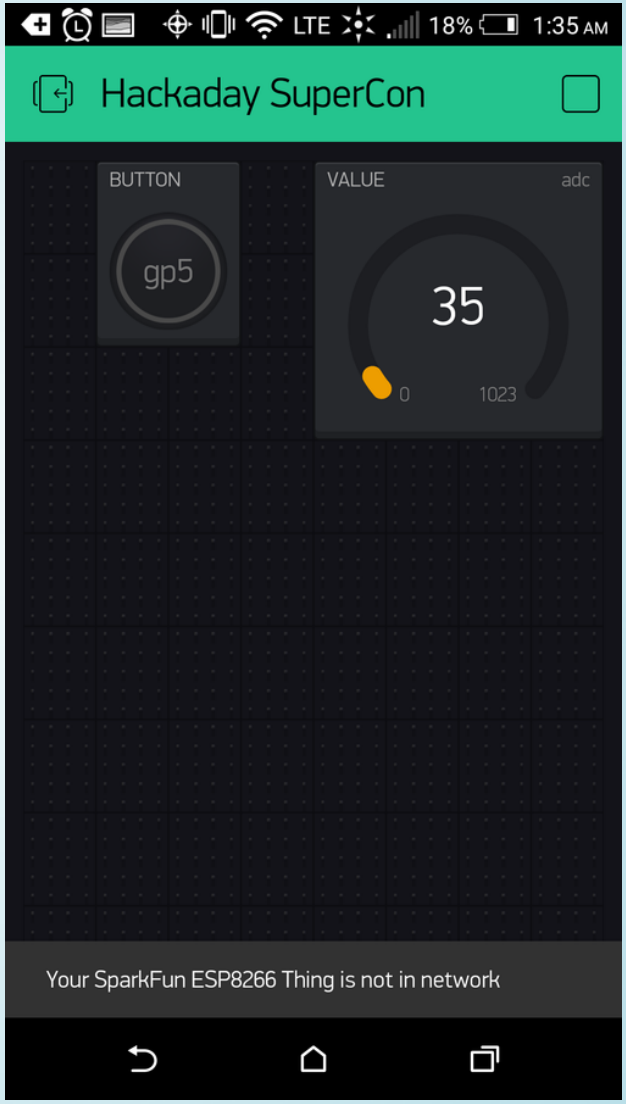
Blynk (cont.)


LTE 51% 4:45 PM
Gauge Settings
GAUGE
73
PIN
GAUGE
INPUT
PIN
0
1023
READING FREQUENCY
1 sec
Delete


LTE 51% 4:45 PM
Gauge Settings
Select pin
Analog
Virtual
PIN
adc0
CANCEL
CONTINUE
Delete

Blynk (cont.)


LTE 18% 1:35 AM
Hackaday Superc
BUTTON
gp5
VALUE
adc
35
0
1023


LTE 18% 1:35 AM
Hackaday SuperCon
BUTTON
gp5
VALUE
adc
35
0
1023
Your SparkFun ESP8266 Thing is not in network

Take your data to the Internet

Phant/Data.Sparkfun.Com

- Data.SparkFun is a data logging service
  - Anyone can post data anonymously
    - Uses public/private keys for logging
    - Streams are public however
  - 50mB data limit/stream
  - 100 log requests/15 minute interval
  - Allows HTTPS GET/POST requests

DATA.SPARKFUN.COM

Public Streams

Jim's ESP8266 Temp_Humidity #1	esp8266	Seattle , Washington , United States last push: in a few seconds
SunTech Drive	suntechdrive	Boulder , Colorado , United States last push: in a few seconds
Crowthorne Sensors	crowthorne, temp	Crowthorne , England , United Kingdom last push: in a few seconds
Water level	monitoring	Oakton , Virginia , United States last push: in a few seconds
Beer Temperature	beer, keg, temp	Sherwood , Oregon , United States last push: in a few seconds
Maint Mez		Salt Lake City , Utah , United States last push: in a few seconds
Watts	power	Melbourne , Victoria , Australia last push: in a few seconds
pkiSensor	humidity, lux, pressure, temperature	Omaha , Nebraska , United States last push: in a few seconds
WallE Weather 1		last push: in a few seconds

Examples of Individual Streams

Jim's ESP8266 Temp_Humidity #1 DHT-11 temperature and humidity data from an ESP8266 - Sensor #1

Manage | Export to Analog.io

JSON | CSV | MySQL | PostgreSQL | Atom

TAGS esp8266

64% (31.99 of 50 MB) remaining.

humidity	temperature	timestamp
37 .0000	66 .2000	2015-11-09T20:43:04.723Z
37 .0000	66 .2000	2015-11-09T20:42:42.828Z
37 .0000	66 .2000	2015-11-09T20:42:11.798Z
37 .0000	66 .2000	2015-11-09T20:41:45.210Z
37 .0000	66 .2000	2015-11-09T20:41:18.895Z

Tommy's Reef Online Datalogger 2 temperature sensors, 2 level switches give HIGH or LOW level-indication

Manage | Export to Analog.io

JSON | CSV | MySQL | PostgreSQL | Atom

TAGS aquarium | level | reef | temp

92% (45.76 of 50 MB) remaining.

level	temp_aqua	temp_room	timestamp
BADPV	24.63	23.38	2015-11-09T20:44:51.867Z
HIGH	24.63	23.38	2015-11-09T20:43:53.685Z
BADPV	24.63	23.38	2015-11-09T20:42:53.004Z
BADPV	24.63	23.38	2015-11-09T20:41:38.190Z
BADPV	24.63	23.38	2015-11-09T20:40:51.274Z
BADPV	24.63	23.38	2015-11-09T20:39:46.056Z

Phant

- Data.SparkFun Runs an instance of Phant
  - Phant.io
  - Modular node.js service
  - Can be configured/deployed on personal servers
  - Open-source!

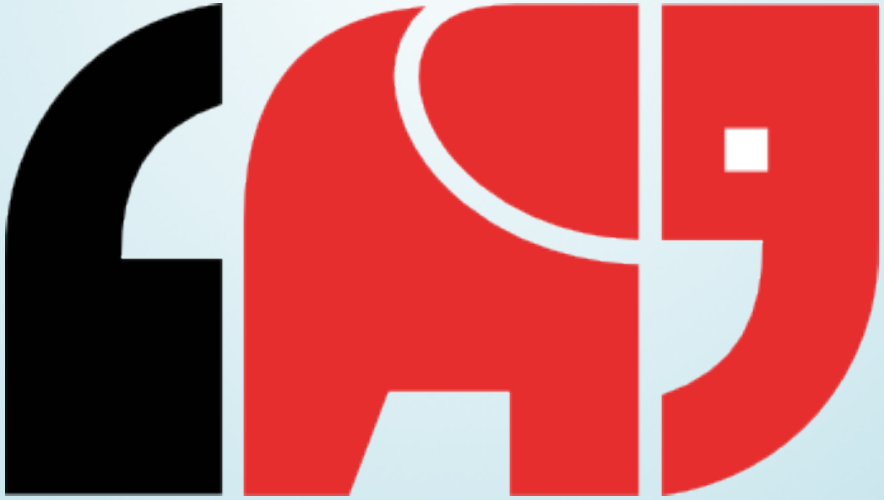


Image Source: SparkFun Electronics (CC-By-NC-SA 3.0)

Sketch 4: Post to Phant

- Phant_Post.ino
- Post the following data
  - Thing Mac ID
  - Analog reading
  - Button state
  - Time
- Post once every 30 seconds
  - Avoid hitting log request limit

Questions?

Thank You!

Resources

- ESP8266 Community Forum
- ESP8266 GitHub
- ESP8266 Thing Hook-up Guide
- Thing & IFTTT Demo Project
- Port Forwarding with the ESP8266
- Cloud Clouds Demo
- Lipo battery options