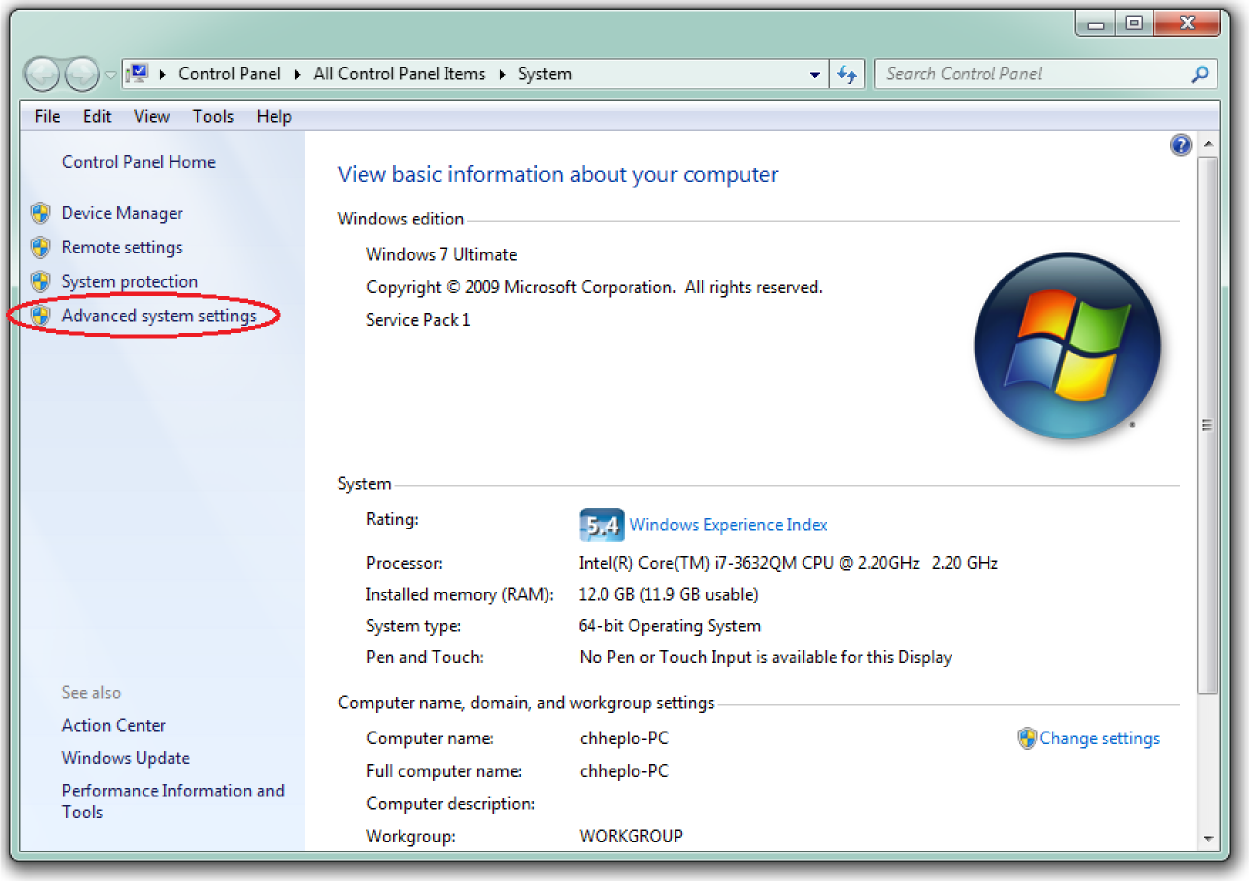
Chapter 1: Getting Started with Python and Arduino



View basic information about your computer

Windows edition

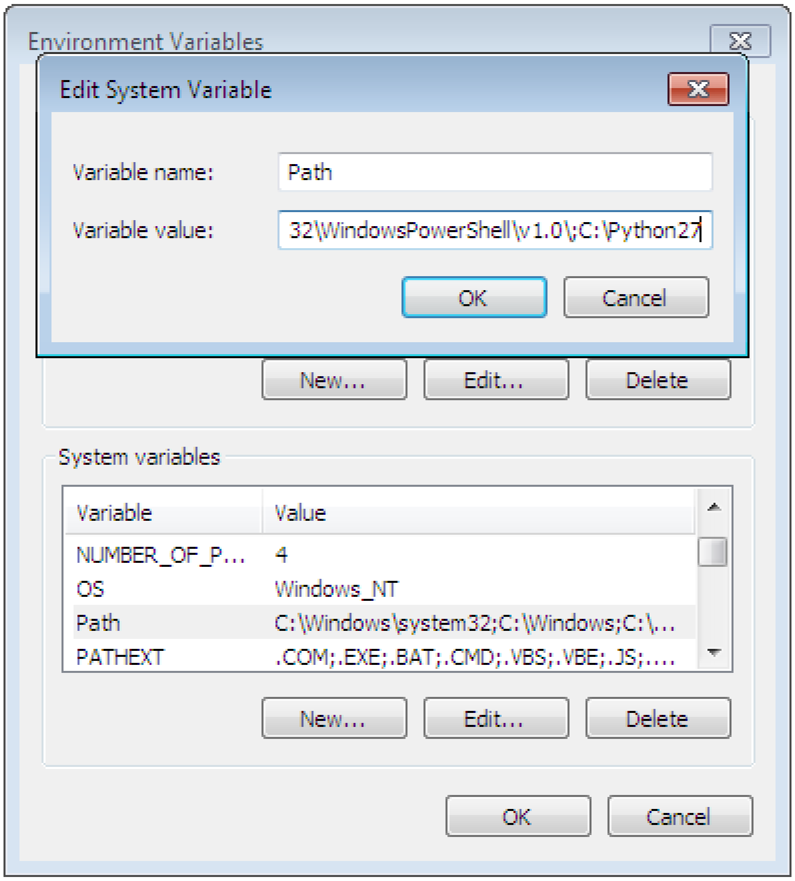
Windows 7 Ultimate
Copyright © 2009 Microsoft Corporation. All rights reserved.
Service Pack 1

System

Rating:	5.4 Windows Experience Index
Processor:	Intel(R) Core(TM) i7-3632QM CPU @ 2.20GHz 2.20 GHz
Installed memory (RAM):	12.0 GB (11.9 GB usable)
System type:	64-bit Operating System
Pen and Touch:	No Pen or Touch Input is available for this Display

Computer name, domain, and workgroup settings

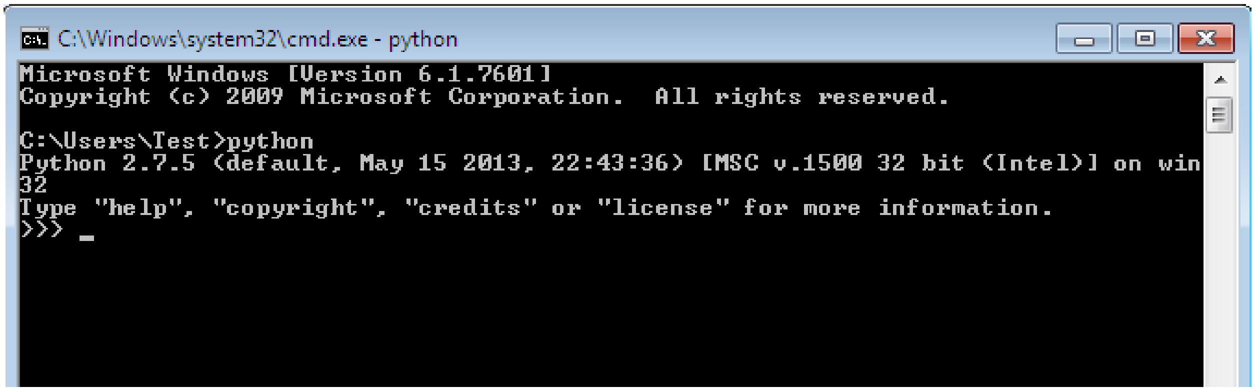
Computer name:	chheplo-PC
Full computer name:	chheplo-PC
Computer description:	
Workgroup:	WORKGROUP



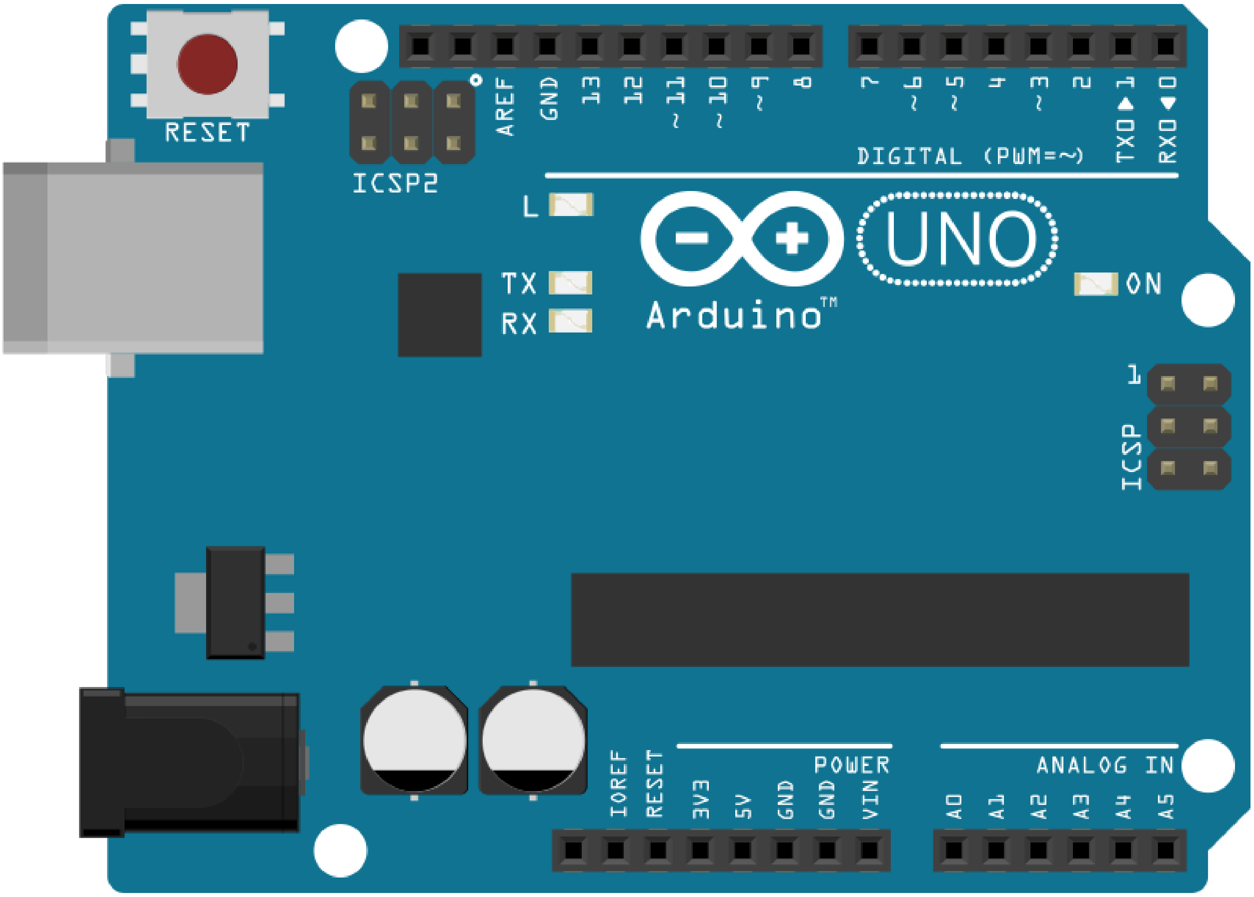
Variable name: Path

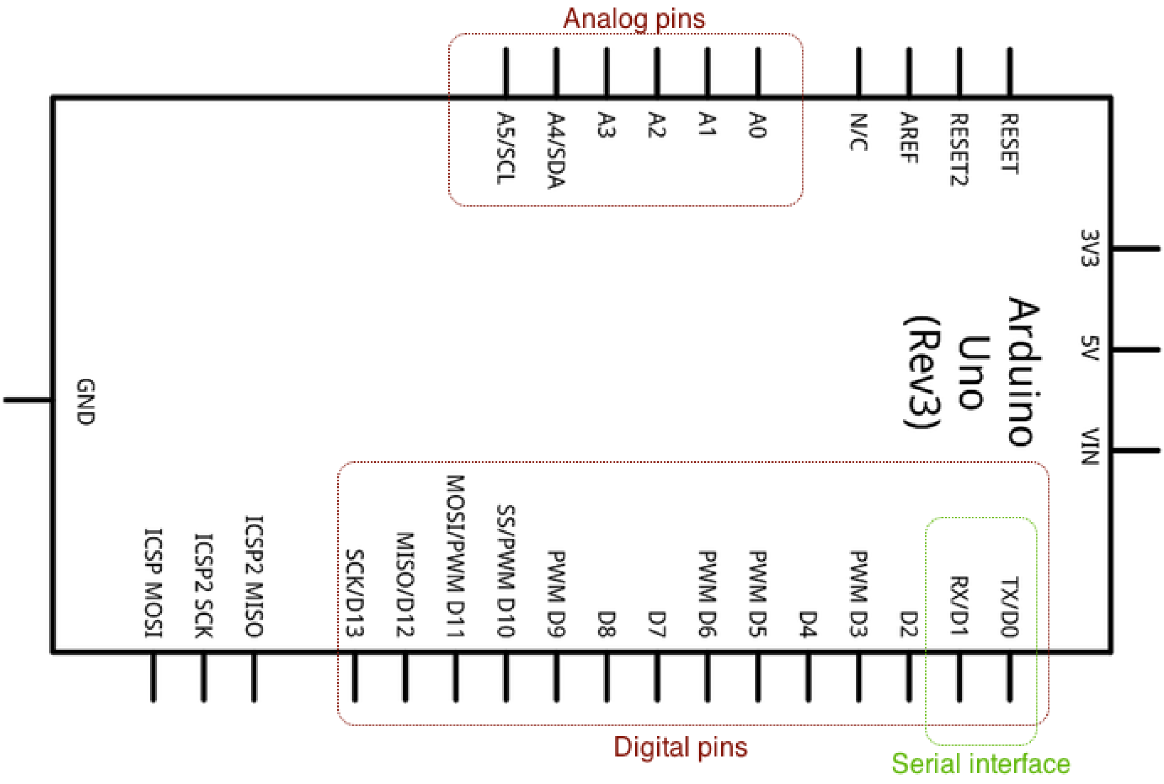
Variable value: 32\WindowsPowerShell\v1.0\;C:\Python27

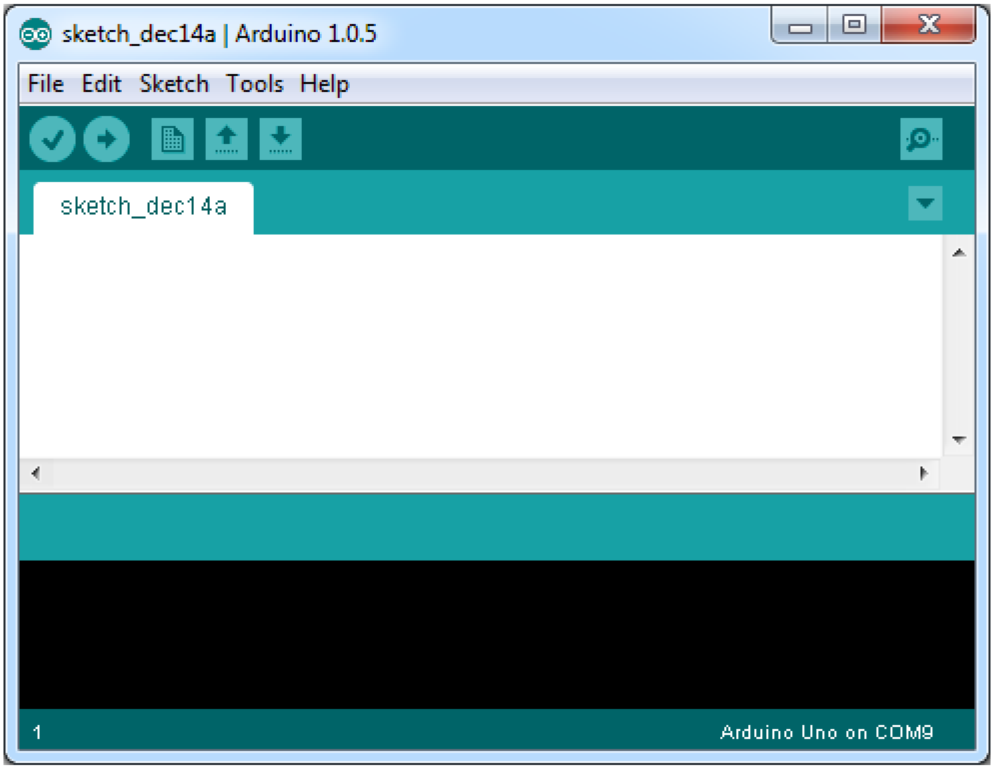
Variable	Value
NUMBER_OF_P...	4
OS	Windows_NT
Path	C:\Windows\system32;C:\Windows;C:\...
PATHEXT	.COM;.EXE;.BAT;.CMD;.VBS;.VBE;.JS;....

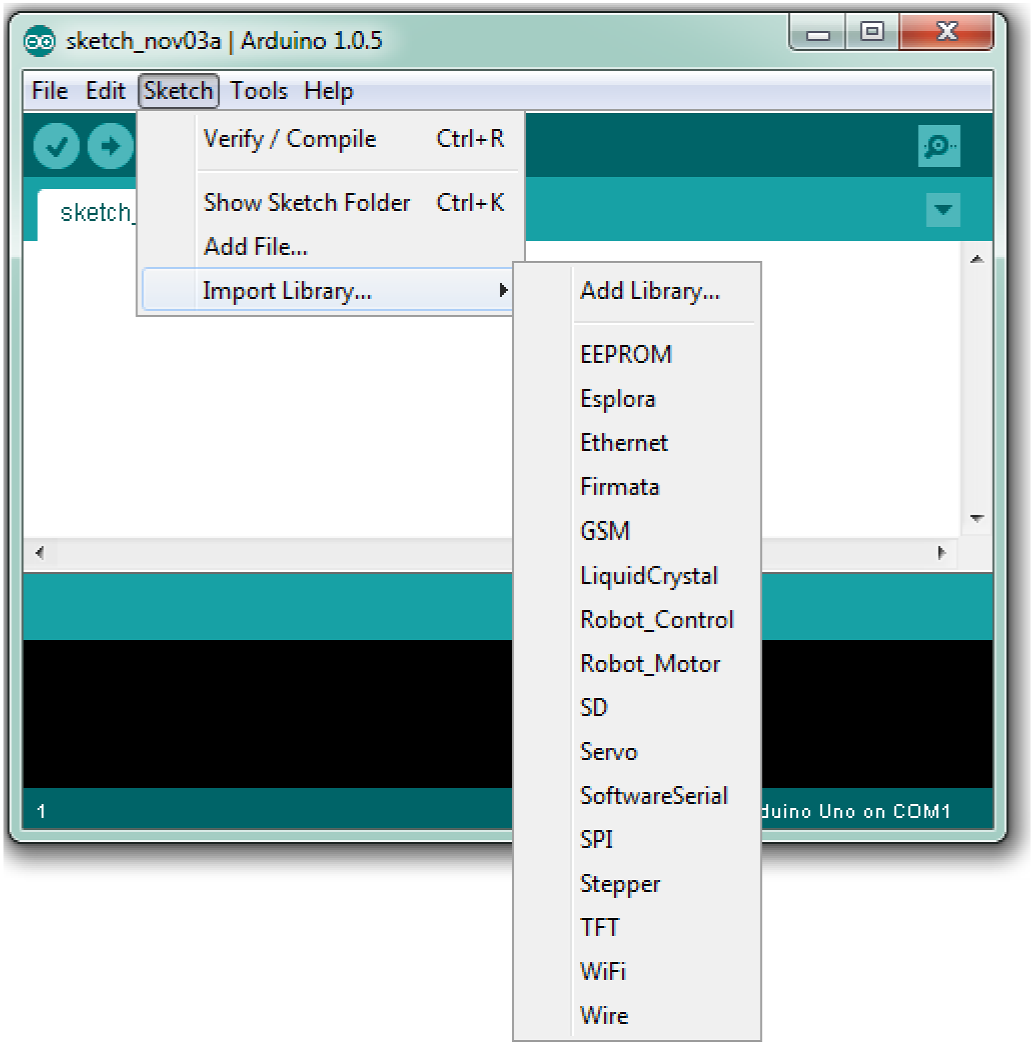


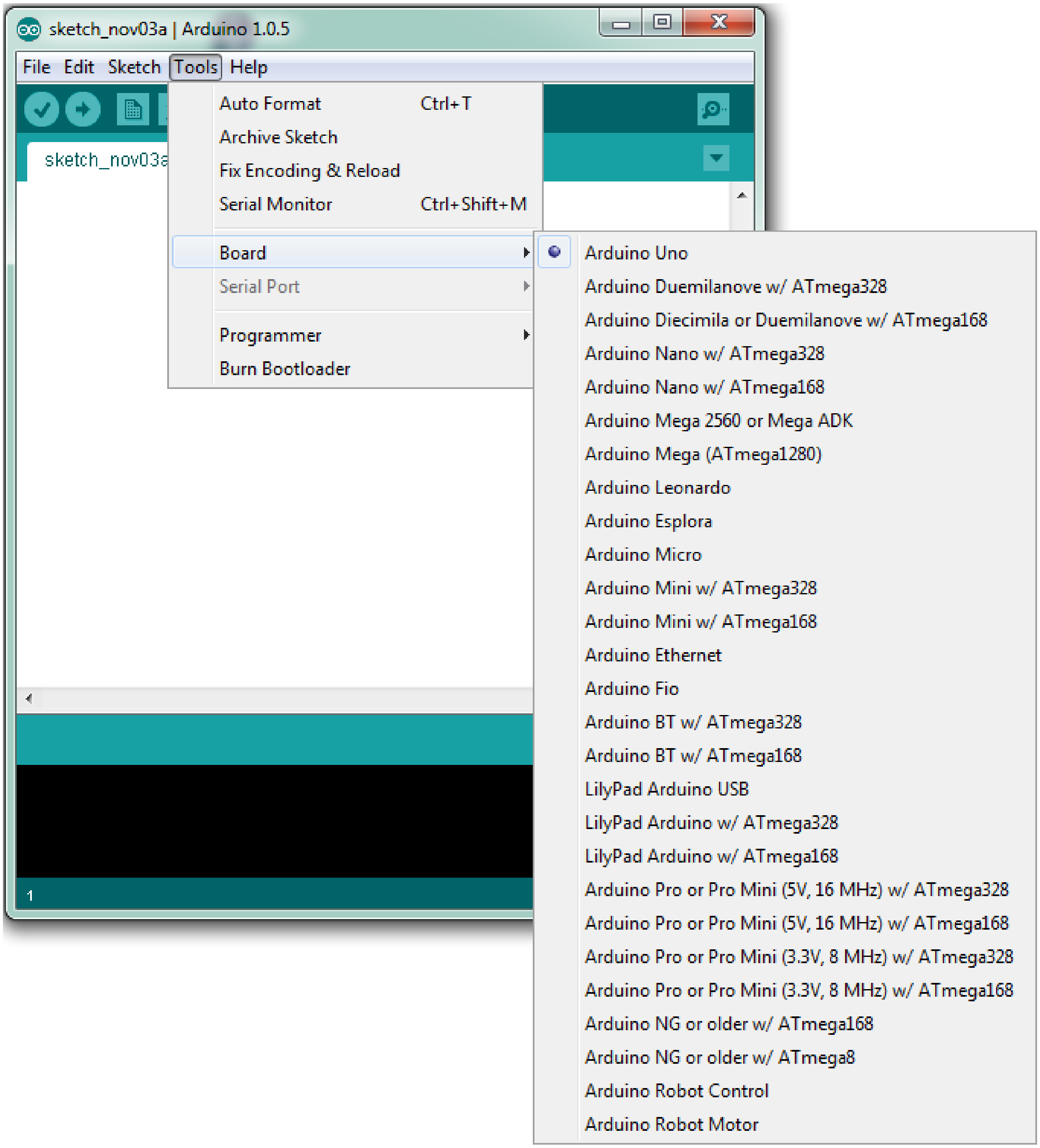
```
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation.  All rights reserved.

C:\Users\Test>python
Python 2.7.5 (default, May 15 2013, 22:43:36) [MSC v.1500 32 bit (Intel)] on win
32
Type "help", "copyright", "credits" or "license" for more information.
>>> _
```

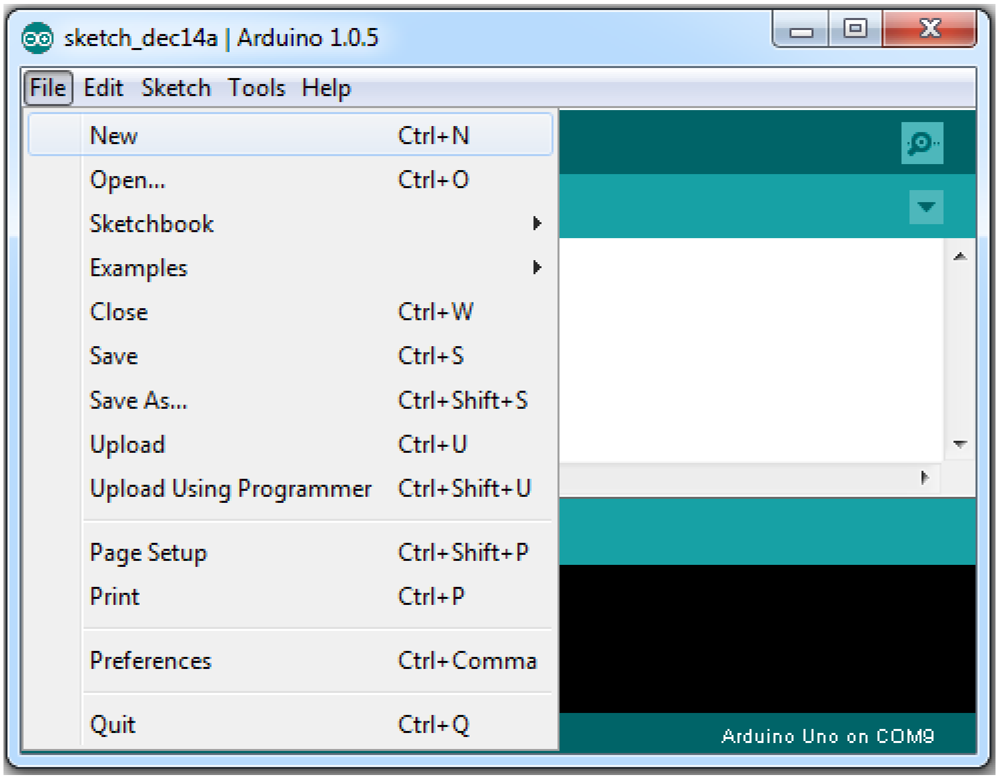

RESET
ICSP2
AREF
GND
13
12
~11
~10
~9
8
7
~6
~5
4
~3
2
TX▶1
RX◀0
DIGITAL (PWM=~)
L
TX
RX
UNO
Arduino™
ON
1
ICSP
IOREF
RESET
3V3
5V
GND
GND
VIN
POWER
ANALOG IN
A0
A1
A2
A3
A4
A5

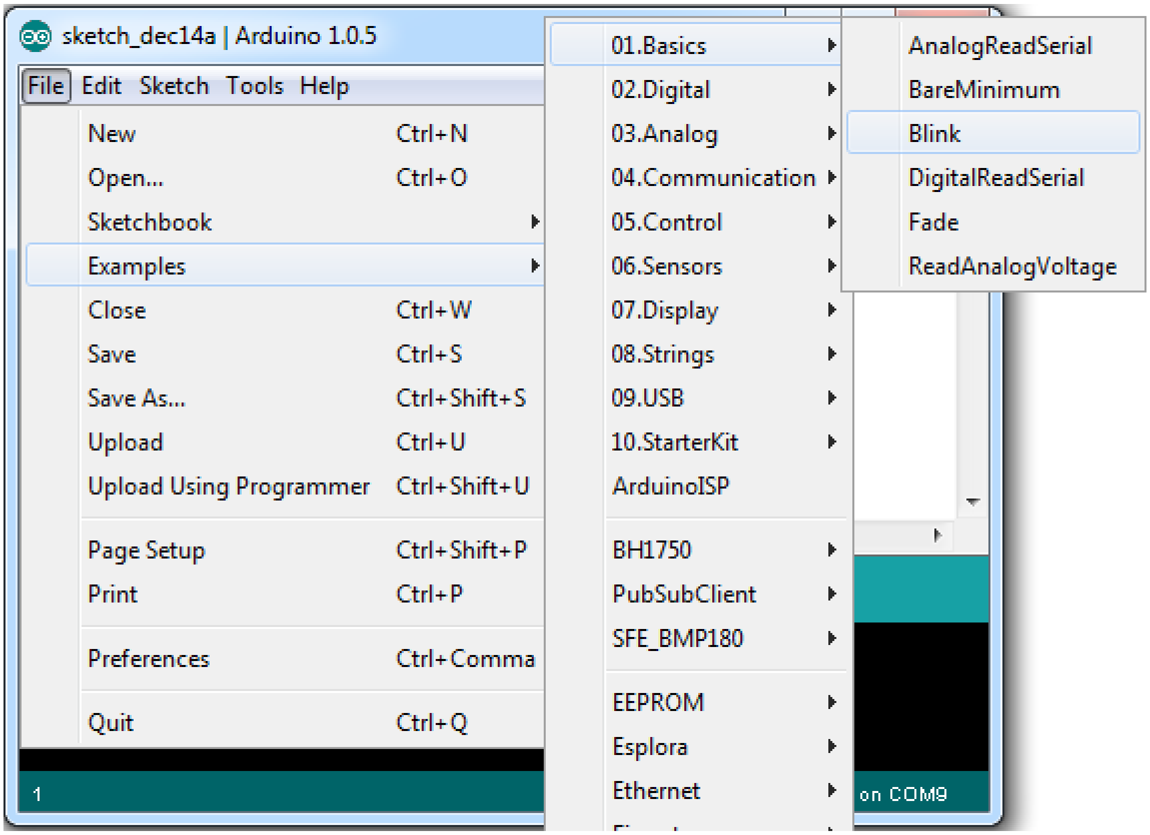

Analog pins
A5/SCL
A4/SDA
A3
A2
A1
A0
N/C
AREF
RESET2
RESET
3V3
5V
VIN
Arduino
Uno
(Rev3)
GND
ICSP MOSI
ICSP2 SCK
ICSP2 MISO
SCK/D13
MISO/D12
MOSI/PWM D11
SS/PWM D10
PWM D9
D8
D7
PWM D6
PWM D5
D4
PWM D3
D2
RX/D1
TX/D0
Digital pins
Serial interface


sketch_dec14a | Arduino 1.0.5
File
Edit
Sketch
Tools
Help
sketch_dec14a
1
Arduino Uno on COM9


sketch_nov03a | Arduino 1.0.5
File
Edit
Sketch
Tools
Help
Verify / Compile Ctrl+R
Show Sketch Folder Ctrl+K
Add File...
Import Library...
Add Library...
EEPROM
Esplora
Ethernet
Firmata
GSM
LiquidCrystal
Robot_Control
Robot_Motor
SD
Servo
SoftwareSerial
SPI
Stepper
TFT
WiFi
Wire
sketch_
1
duino Uno on COM1

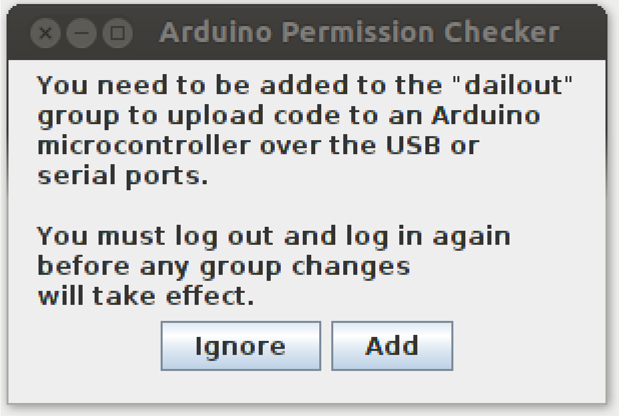

sketch_nov03a | Arduino 1.0.5
File
Edit
Sketch
Tools
Help
sketch_nov03a
Auto Format Ctrl+T
Archive Sketch
Fix Encoding & Reload
Serial Monitor Ctrl+Shift+M
Board
Serial Port
Programmer
Burn Bootloader
● Arduino Uno
Arduino Duemilanove w/ ATmega328
Arduino Diecimila or Duemilanove w/ ATmega168
Arduino Nano w/ ATmega328
Arduino Nano w/ ATmega168
Arduino Mega 2560 or Mega ADK
Arduino Mega (ATmega1280)
Arduino Leonardo
Arduino Esplora
Arduino Micro
Arduino Mini w/ ATmega328
Arduino Mini w/ ATmega168
Arduino Ethernet
Arduino Fio
Arduino BT w/ ATmega328
Arduino BT w/ ATmega168
LilyPad Arduino USB
LilyPad Arduino w/ ATmega328
LilyPad Arduino w/ ATmega168
Arduino Pro or Pro Mini (5V, 16 MHz) w/ ATmega328
Arduino Pro or Pro Mini (5V, 16 MHz) w/ ATmega168
Arduino Pro or Pro Mini (3.3V, 8 MHz) w/ ATmega328
Arduino Pro or Pro Mini (3.3V, 8 MHz) w/ ATmega168
Arduino NG or older w/ ATmega168
Arduino NG or older w/ ATmega8
Arduino Robot Control
Arduino Robot Motor
1


sketch_dec14a | Arduino 1.0.5
File Edit Sketch Tools Help
New Ctrl+N
Open... Ctrl+O
Sketchbook
Examples
Close Ctrl+W
Save Ctrl+S
Save As... Ctrl+Shift+S
Upload Ctrl+U
Upload Using Programmer Ctrl+Shift+U
Page Setup Ctrl+Shift+P
Print Ctrl+P
Preferences Ctrl+Comma
Quit Ctrl+Q
Arduino Uno on COM9


sketch_dec14a | Arduino 1.0.5
File Edit Sketch Tools Help
New Ctrl+N
Open... Ctrl+O
Sketchbook
Examples
Close Ctrl+W
Save Ctrl+S
Save As... Ctrl+Shift+S
Upload Ctrl+U
Upload Using Programmer Ctrl+Shift+U
Page Setup Ctrl+Shift+P
Print Ctrl+P
Preferences Ctrl+Comma
Quit Ctrl+Q
01.Basics
02.Digital
03.Analog
04.Communication
05.Control
06.Sensors
07.Display
08.Strings
09.USB
10.StarterKit
ArduinoISP
BH1750
PubSubClient
SFE_BMP180
EEPROM
Esplora
Ethernet
AnalogReadSerial
BareMinimum
Blink
DigitalReadSerial
Fade
ReadAnalogVoltage
1
on COM9

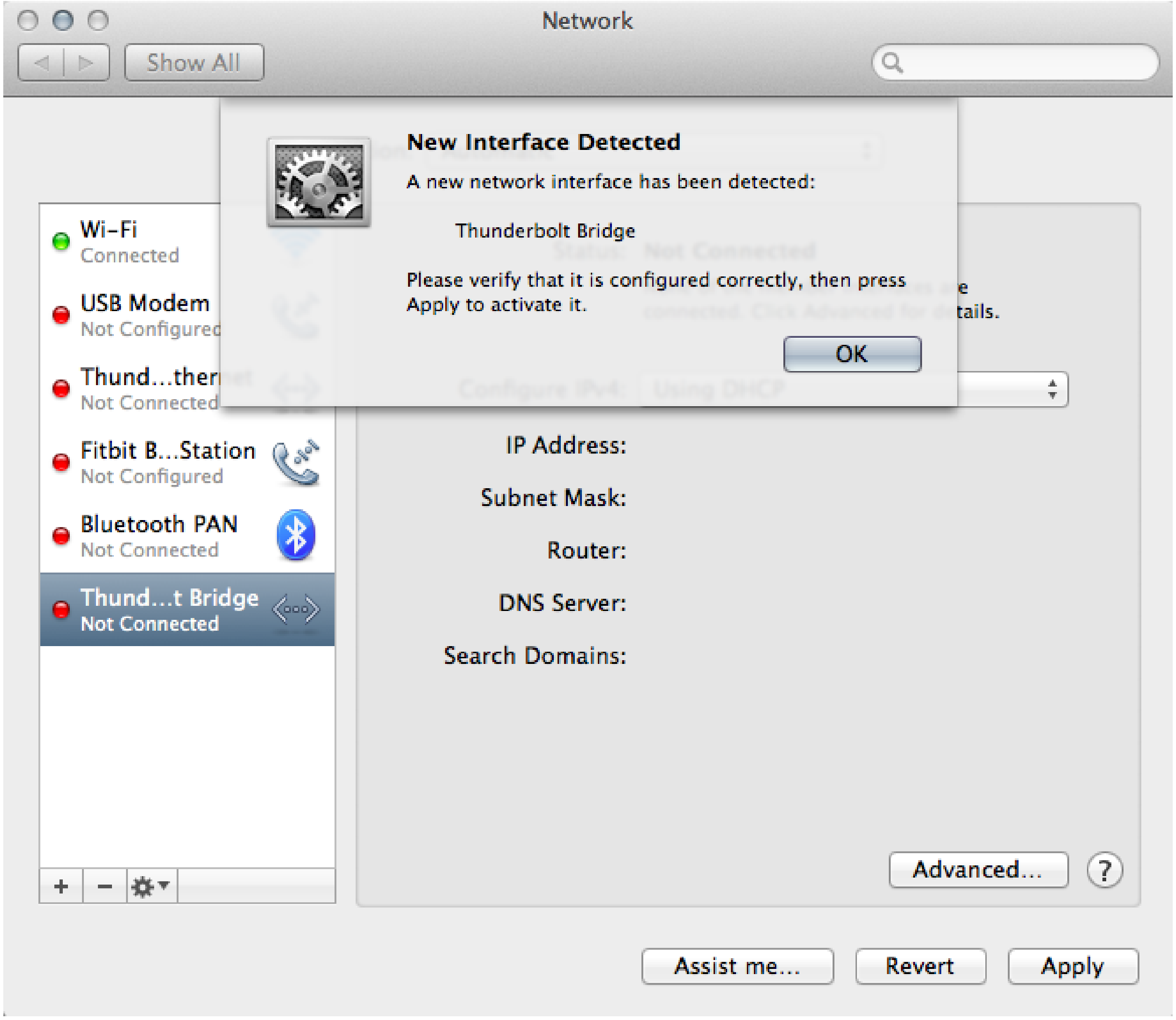
Chapter 2: Working with the Firmata Protocol and the pySerial Library

Image courtesy: Sparkfun Inc.



You need to be added to the "dailout" group to upload code to an Arduino microcontroller over the USB or serial ports.

You must log out and log in again before any group changes will take effect.

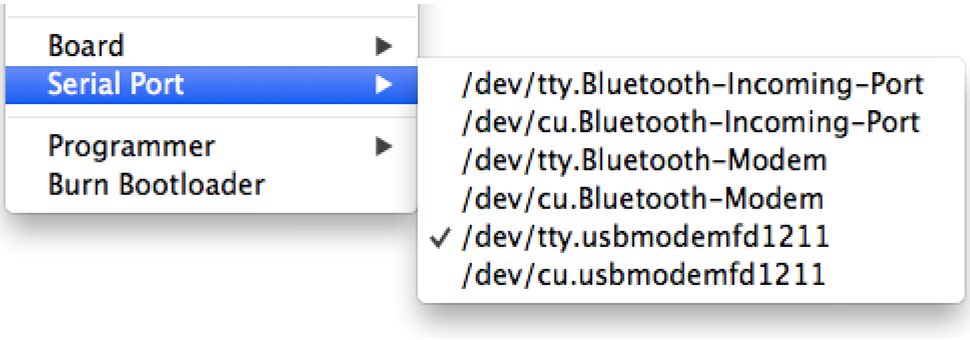


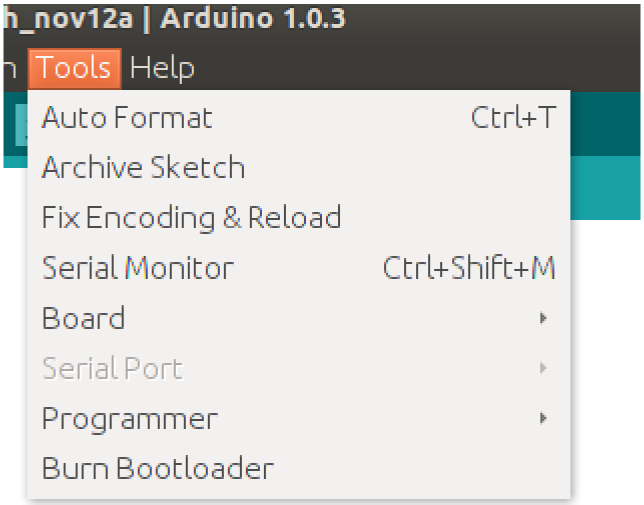
New Interface Detected

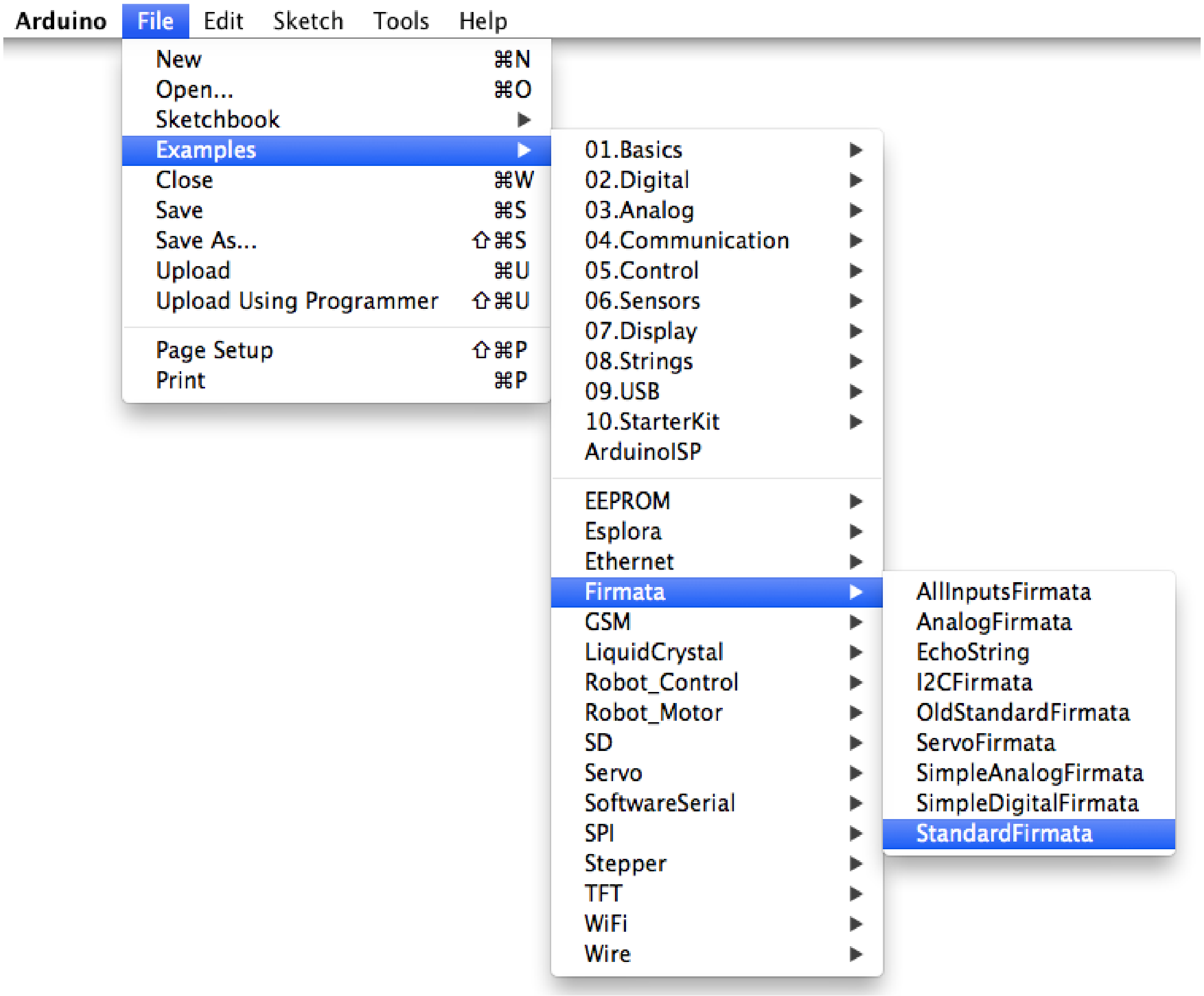
A new network interface has been detected:

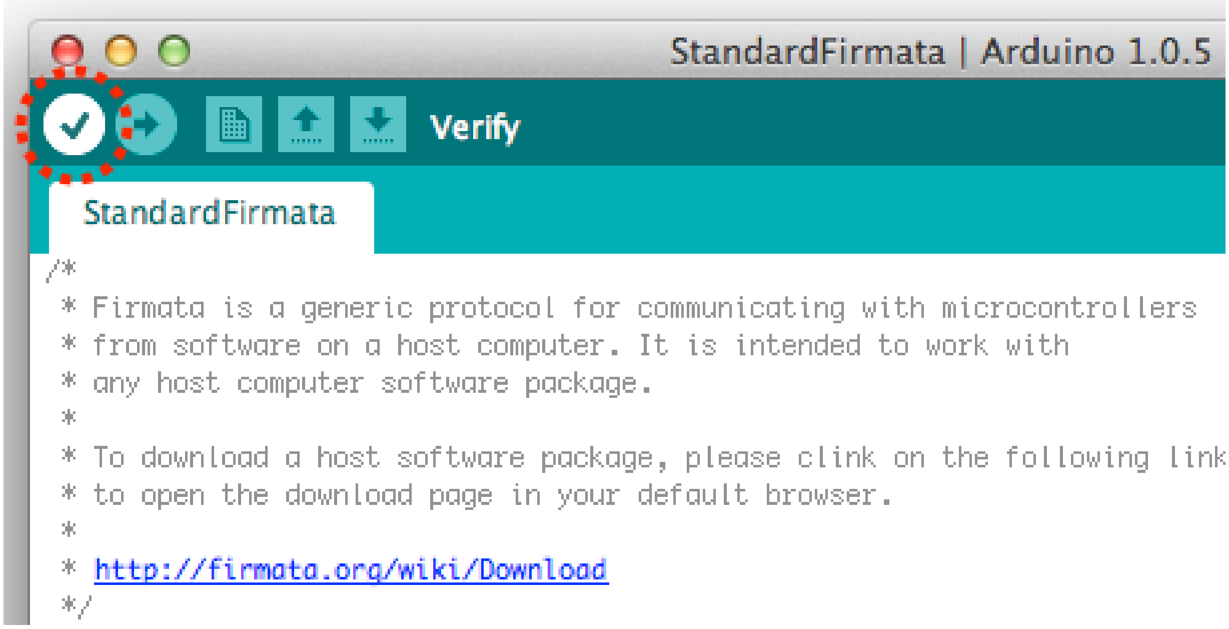
Thunderbolt Bridge

Please verify that it is configured correctly, then press Apply to activate it.

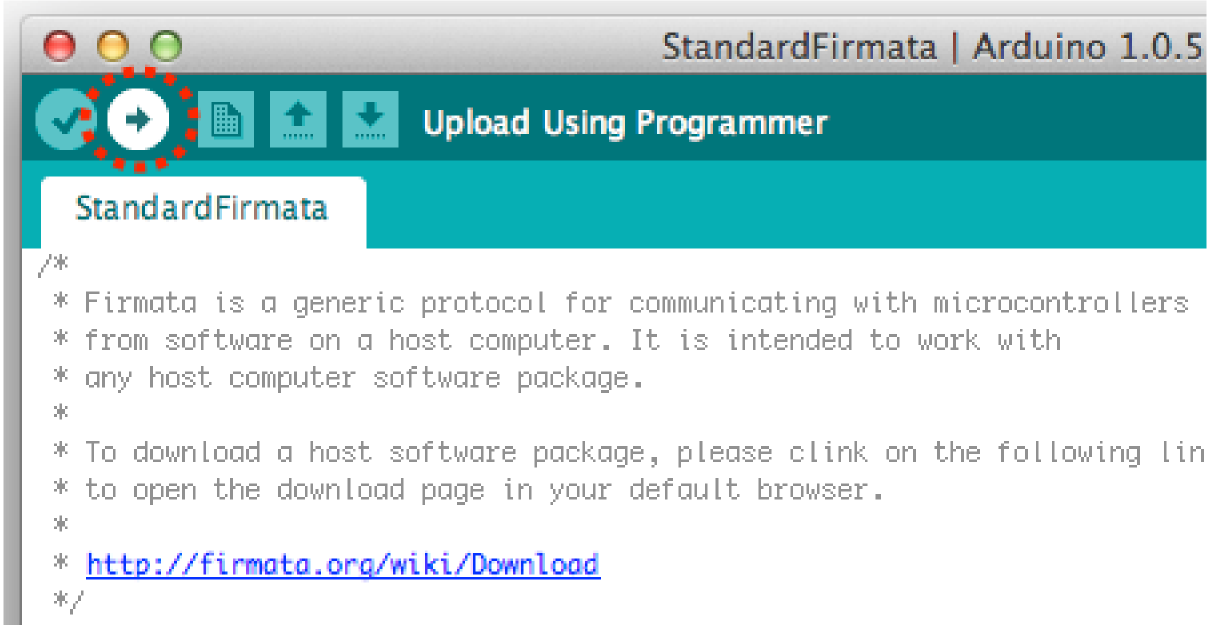

Board ▶
Serial Port ▶
Programmer ▶
Burn Bootloader
/dev/tty.Bluetooth-Incoming-Port
/dev/cu.Bluetooth-Incoming-Port
/dev/tty.Bluetooth-Modem
/dev/cu.Bluetooth-Modem
✓ /dev/tty.usbmodemfd1211
/dev/cu.usbmodemfd1211


h_nov12a | Arduino 1.0.3
h Tools Help
Auto Format Ctrl+T
Archive Sketch
Fix Encoding & Reload
Serial Monitor Ctrl+Shift+M
Board
Serial Port
Programmer
Burn Bootloader

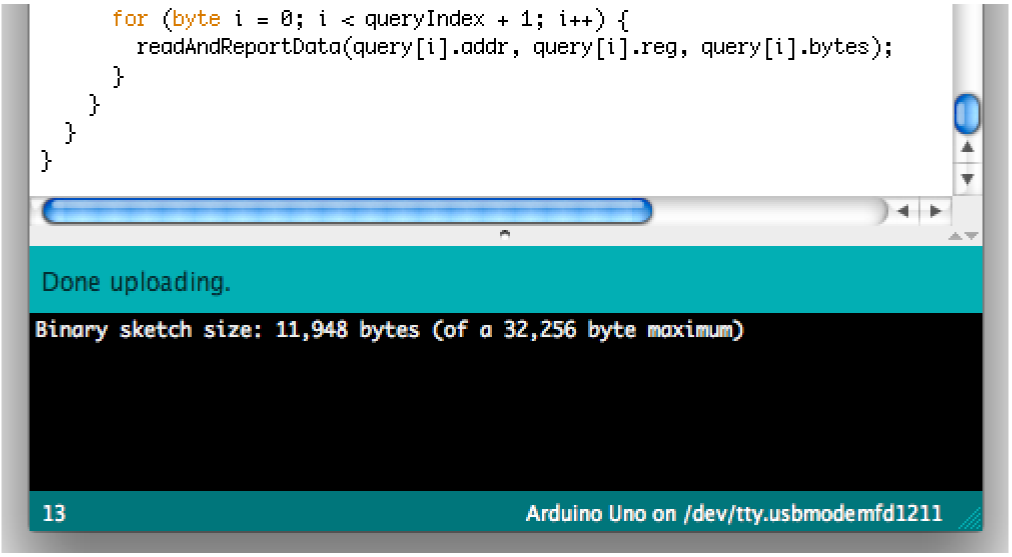




```
/*
 * Firmata is a generic protocol for communicating with microcontrollers
 * from software on a host computer. It is intended to work with
 * any host computer software package.
 *
 * To download a host software package, please clink on the following link
 * to open the download page in your default browser.
 *
 * http://firmata.org/wiki/Download
 */
```



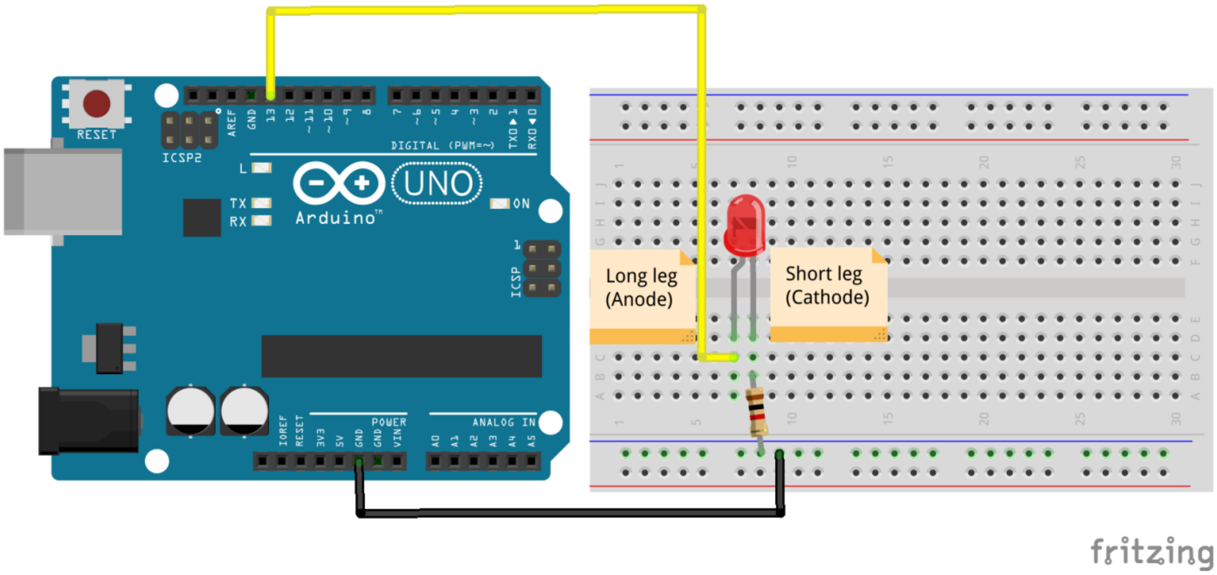
```
/*
 * Firmata is a generic protocol for communicating with microcontrollers
 * from software on a host computer. It is intended to work with
 * any host computer software package.
 *
 * To download a host software package, please clink on the following lin
 * to open the download page in your default browser.
 *
 * http://firmata.org/wiki/Download
 */
```

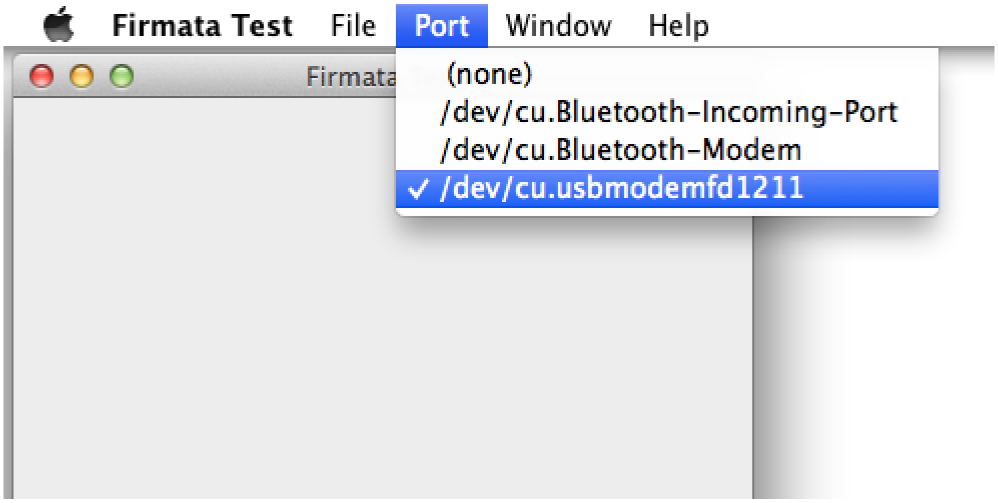


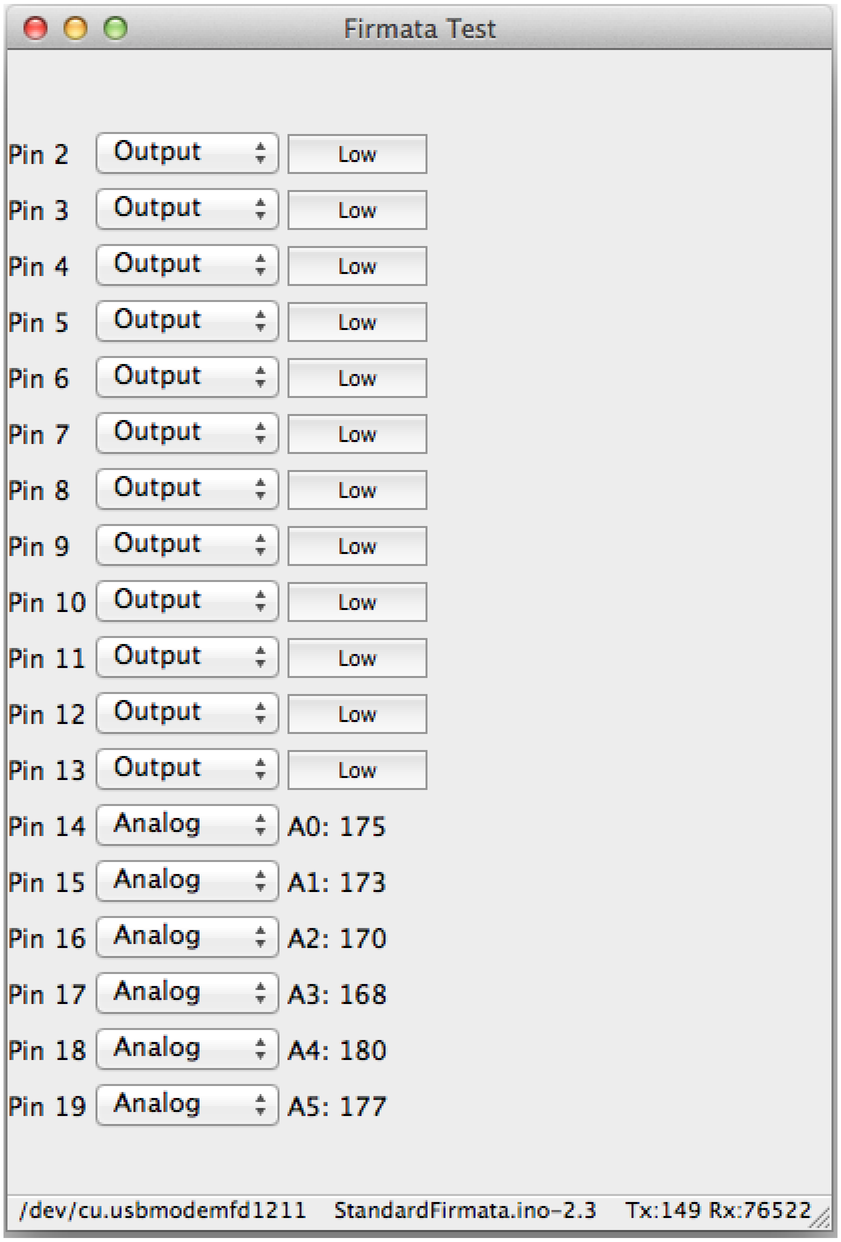
```
      for (byte i = 0; i < queryIndex + 1; i++) {
        readAndReportData(query[i].addr, query[i].reg, query[i].bytes);
      }
    }
  }
}
```

Done uploading.

```
Binary sketch size: 11,948 bytes (of a 32,256 byte maximum)
```


Long leg
(Anode)
Short leg
(Cathode)
RESET
ICSP2
DIGITAL (PWM=~)
UNO
Arduino
TX
RX
ON
ICSP
POWER
ANALOG IN
fritzing


Firmata Test
File
Port
Window
Help
Firmata
(none)
/dev/cu.Bluetooth-Incoming-Port
/dev/cu.Bluetooth-Modem
✓ /dev/cu.usbmodemfd1211



Pin 2 Output Low

Pin 3 Output Low

Pin 4 Output Low

Pin 5 Output Low

Pin 6 Output Low

Pin 7 Output Low

Pin 8 Output Low

Pin 9 Output Low

Pin 10 Output Low

Pin 11 Output Low

Pin 12 Output Low

Pin 13 Output Low

Pin 14 Analog A0: 175

Pin 15 Analog A1: 173

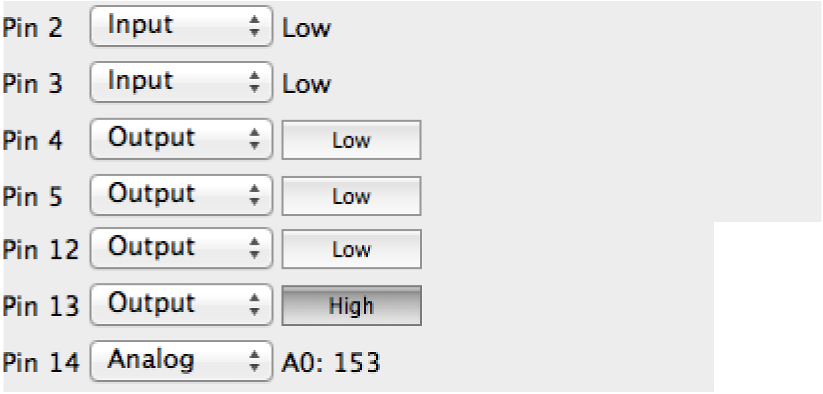
Pin 16 Analog A2: 170

Pin 17 Analog A3: 168

Pin 18 Analog A4: 180

Pin 19 Analog A5: 177

/dev/cu.usbmodemfd1211 StandardFirmata.ino-2.3 Tx:149 Rx:76522



Pin 2 Input Low

Pin 3 Input Low

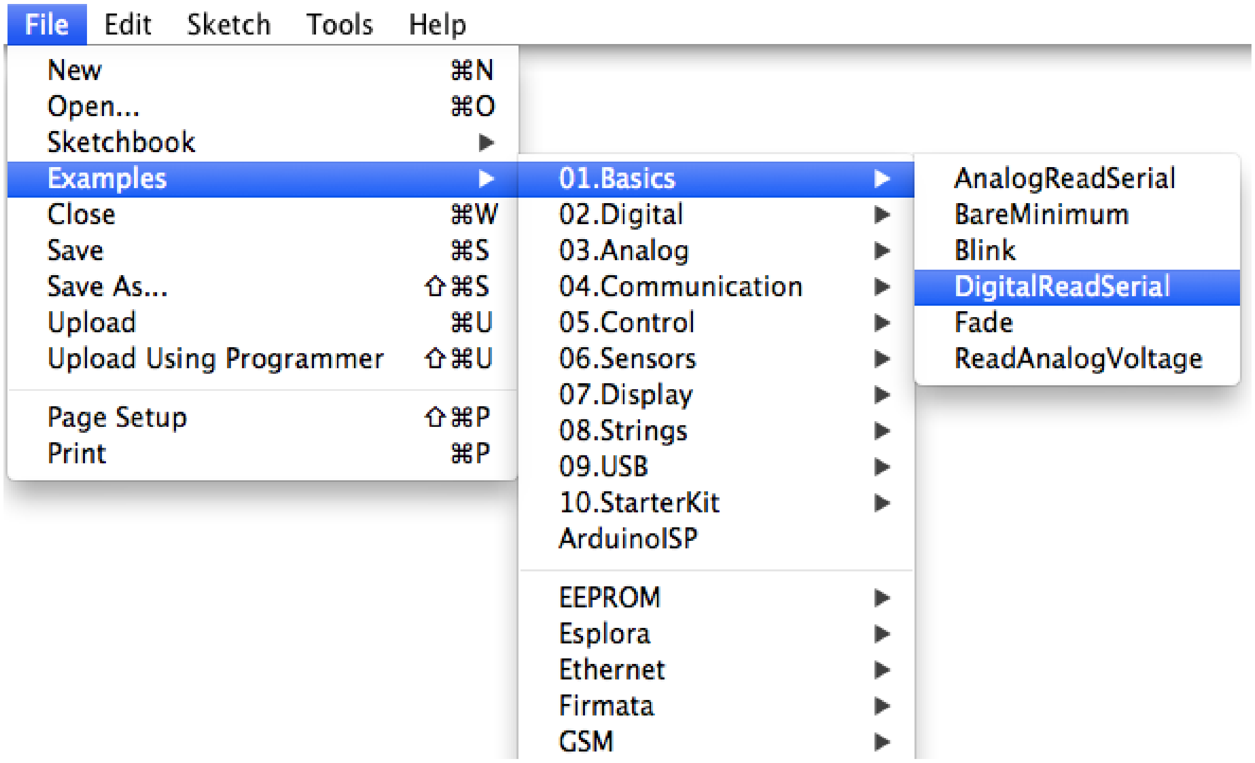
Pin 4 Output Low

Pin 5 Output Low

Pin 12 Output Low

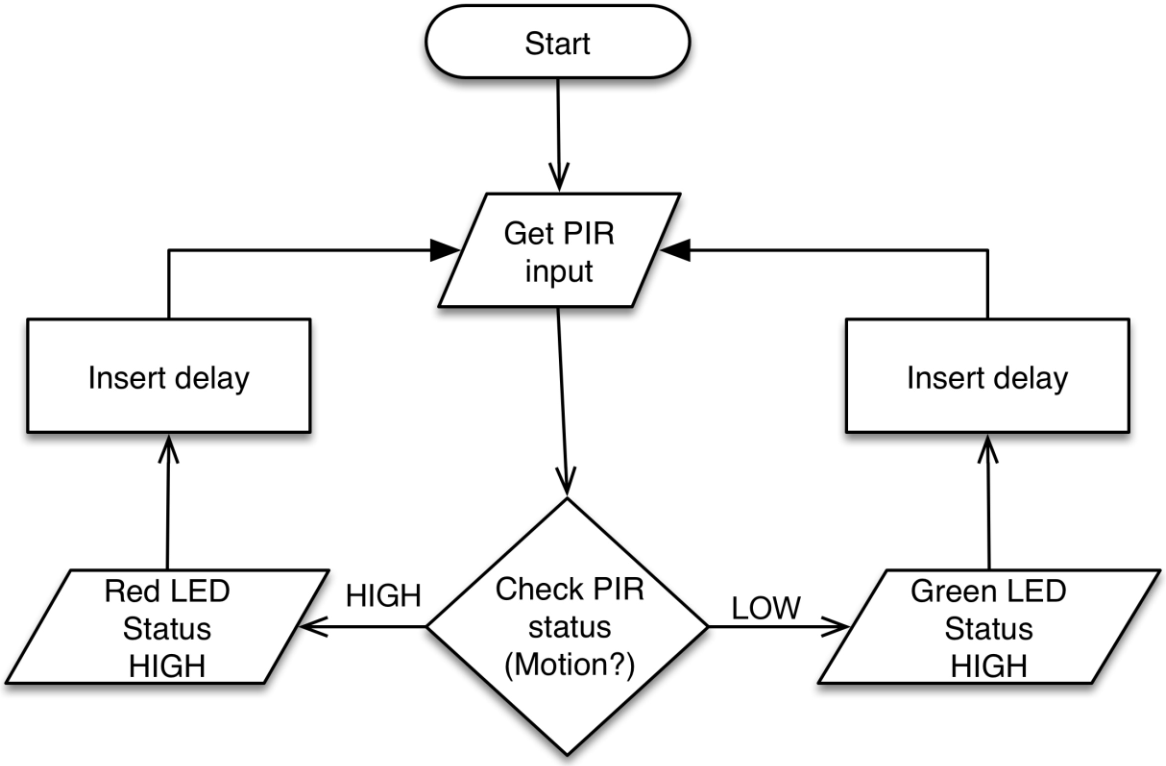
Pin 13 Output High

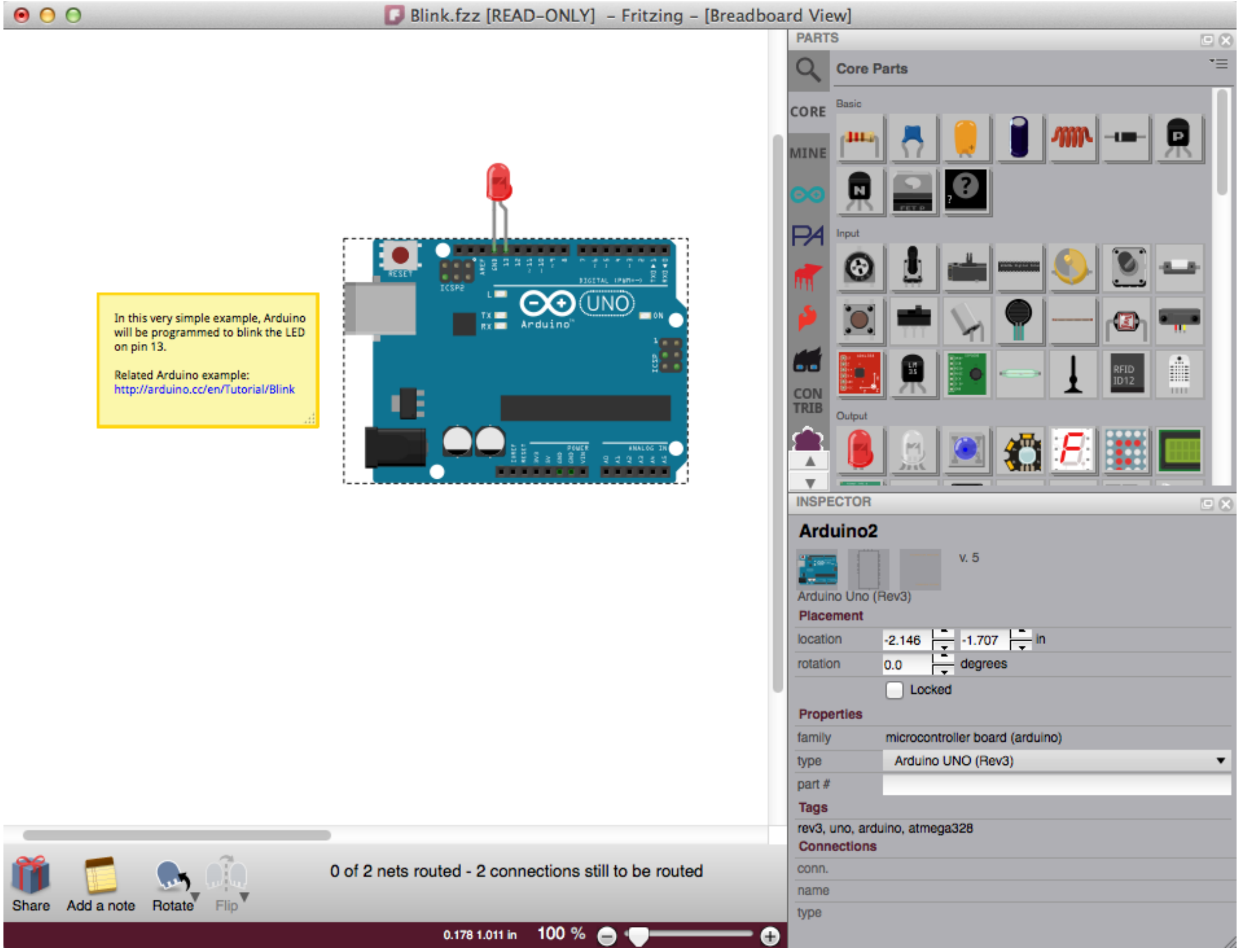
Pin 14 Analog A0: 153



Chapter 3: The First Project – Motion-triggered LEDs

Image courtesy: Sparkfun Inc.


Start
Get PIR input
Insert delay
Insert delay
Red LED Status HIGH
HIGH
Check PIR status (Motion?)
LOW
Green LED Status HIGH



Blink.fzz [READ-ONLY] – Fritzing – [Breadboard View]

In this very simple example, Arduino will be programmed to blink the LED on pin 13.

Related Arduino example:
http://arduino.cc/en/Tutorial/Blink

0 of 2 nets routed - 2 connections still to be routed

0.178 1.011 in 100 %

Arduino2

v. 5

Arduino Uno (Rev3)

Placement

location -2.146 -1.707 in

rotation 0.0 degrees

□ Locked

Properties

family microcontroller board (arduino)

type Arduino UNO (Rev3)

part #

Tags

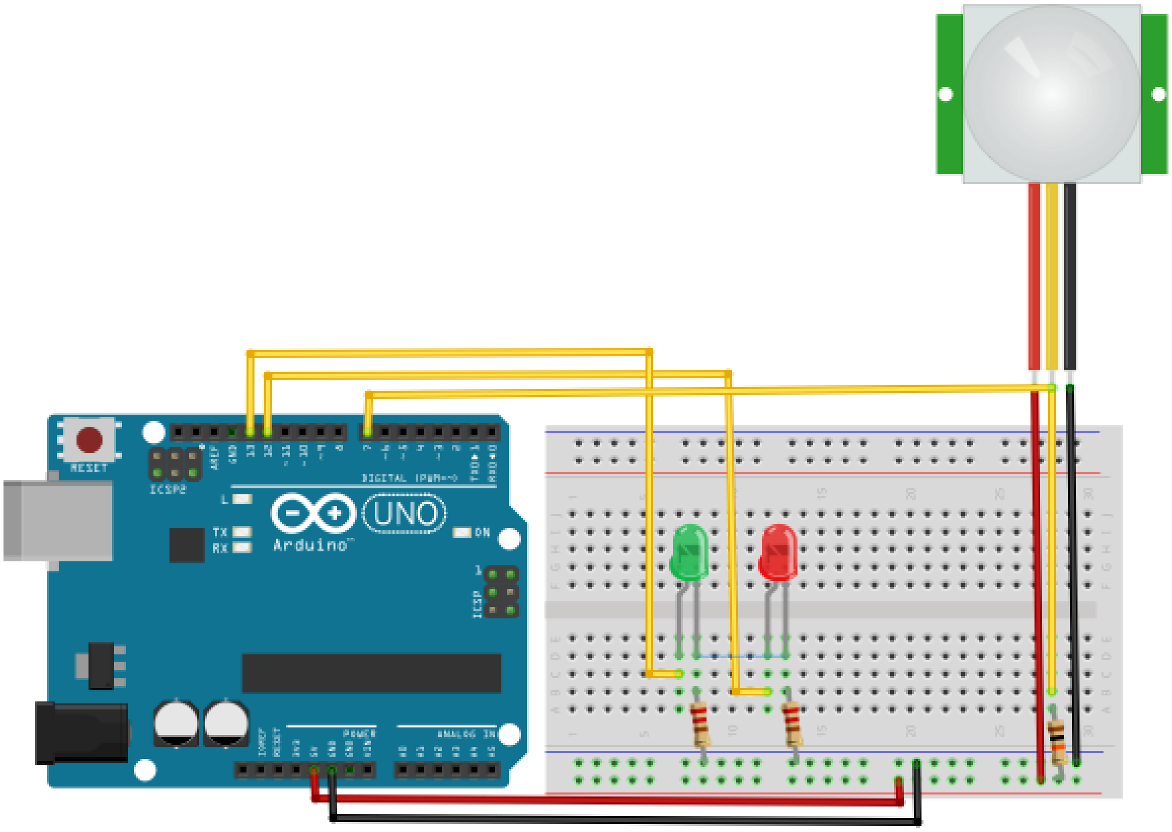
rev3, uno, arduino, atmega328

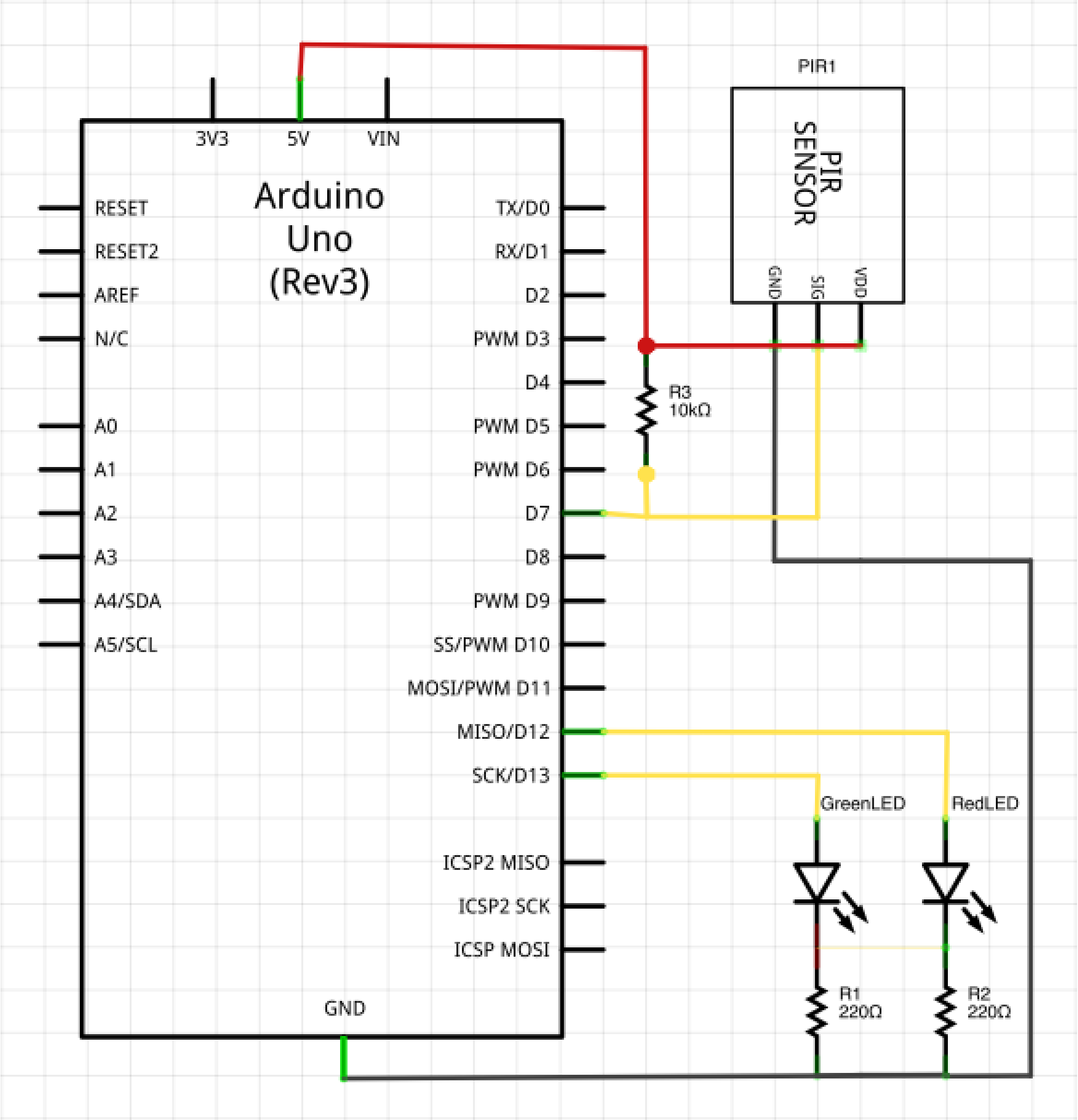
Connections

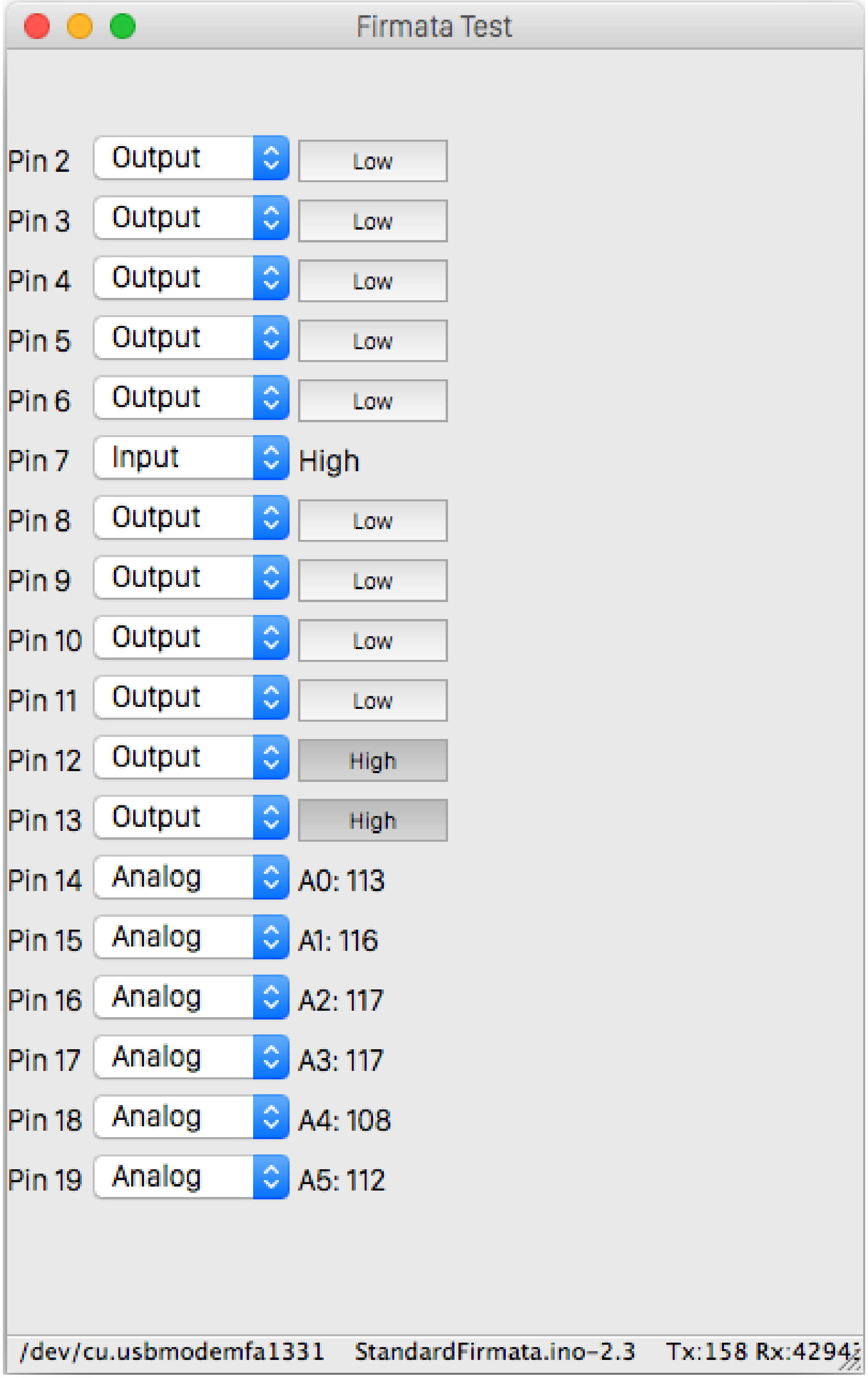
conn.

name

type

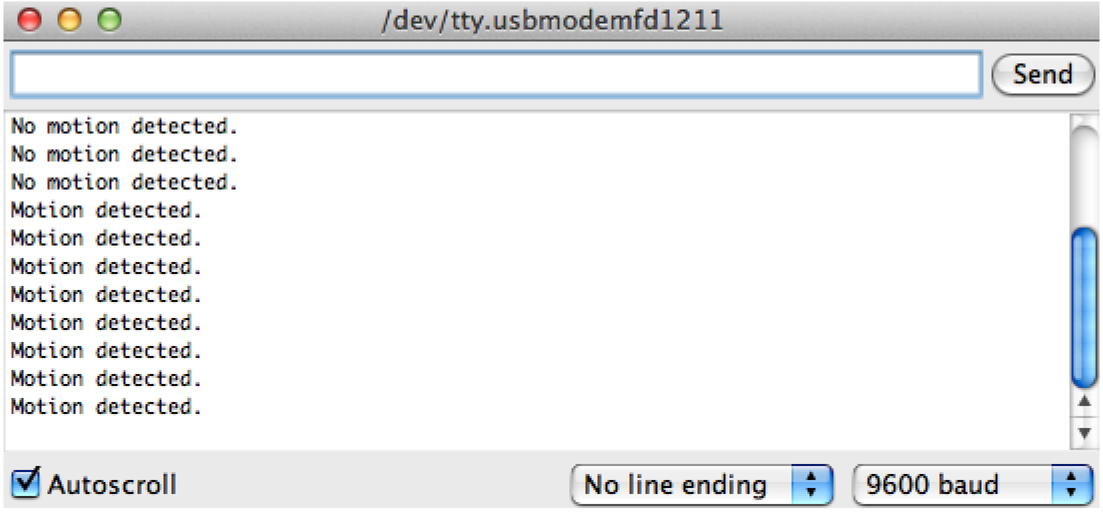

RESET
ICSP2
AREF
GND
13
12
~11
~10
~9
8
7
~6
~5
4
~3
2
TX▶1
RX◀0
DIGITAL (PWM=~)
L
TX
RX
UNO
Arduino
ON
ICSP
IOREF
RESET
3V3
5V
GND
GND
VIN
POWER
A0
A1
A2
A3
A4
A5
ANALOG IN
1
5
10
15
20
25
30
A
B
C
D
E
F
G
H
I
J


PIR1
PIR SENSOR
GND
SIG
VDD
3V3
5V
VIN
Arduino Uno (Rev3)
RESET
RESET2
AREF
N/C
A0
A1
A2
A3
A4/SDA
A5/SCL
TX/D0
RX/D1
D2
PWM D3
D4
PWM D5
PWM D6
D7
D8
PWM D9
SS/PWM D10
MOSI/PWM D11
MISO/D12
SCK/D13
ICSP2 MISO
ICSP2 SCK
ICSP MOSI
GND
R3
10kΩ
GreenLED
RedLED
R1
220Ω
R2
220Ω



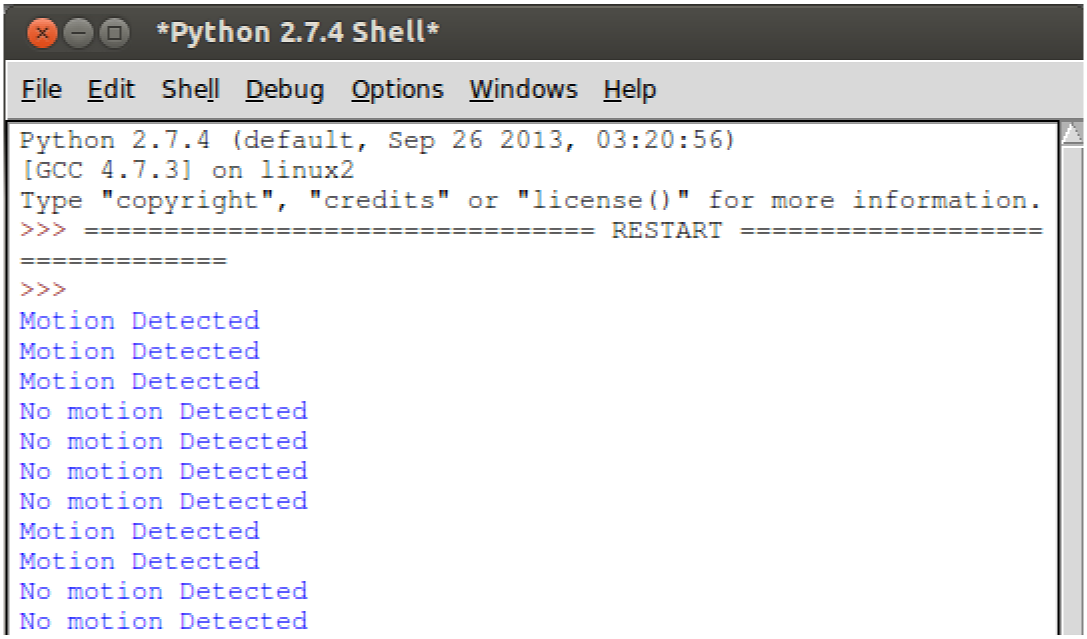
Pin 2 Output Low
Pin 3 Output Low
Pin 4 Output Low
Pin 5 Output Low
Pin 6 Output Low
Pin 7 Input High
Pin 8 Output Low
Pin 9 Output Low
Pin 10 Output Low
Pin 11 Output Low
Pin 12 Output High
Pin 13 Output High
Pin 14 Analog A0: 113
Pin 15 Analog A1: 116
Pin 16 Analog A2: 117
Pin 17 Analog A3: 117
Pin 18 Analog A4: 108
Pin 19 Analog A5: 112

```
/dev/cu.usbmodemfa1331    StandardFirmata.ino-2.3    Tx:158 Rx:4294
```

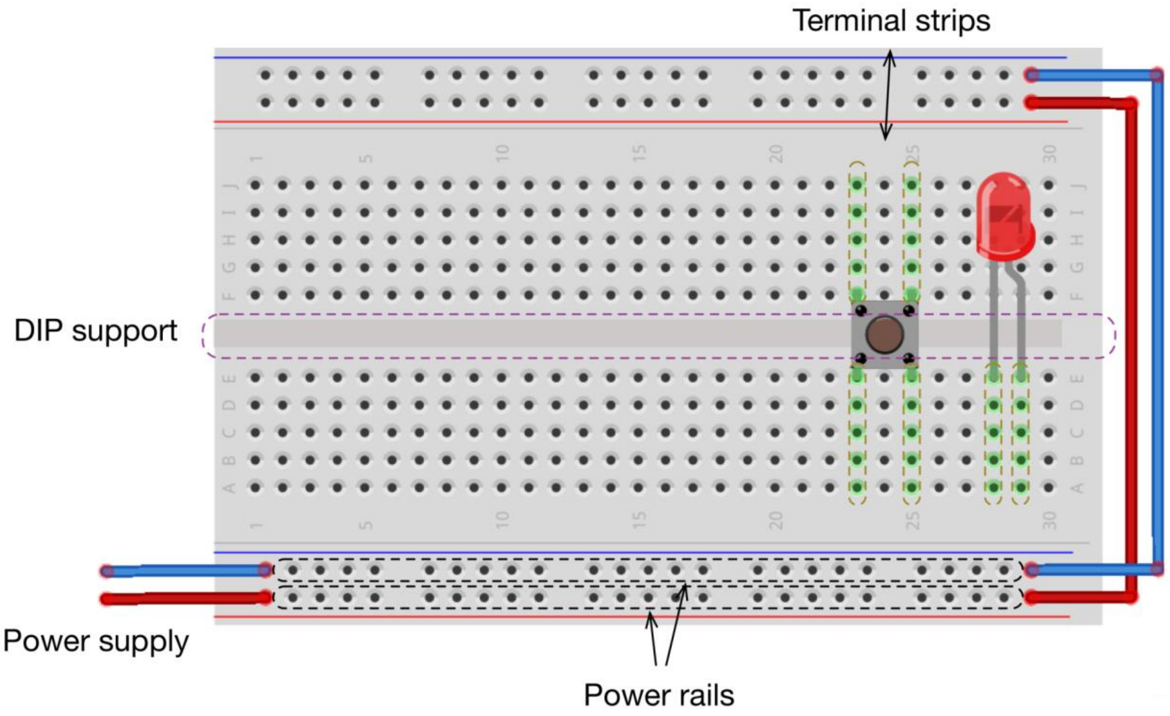


```
No motion detected.
No motion detected.
No motion detected.
Motion detected.
Motion detected.
Motion detected.
Motion detected.
Motion detected.
Motion detected.
Motion detected.
Motion detected.
```

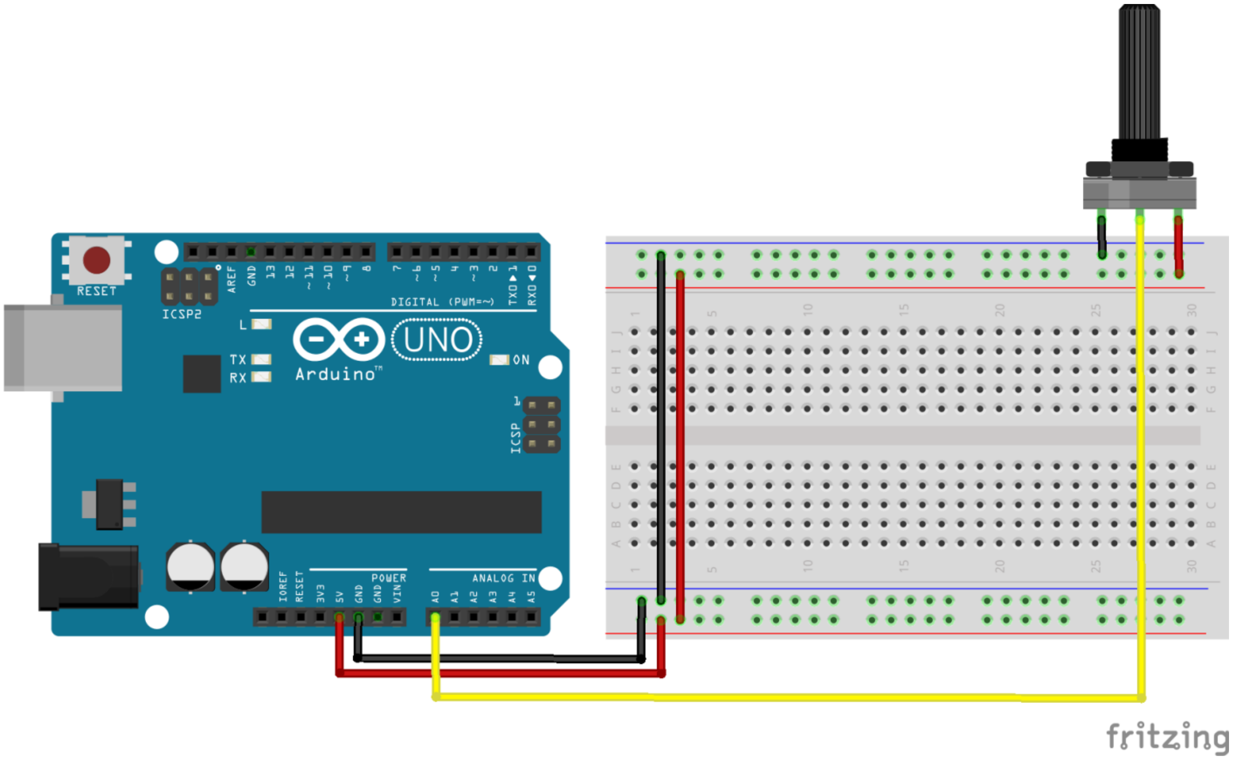
☑ Autoscroll   No line ending   9600 baud

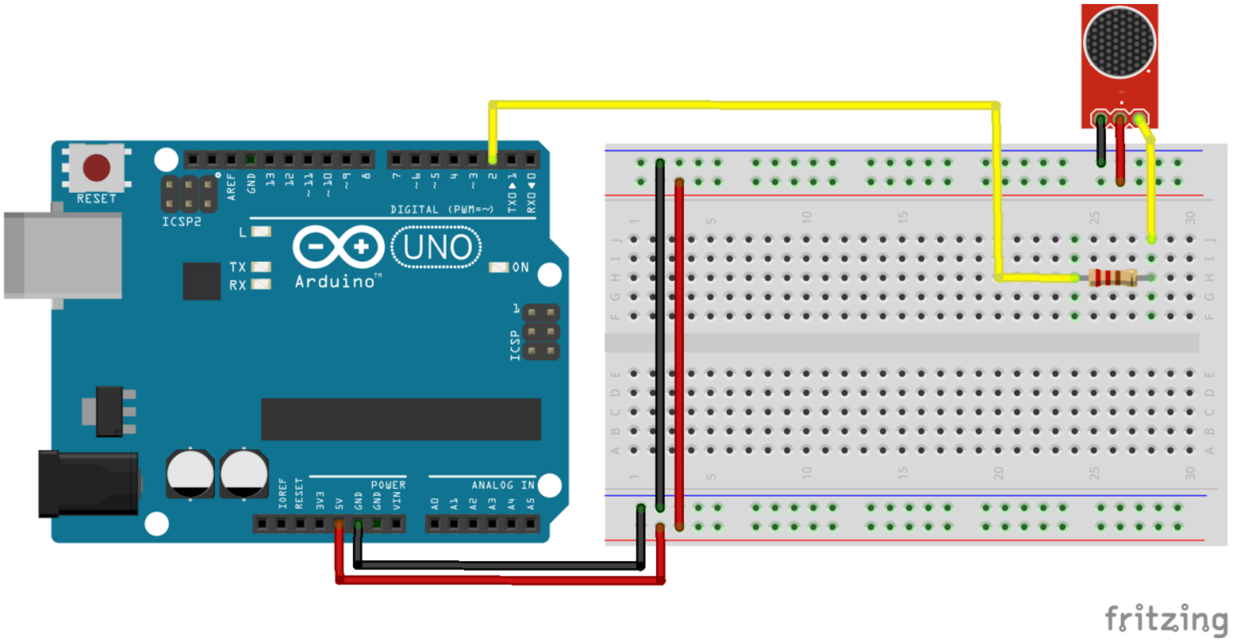


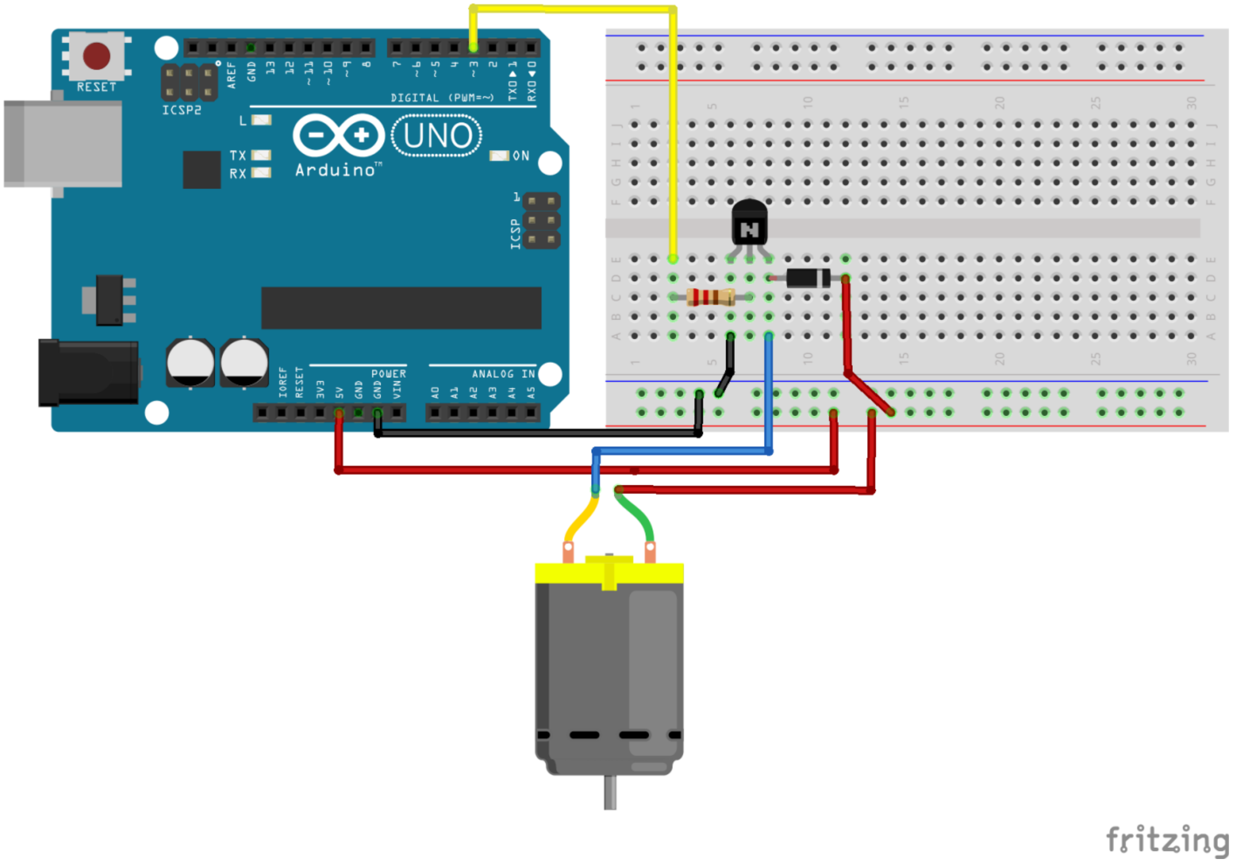
```
Python 2.7.4 (default, Sep 26 2013, 03:20:56)
[GCC 4.7.3] on linux2
Type "copyright", "credits" or "license()" for more information.
>>> ================================ RESTART ===================
=============
>>>
Motion Detected
Motion Detected
Motion Detected
No motion Detected
No motion Detected
No motion Detected
No motion Detected
Motion Detected
Motion Detected
No motion Detected
No motion Detected
```



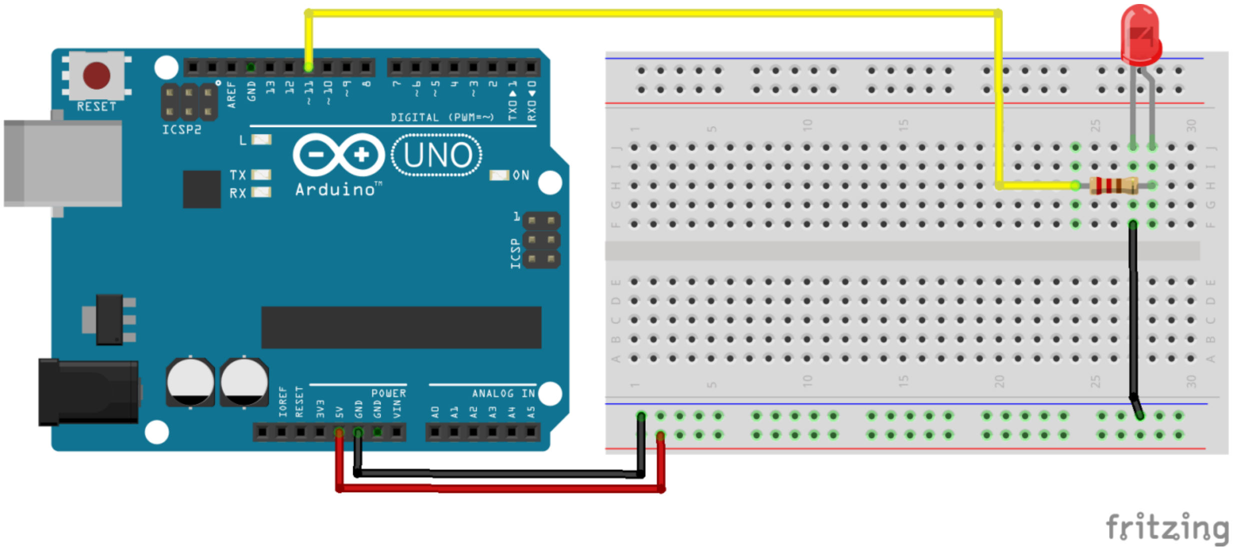
Chapter 4: Diving into Python – Arduino Prototyping


RESET
ICSP2
AREF
GND
13
12
~11
~10
~9
8
7
~6
~5
4
~3
2
TX▶1
RX◀0
DIGITAL (PWM=~)
L
TX
RX
UNO
Arduino™
ON
ICSP
IOREF
RESET
3V3
5V
GND
GND
VIN
POWER
A0
A1
A2
A3
A4
A5
ANALOG IN
fritzing

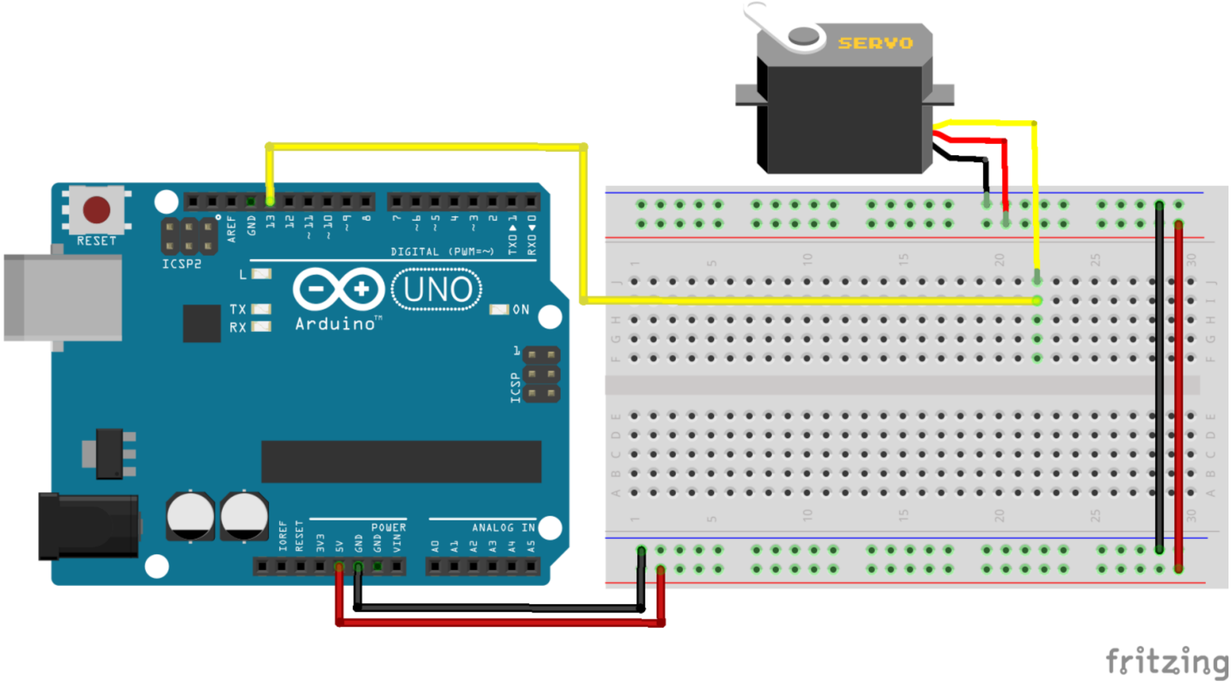

RESET
ICSP2
AREF
GND
13
12
~11
~10
~9
8
7
~6
~5
4
~3
2
TX▶1
RX◀0
DIGITAL (PWM=~)
L
TX
RX
UNO
Arduino™
ON
ICSP
IOREF
RESET
3V3
5V
GND
GND
VIN
POWER
A0
A1
A2
A3
A4
A5
ANALOG IN
fritzing

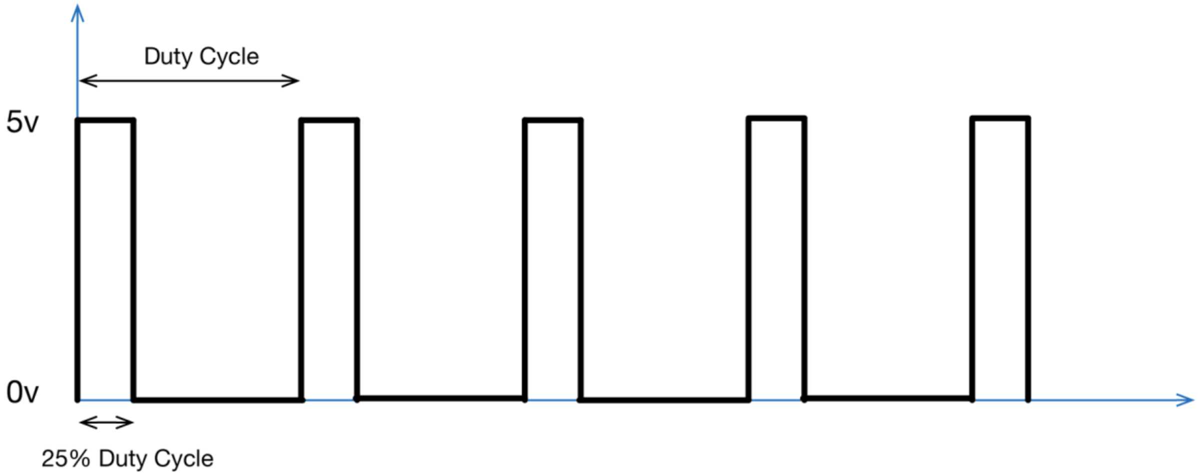


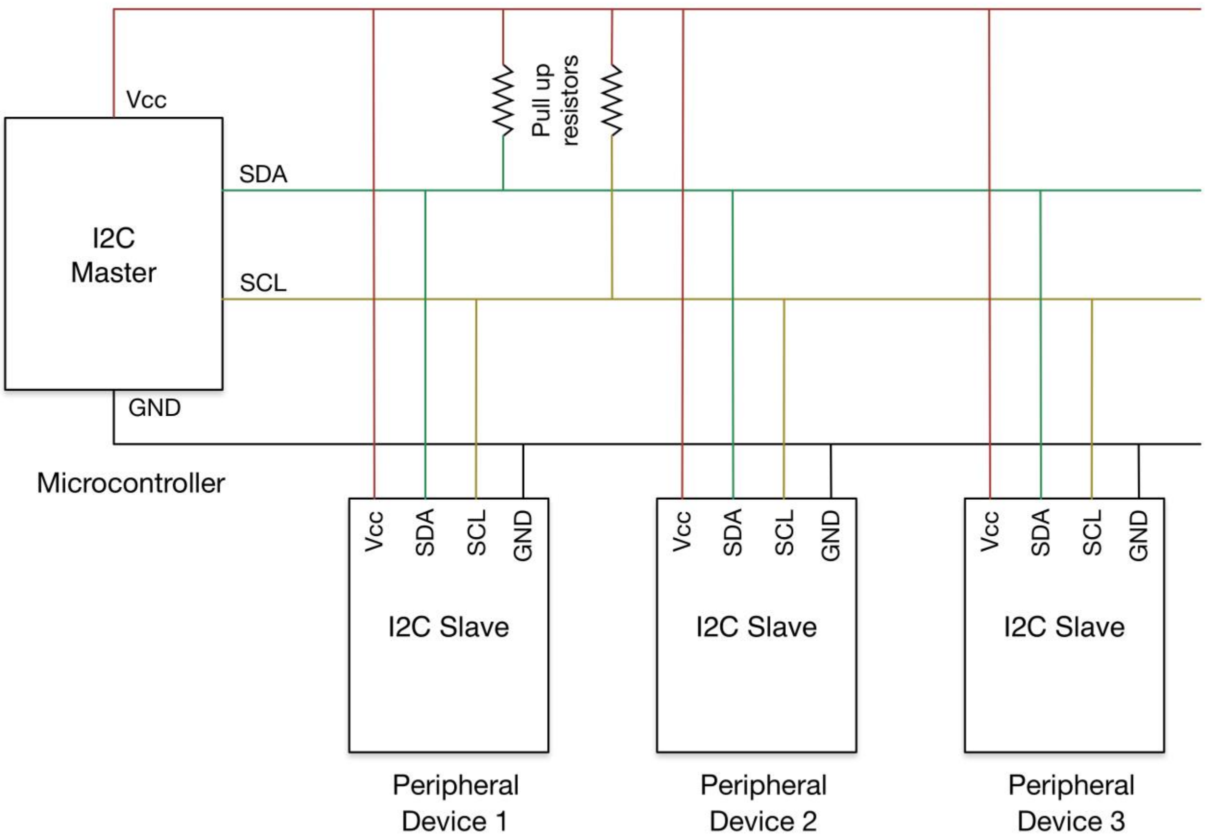
RESET
ICSP2
AREF
GND
13
12
~11
~10
~9
8
7
~6
~5
4
~3
2
TX▶1
RX◀0
DIGITAL (PWM=~)
L
TX
RX
UNO
Arduino™
ON
ICSP
1
IOREF
RESET
3V3
5V
GND
GND
VIN
POWER
A0
A1
A2
A3
A4
A5
ANALOG IN
N
fritzing

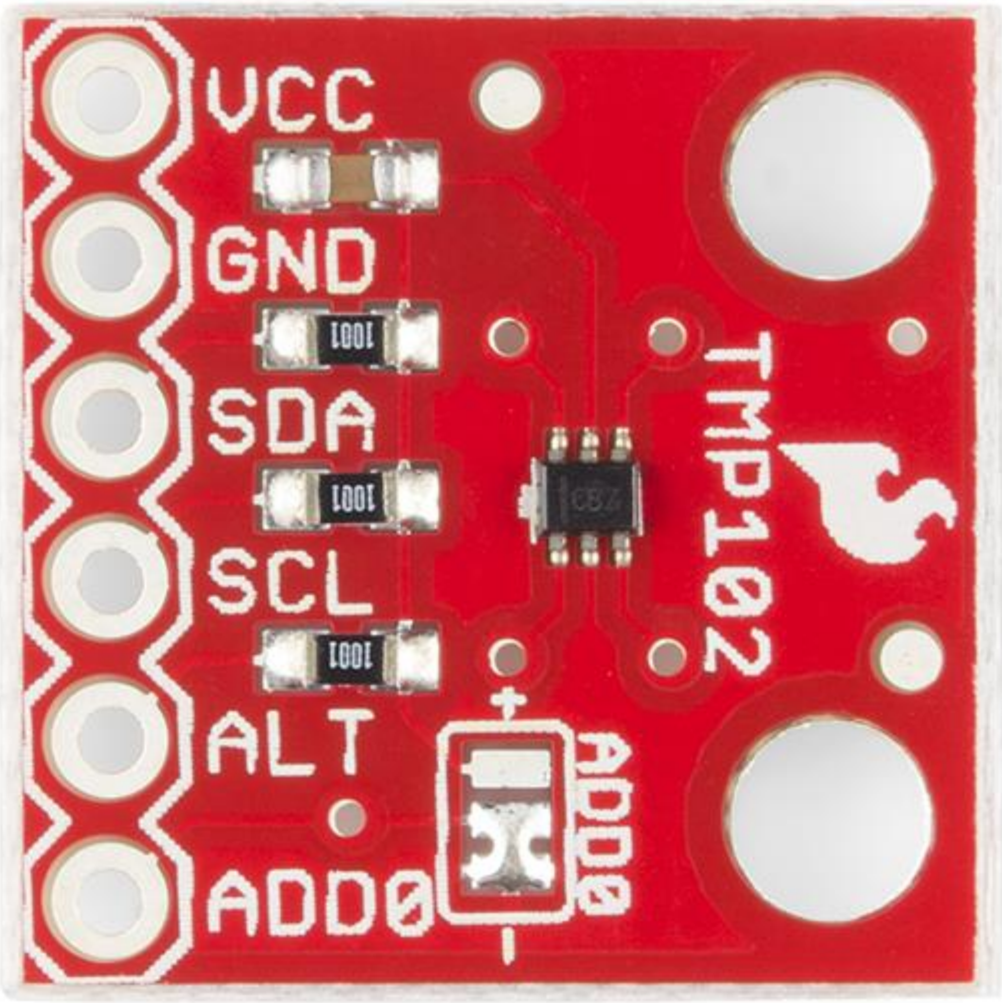


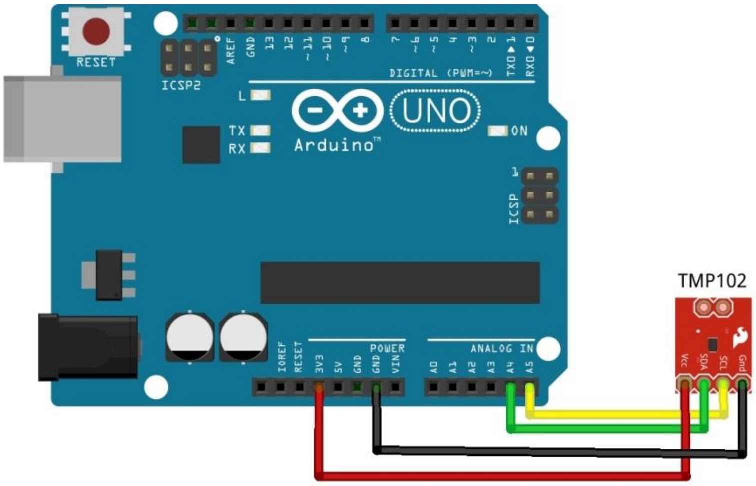
RESET
ICSP2
DIGITAL (PWM=~)
UNO
Arduino™
ON
ICSP
POWER
ANALOG IN
fritzing

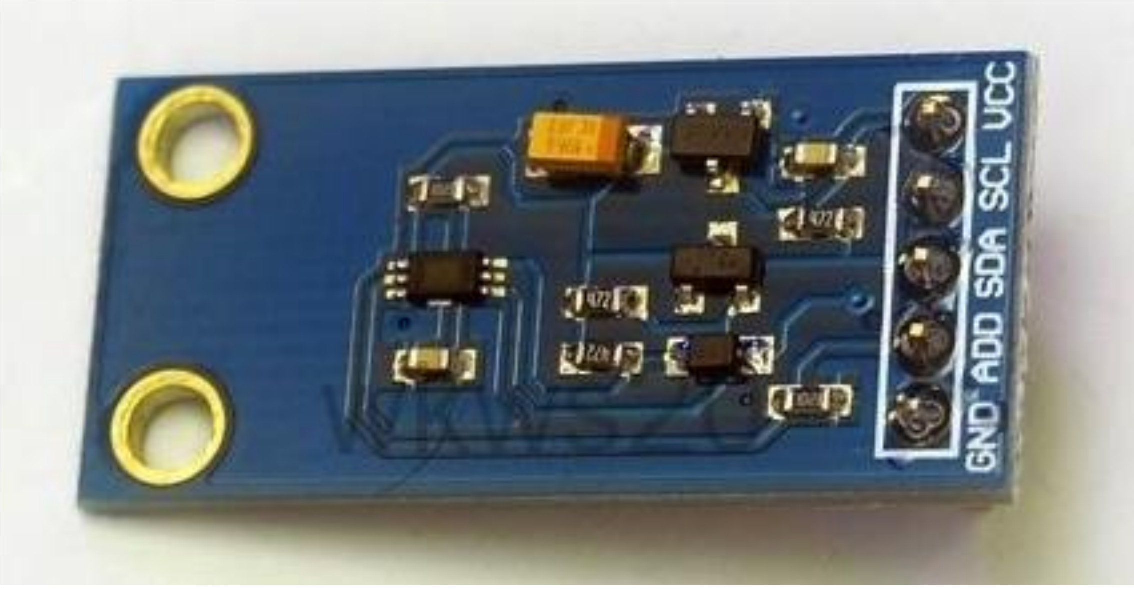

SERVO
RESET
ICSP2
AREF
GND
13
12
~11
~10
~9
8
7
~6
~5
4
~3
2
TX▶1
RX◀0
DIGITAL (PWM=~)
L
TX
RX
UNO
Arduino™
ON
ICSP
1
IOREF
RESET
3V3
5V
GND
GND
VIN
POWER
ANALOG IN
A0
A1
A2
A3
A4
A5
fritzing

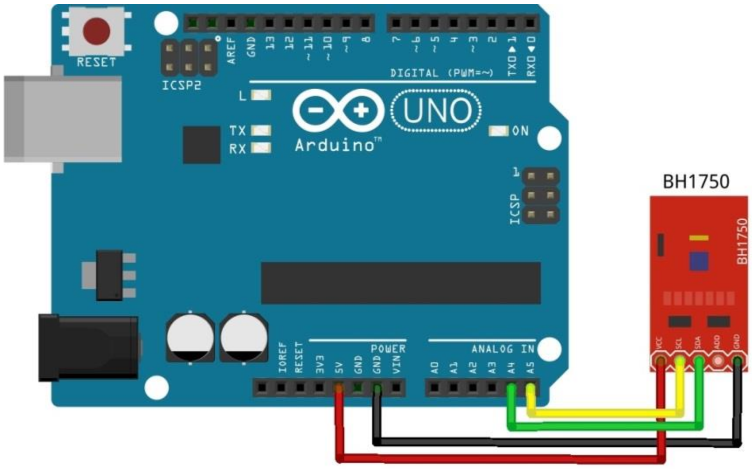

Duty Cycle
5v
0v
25% Duty Cycle


Vcc
SDA
SCL
GND
I2C
Master
Microcontroller
Pull up
resistors
Vcc
SDA
SCL
GND
I2C Slave
Peripheral
Device 1
Vcc
SDA
SCL
GND
I2C Slave
Peripheral
Device 2
Vcc
SDA
SCL
GND
I2C Slave
Peripheral
Device 3

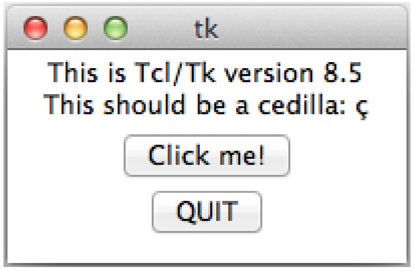

VCC
GND
SDA
SCL
ALT
ADD0
TMP102
ADD0
+
-
1001
1001
1001


TMP102
Vcc
SDA
SCL
Gnd
RESET
ICSP2
AREF
GND
DIGITAL (PWM=~)
UNO
Arduino
ON
ICSP
IOREF
RESET
3V3
5V
GND
GND
VIN
POWER
ANALOG IN
A0
A1
A2
A3
A4
A5

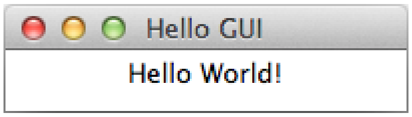

VCC
SCL
SDA
ADD
GND


BH1750
BH1750
VCC
SCL
SDA
ADD
GND
RESET
ICSP2
DIGITAL (PWM=~)
UNO
Arduino
ON
ICSP
POWER
ANALOG IN
5V
GND
A4
A5

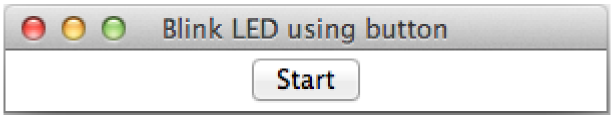
Chapter 5: Working with the Python GUI

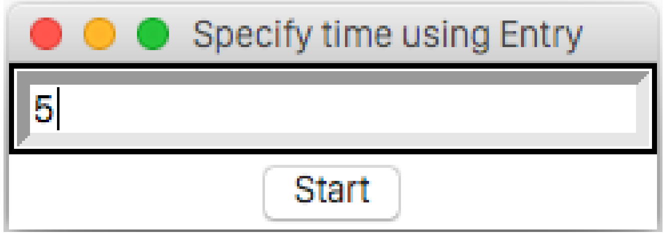


This is Tcl/Tk version 8.5
This should be a cedilla: ç

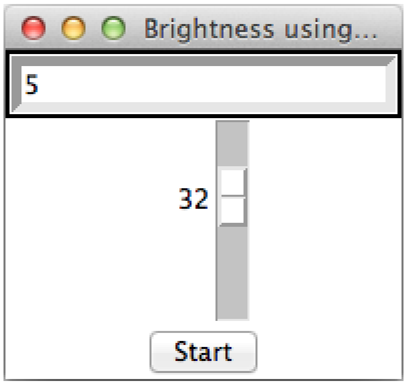


Hello World!

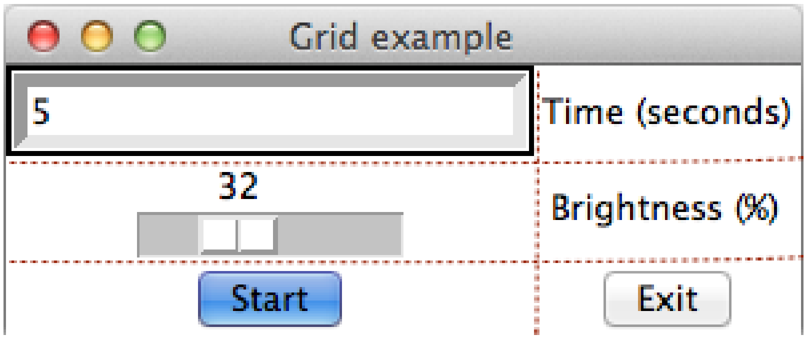




5

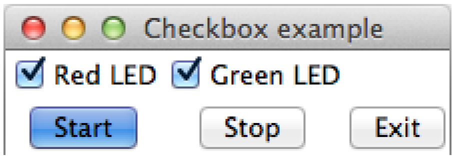


5

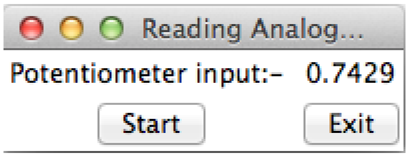


5 Time (seconds)

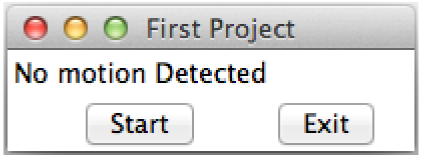
32 Brightness (%)



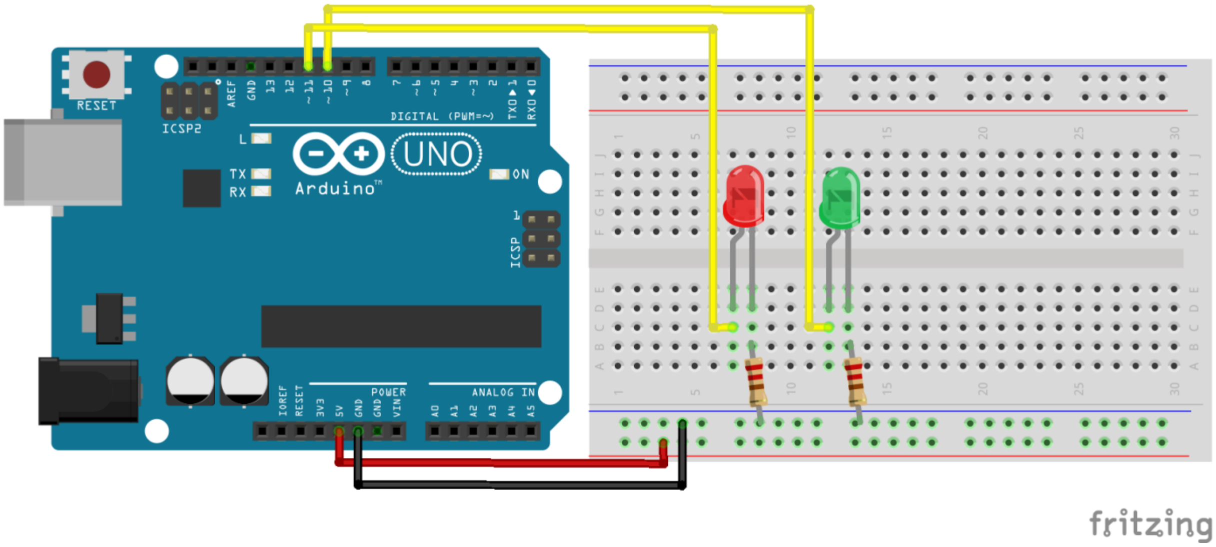
☑ Red LED ☑ Green LED

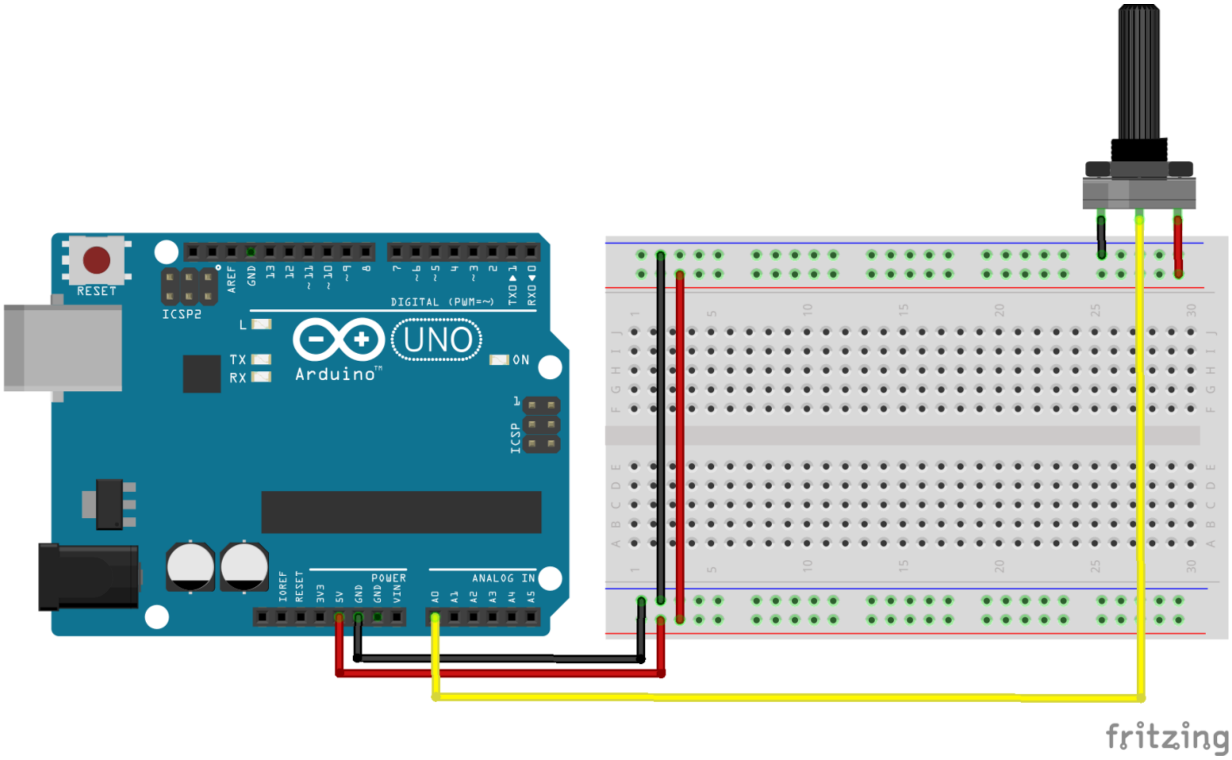


Potentiometer input:- 0.7429

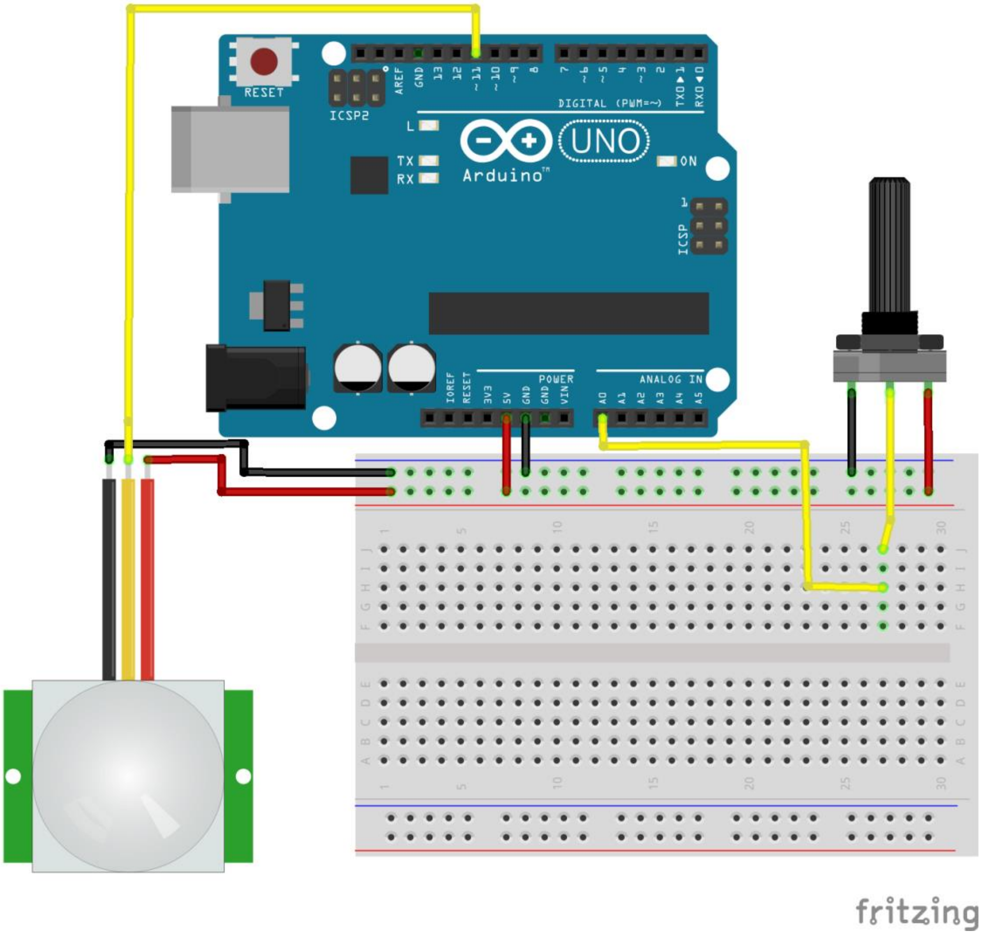


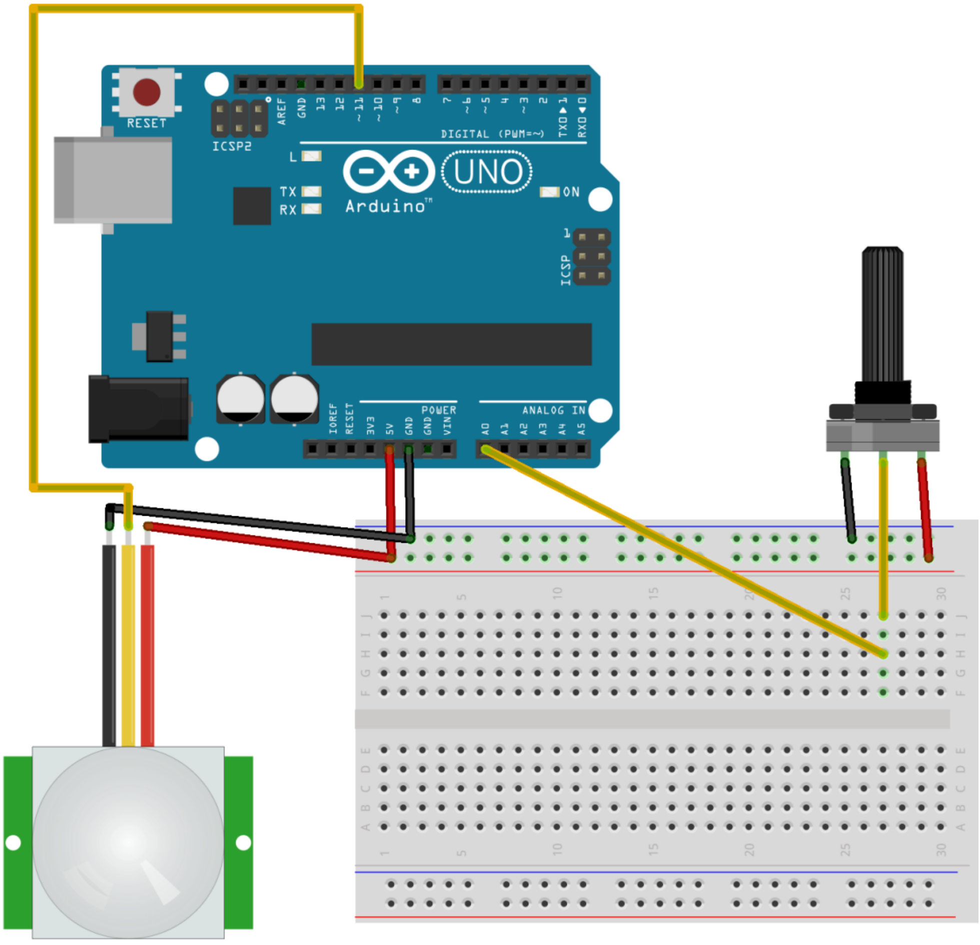
No motion Detected





Chapter 6: Storing and Plotting Arduino Data


RESET
ICSP2
AREF
GND
13
12
~11
~10
~9
8
7
~6
~5
4
~3
2
TX▶1
RX◀0
DIGITAL (PWM=~)
L
TX
RX
UNO
Arduino™
ON
ICSP
1
IOREF
RESET
3V3
5V
GND
GND
VIN
POWER
ANALOG IN
A0
A1
A2
A3
A4
A5
1
5
10
15
20
25
30
J
I
H
G
F
E
D
C
B
A
fritzing


RESET
ICSP2
AREF
GND
13
12
~11
~10
~9
8
7
~6
~5
4
~3
2
TX▶1
RX◀0
DIGITAL (PWM=~)
L
TX
RX
UNO
Arduino™
ON
ICSP
1
IOREF
RESET
3V3
5V
GND
GND
VIN
POWER
ANALOG IN
A0
A1
A2
A3
A4
A5
1
5
10
15
20
25
30
J
I
H
G
F
E
D
C
B
A

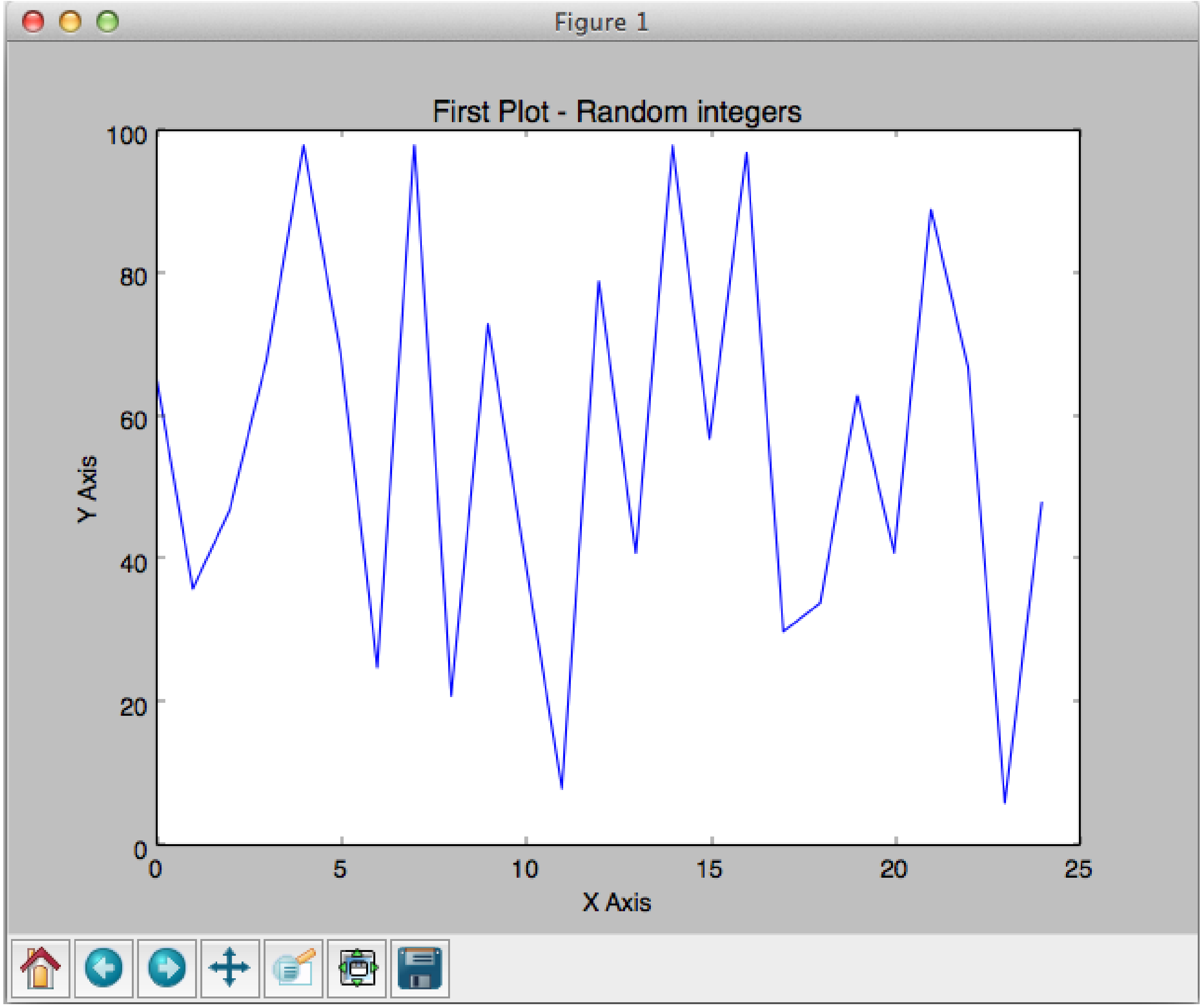


Figure 1
First Plot - Random integers
100
80
60
40
20
0
Y Axis
0
5
10
15
20
25
X Axis

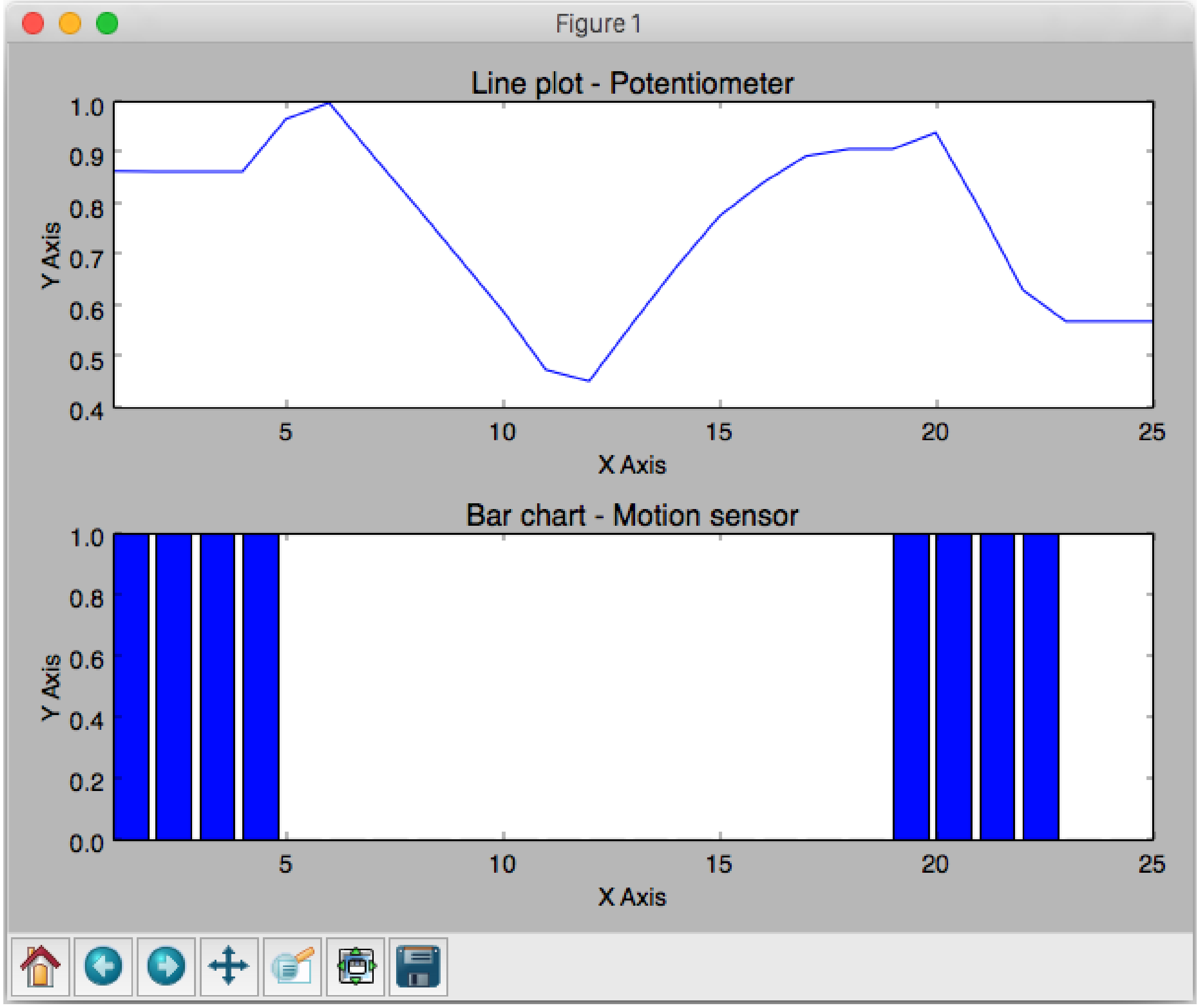


Figure 1
Line plot - Potentiometer
1.0
0.9
0.8
0.7
0.6
0.5
0.4
Y Axis
5
10
15
20
25
X Axis
Bar chart - Motion sensor
1.0
0.8
0.6
0.4
0.2
0.0
Y Axis
5
10
15
20
25
X Axis

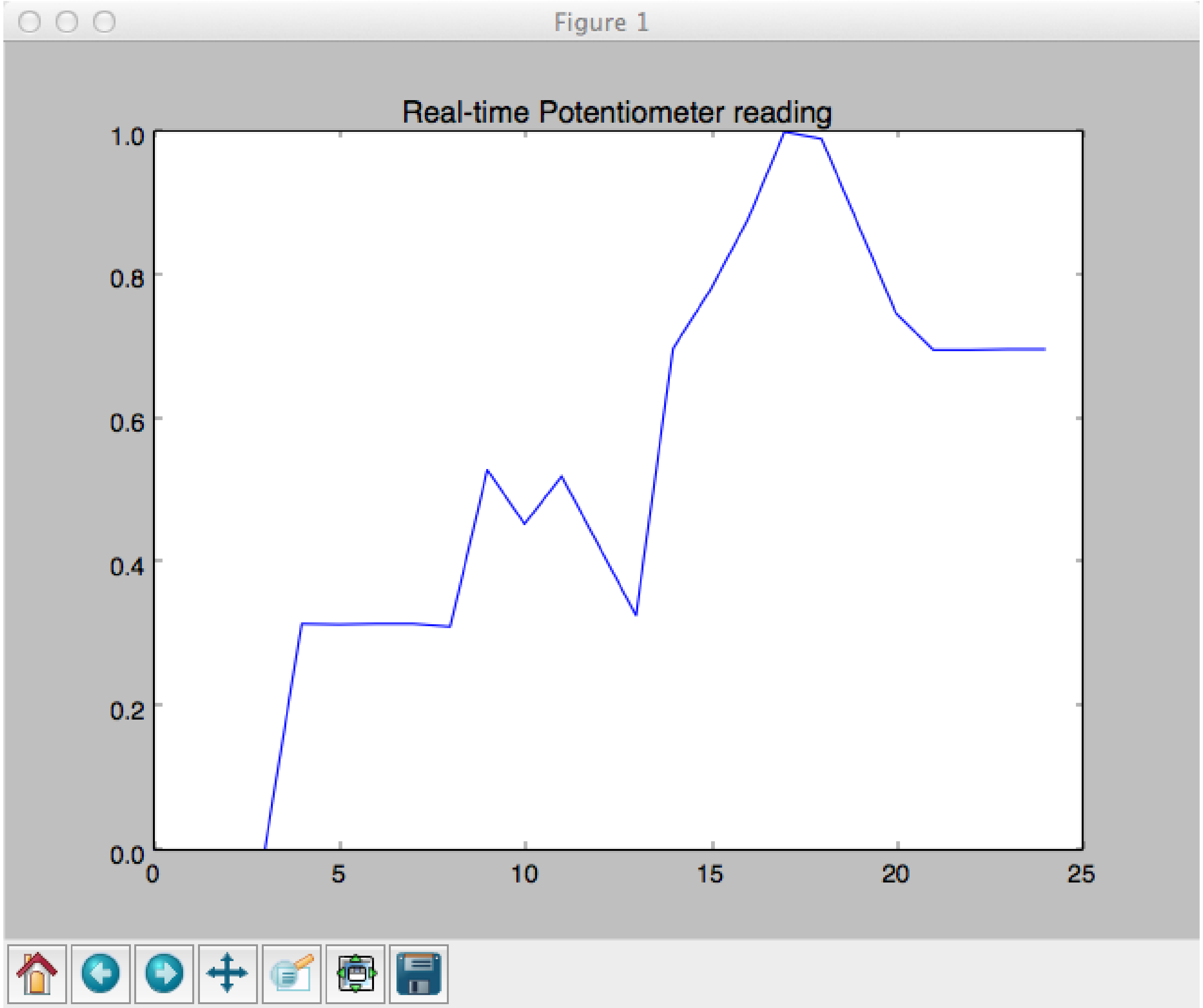
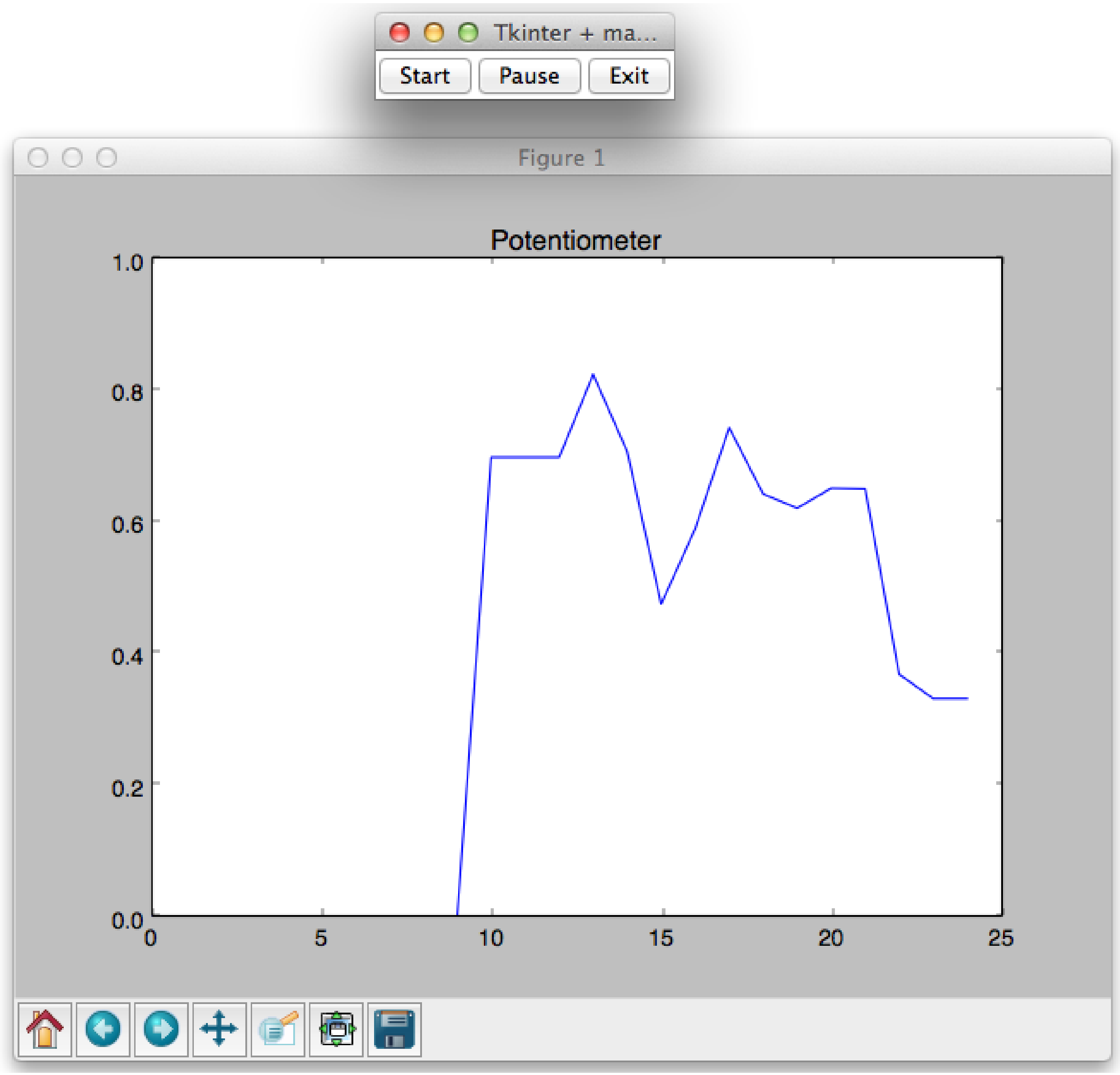
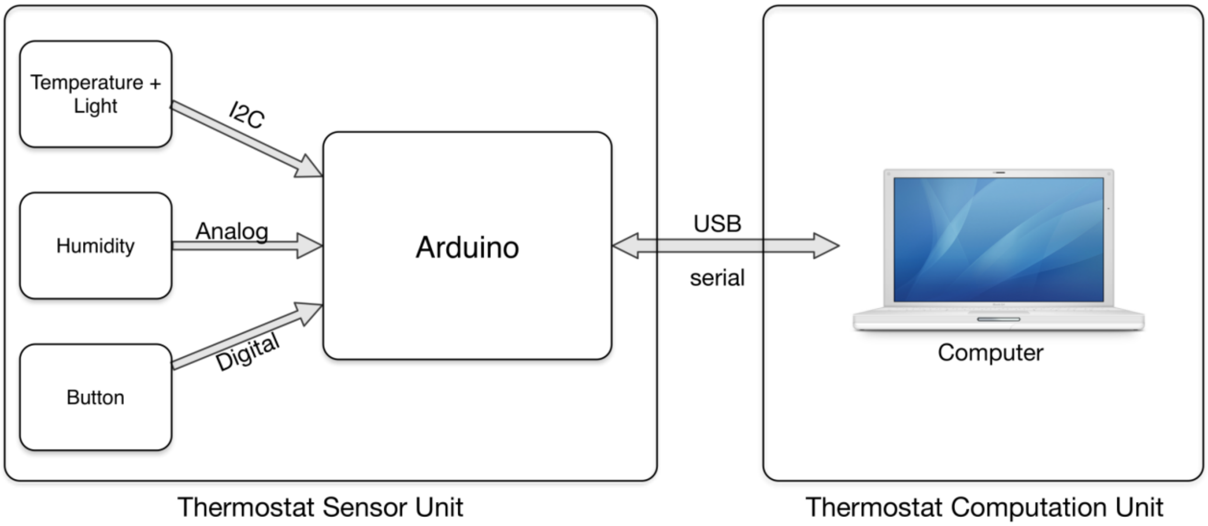


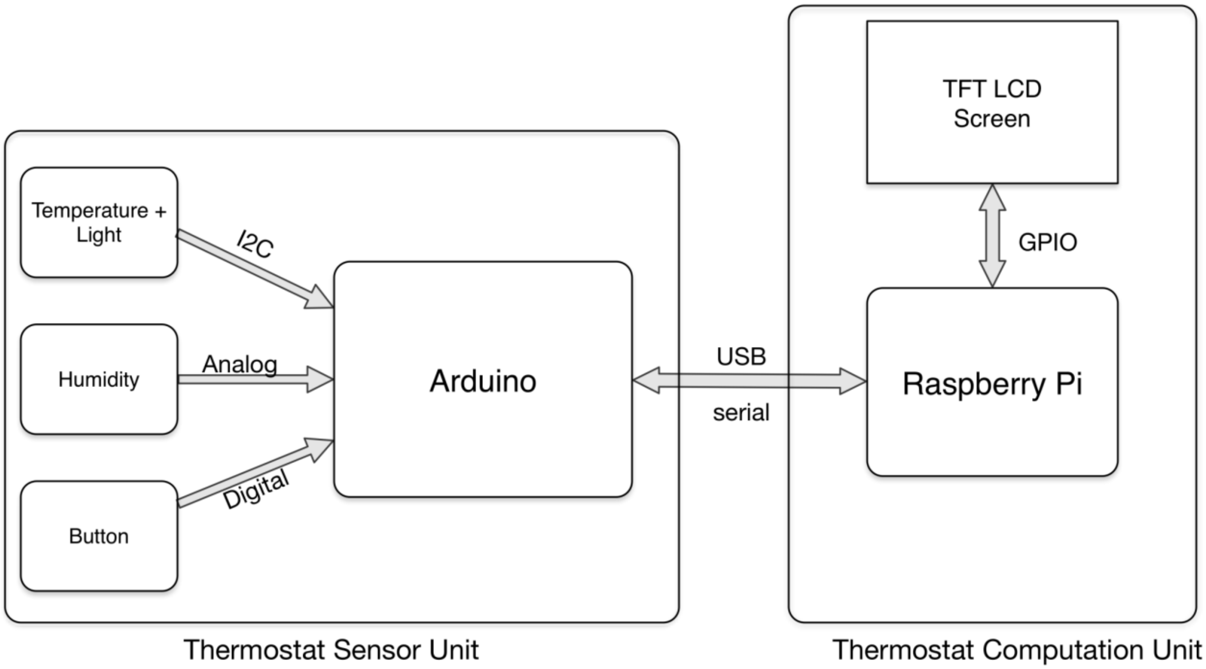
Figure 1
Real-time Potentiometer reading
1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25

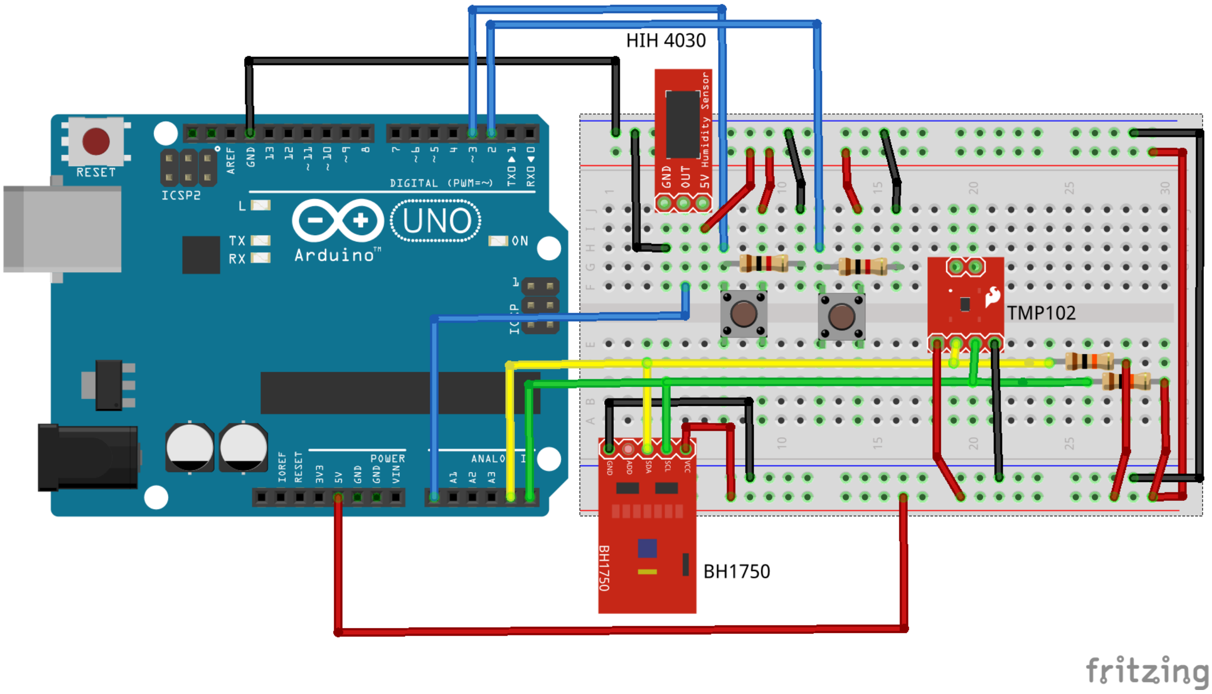


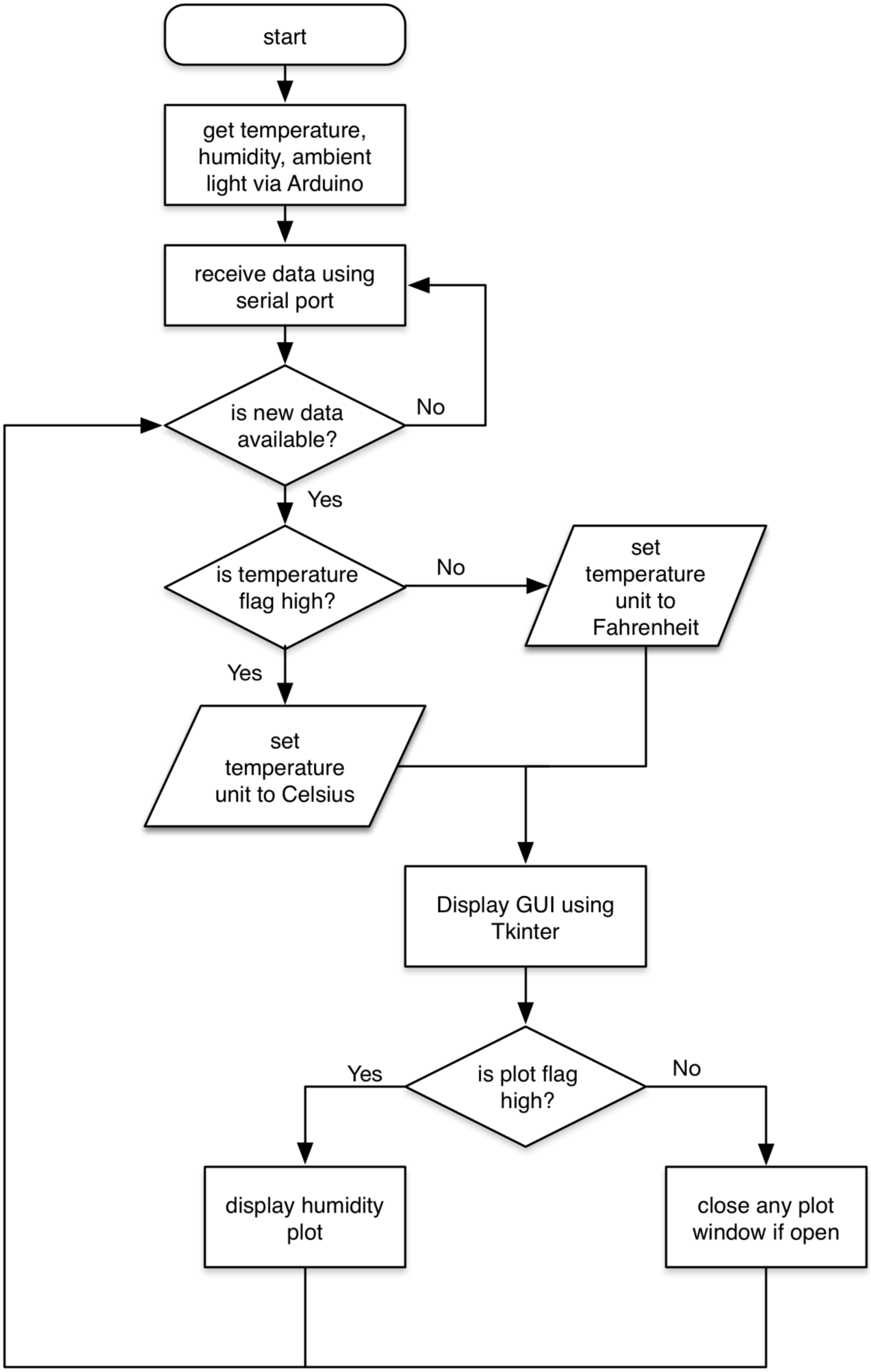
Chapter 7: The Midterm Project – a Portable DIY Thermostat

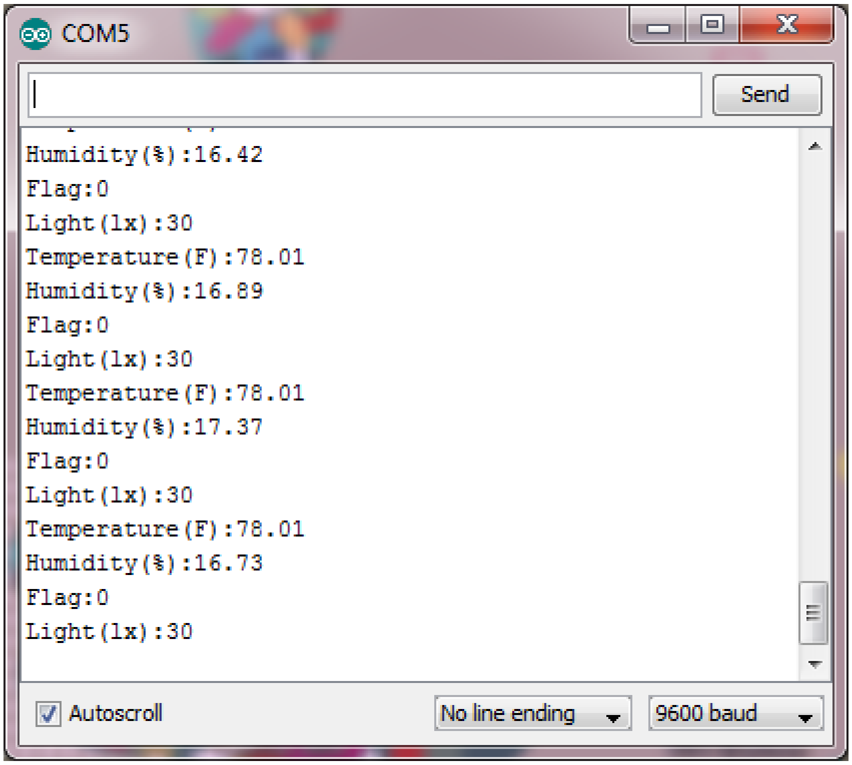
GND
OUT
5V
Humidity Sensor


Temperature + Light
I2C
Humidity
Analog
Button
Digital
Arduino
USB
serial
Computer
Thermostat Sensor Unit
Thermostat Computation Unit


TFT LCD Screen
GPIO
Temperature + Light
I2C
Humidity
Analog
Button
Digital
Arduino
USB
serial
Raspberry Pi
Thermostat Sensor Unit
Thermostat Computation Unit

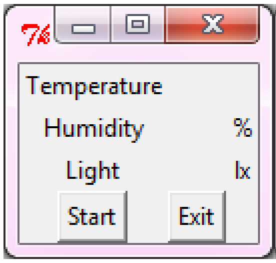

HIH 4030
GND
OUT
5V Humidity Sensor
TMP102
BH1750
GND
ADD
SDA
SCL
VCC
RESET
ICSP2
AREF
GND
13
12
~11
~10
~9
8
7
~6
~5
4
~3
2
TX▶1
RX◀0
DIGITAL (PWM=~)
L
TX
RX
UNO
Arduino
ON
ICSP
IOREF
RESET
3V3
5V
GND
GND
VIN
POWER
ANALOG IN
A1
A2
A3
fritzing


start
get temperature, humidity, ambient light via Arduino
receive data using serial port
is new data available?
No
Yes
is temperature flag high?
No
set temperature unit to Fahrenheit
Yes
set temperature unit to Celsius
Display GUI using Tkinter
is plot flag high?
Yes
No
display humidity plot
close any plot window if open

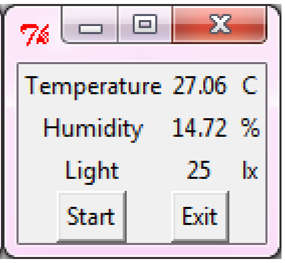


```
Humidity(%):16.42
Flag:0
Light(lx):30
Temperature(F):78.01
Humidity(%):16.89
Flag:0
Light(lx):30
Temperature(F):78.01
Humidity(%):17.37
Flag:0
Light(lx):30
Temperature(F):78.01
Humidity(%):16.73
Flag:0
Light(lx):30
```

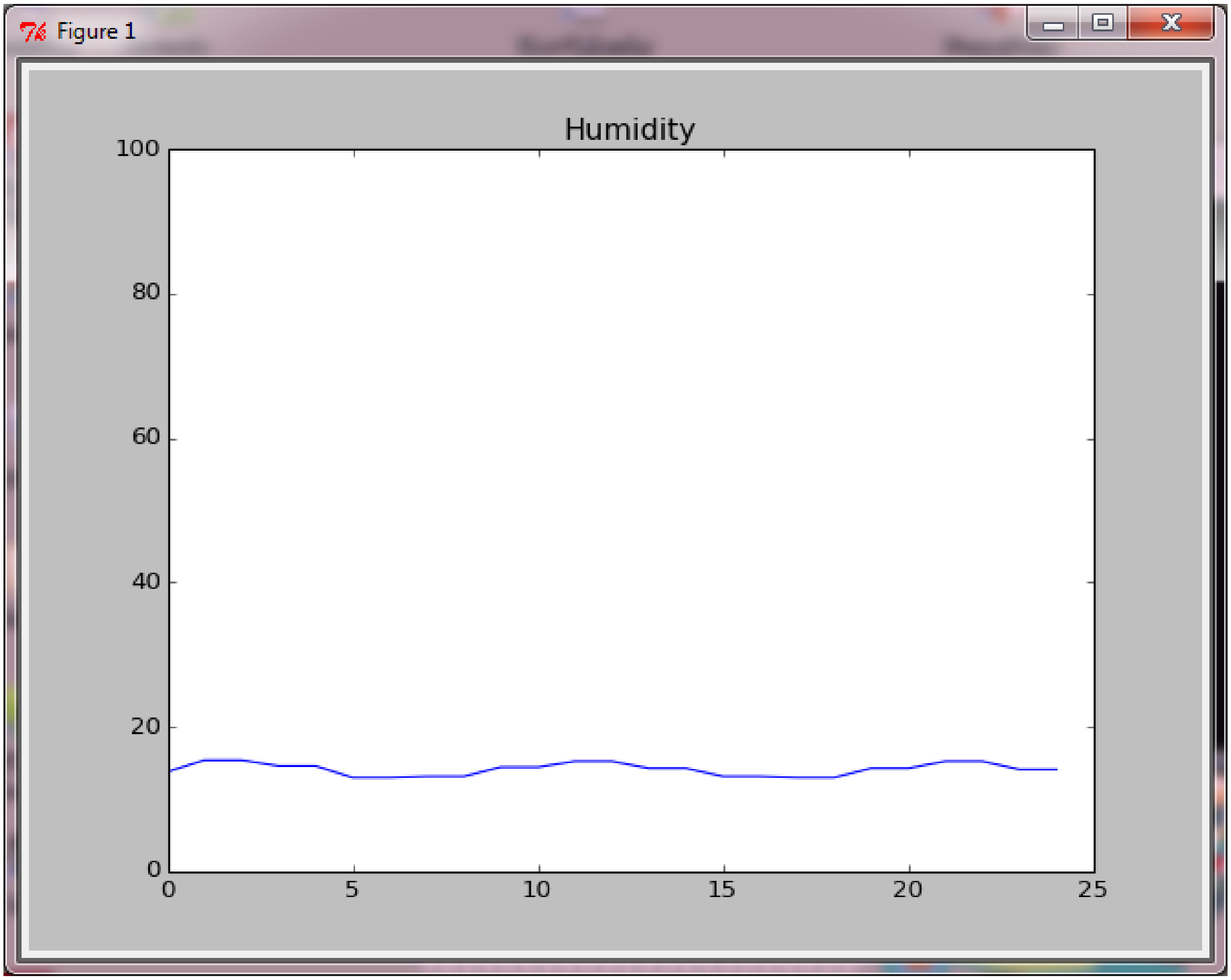
☑ Autoscroll
No line ending
9600 baud

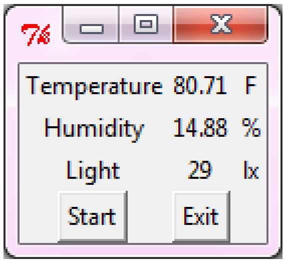


Temperature
Humidity %
Light lx



Temperature 27.06 C
Humidity 14.72 %
Light 25 lx

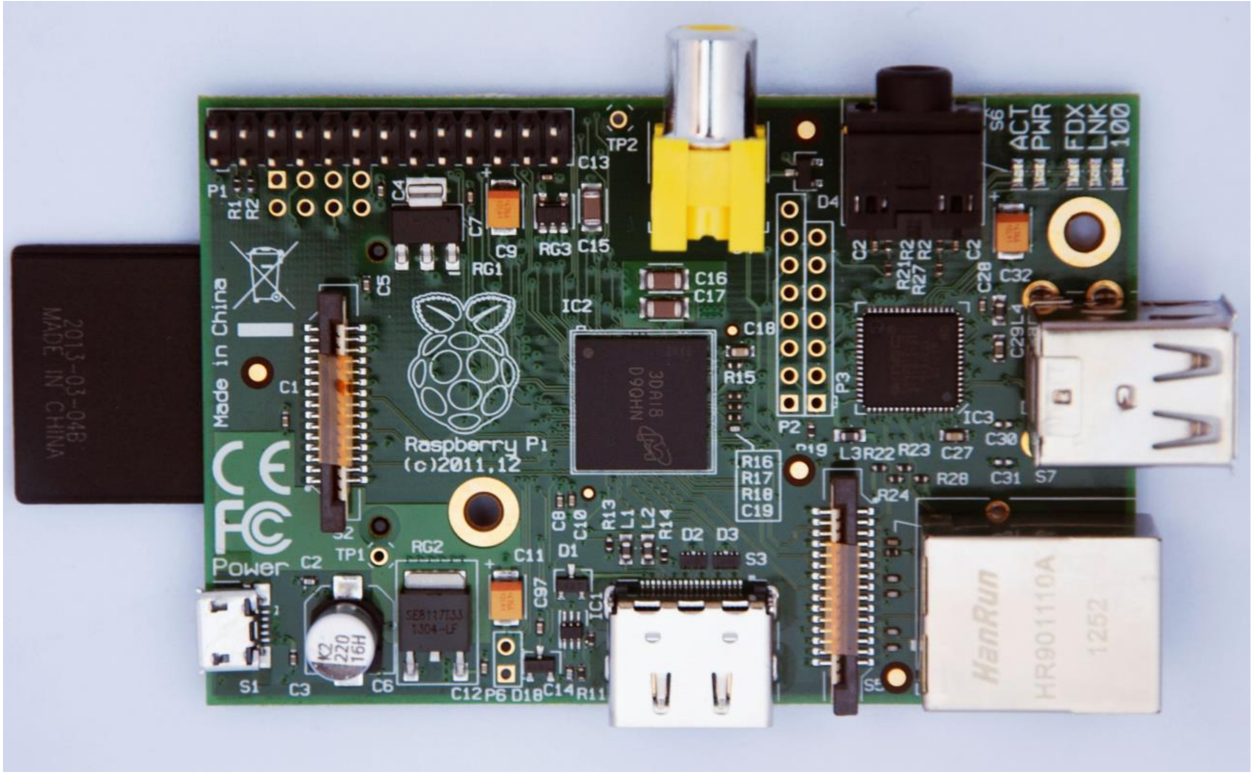


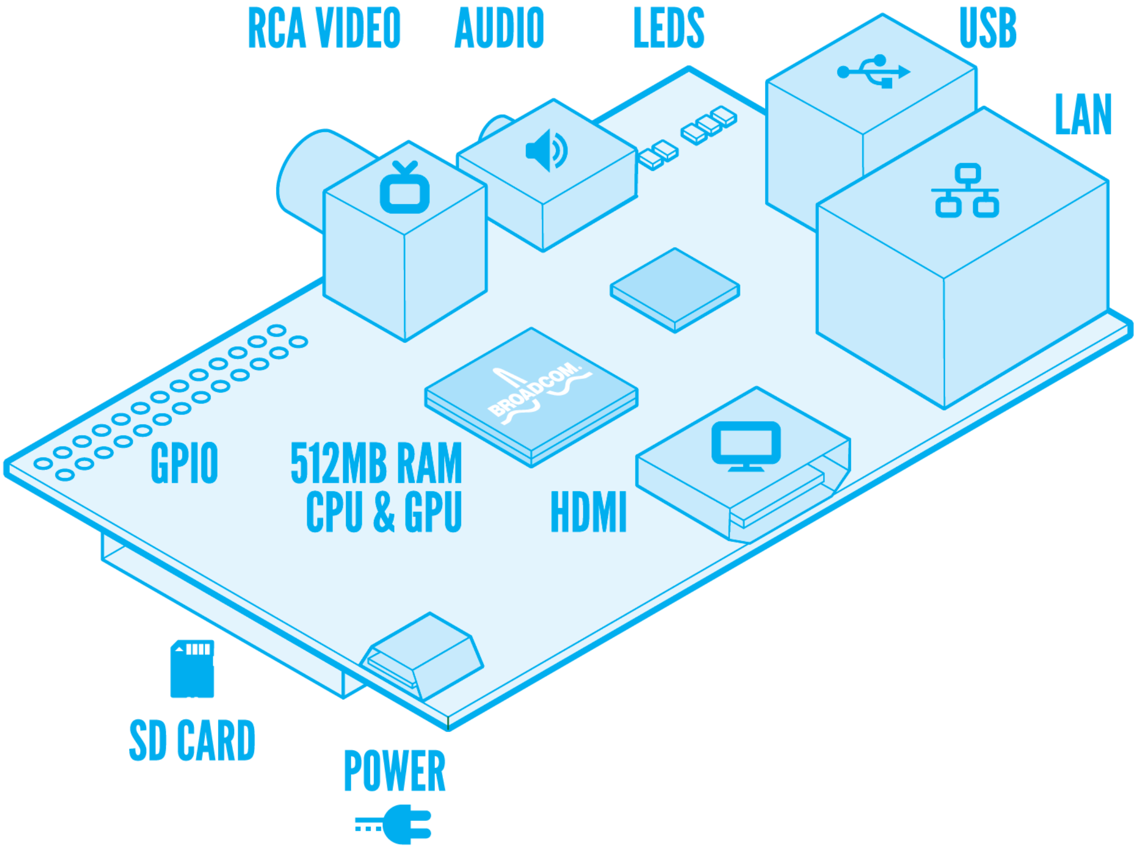


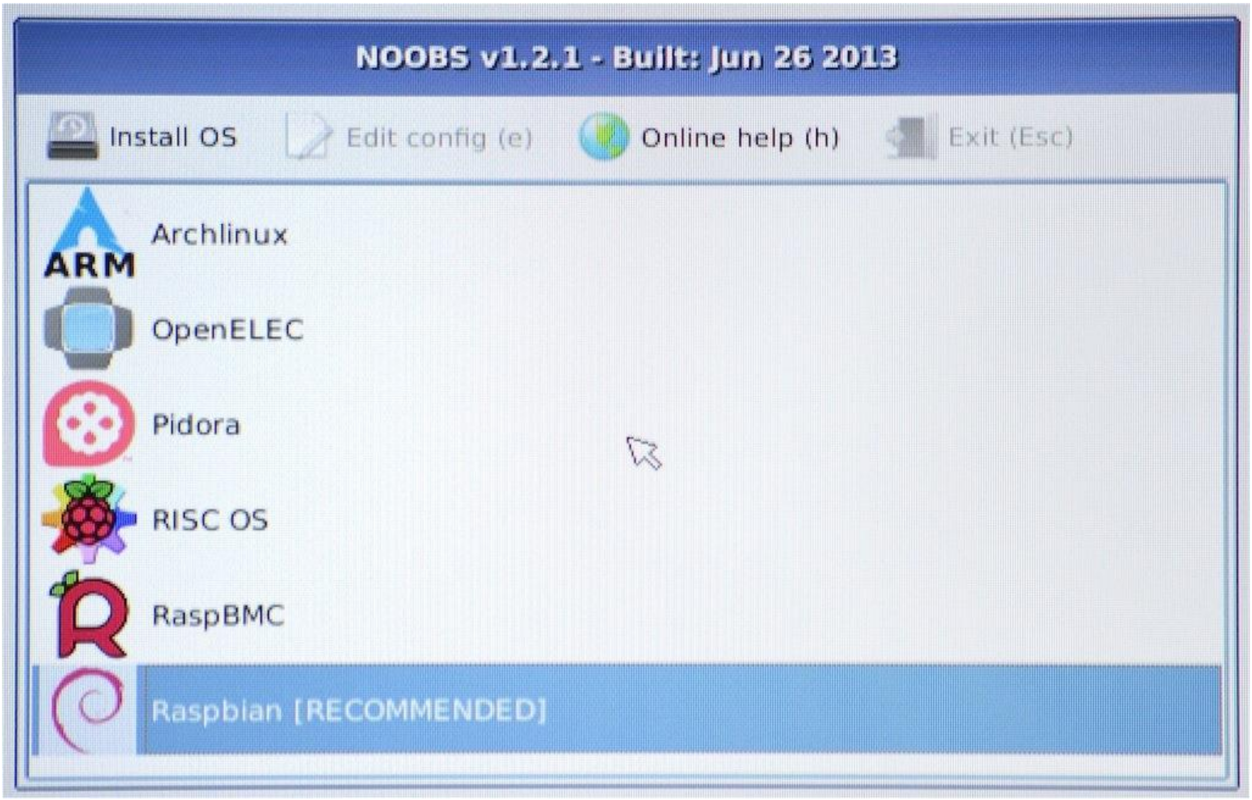
Temperature 80.71 F

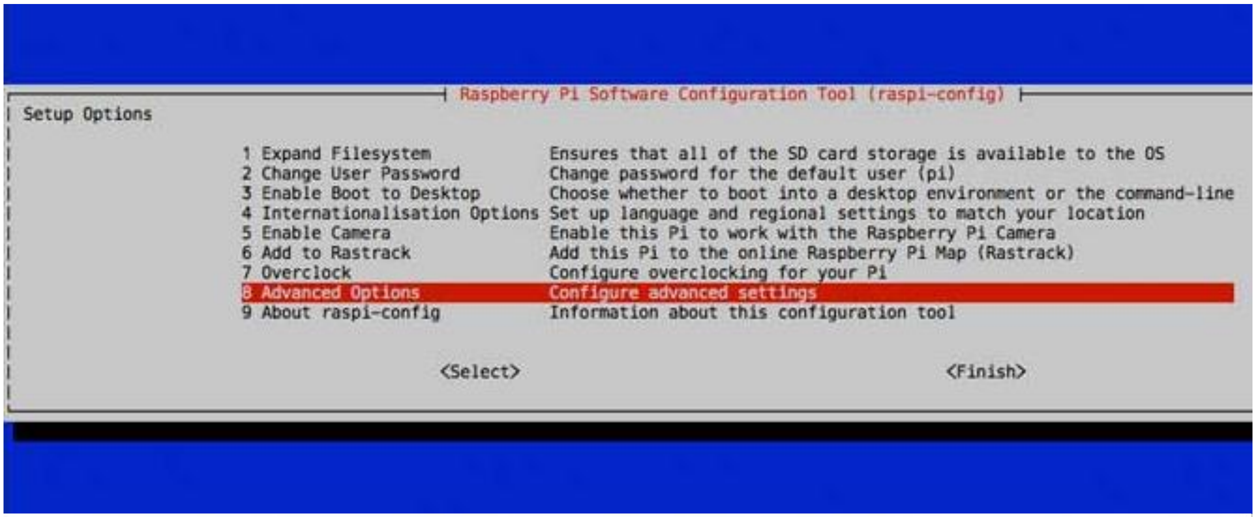
Humidity 14.88 %

Light 29 lx

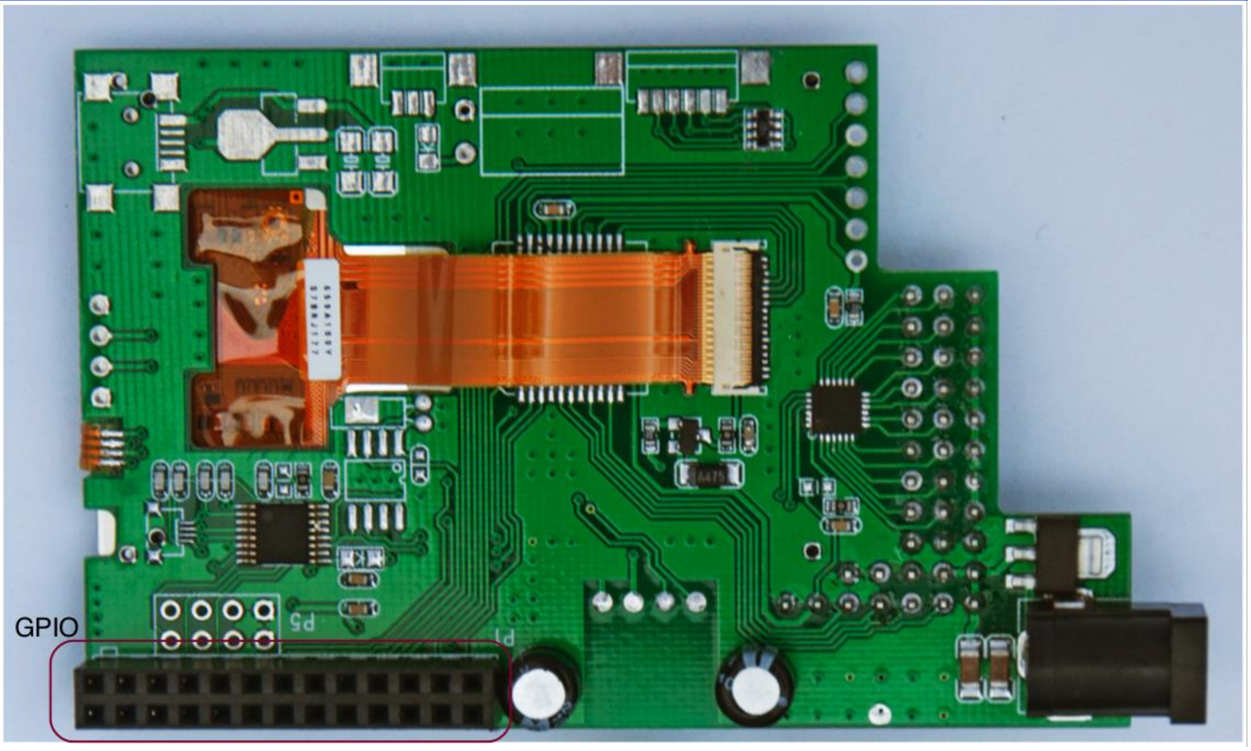


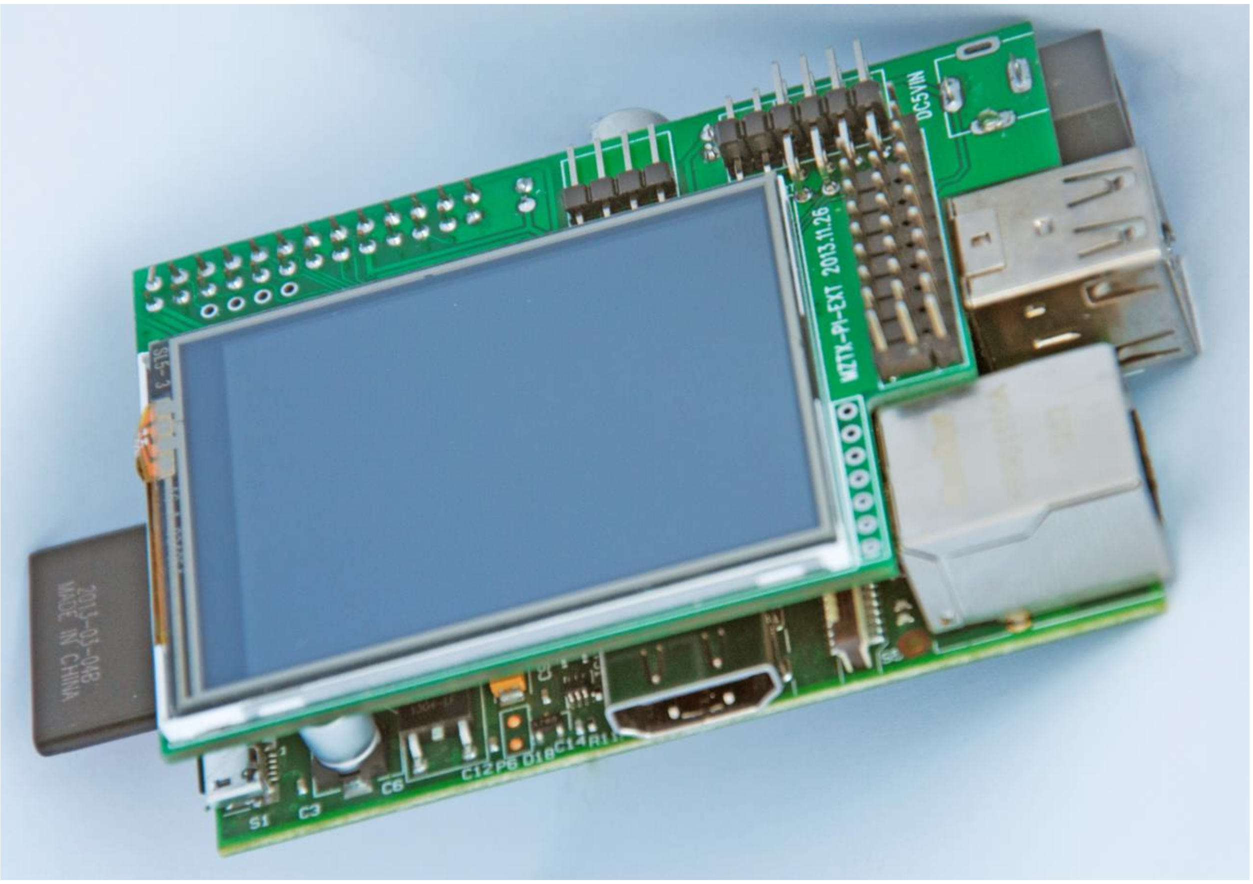

RCA VIDEO
AUDIO
LEDS
USB
LAN
GPIO
512MB RAM
CPU & GPU
HDMI
SD CARD
POWER

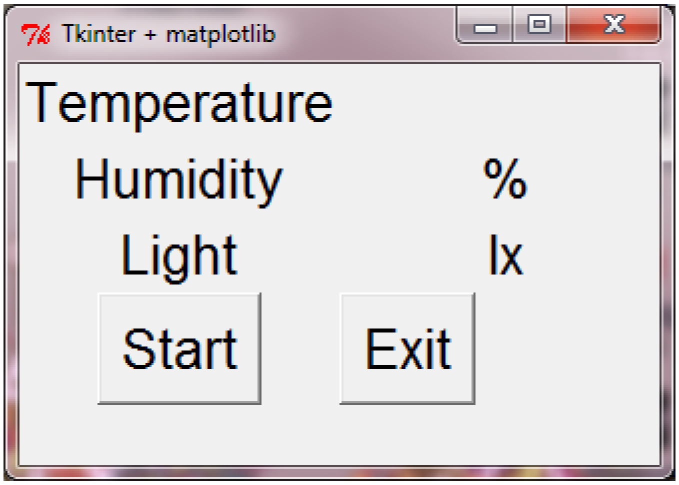

NOOBS v1.2.1 - Built: Jun 26 2013
Install OS
Edit config (e)
Online help (h)
Exit (Esc)
ARM
Archlinux
OpenELEC
Pidora
RISC OS
RaspBMC
Raspbian [RECOMMENDED]

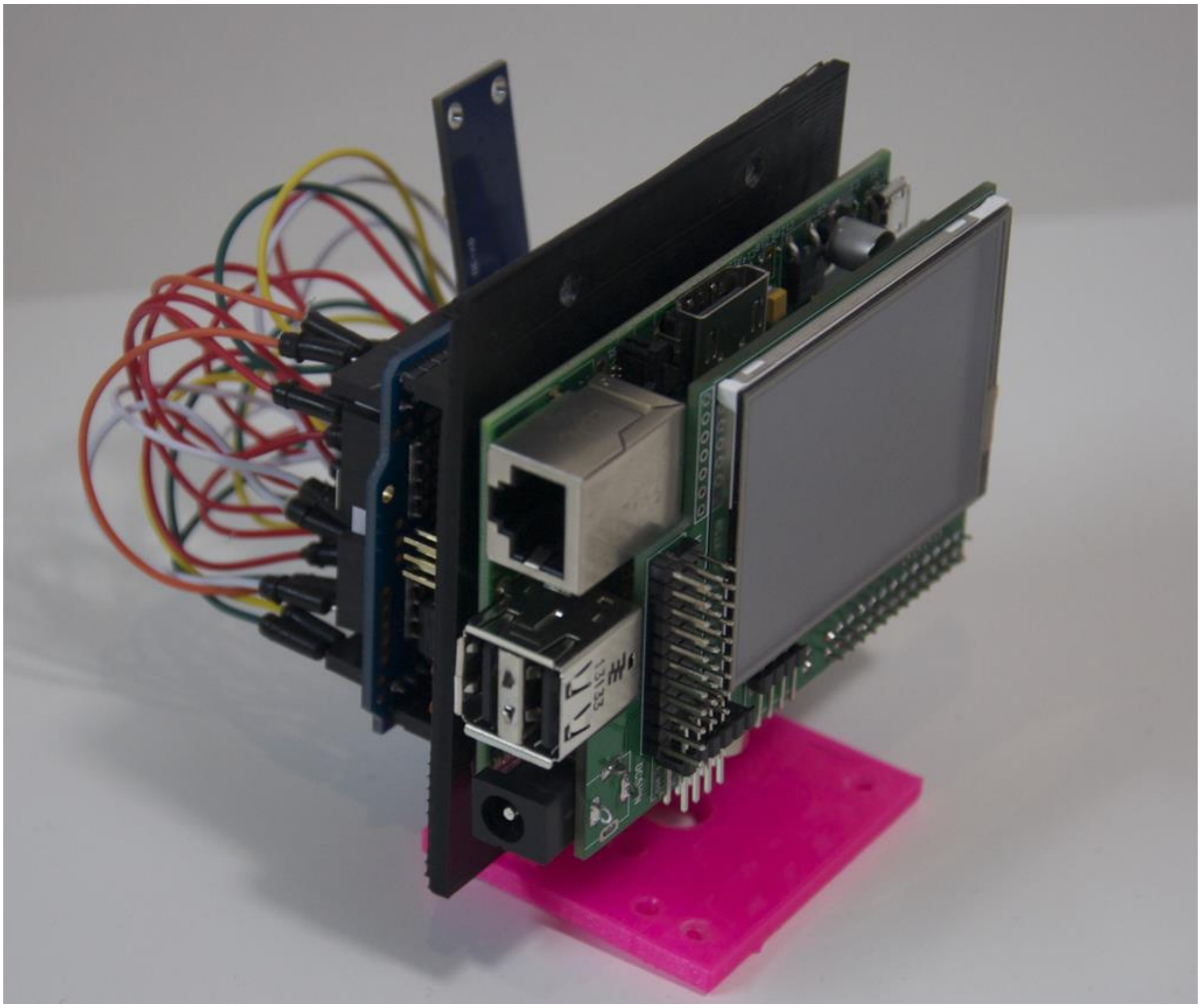


```
                    Raspberry Pi Software Configuration Tool (raspi-config)
Setup Options

             1 Expand Filesystem          Ensures that all of the SD card storage is available to the OS
             2 Change User Password       Change password for the default user (pi)
             3 Enable Boot to Desktop     Choose whether to boot into a desktop environment or the command-line
             4 Internationalisation Options Set up language and regional settings to match your location
             5 Enable Camera              Enable this Pi to work with the Raspberry Pi Camera
             6 Add to Rastrack            Add this Pi to the online Raspberry Pi Map (Rastrack)
             7 Overclock                  Configure overclocking for your Pi
             8 Advanced Options           Configure advanced settings
             9 About raspi-config         Information about this configuration tool

                        <Select>                                   <Finish>
```

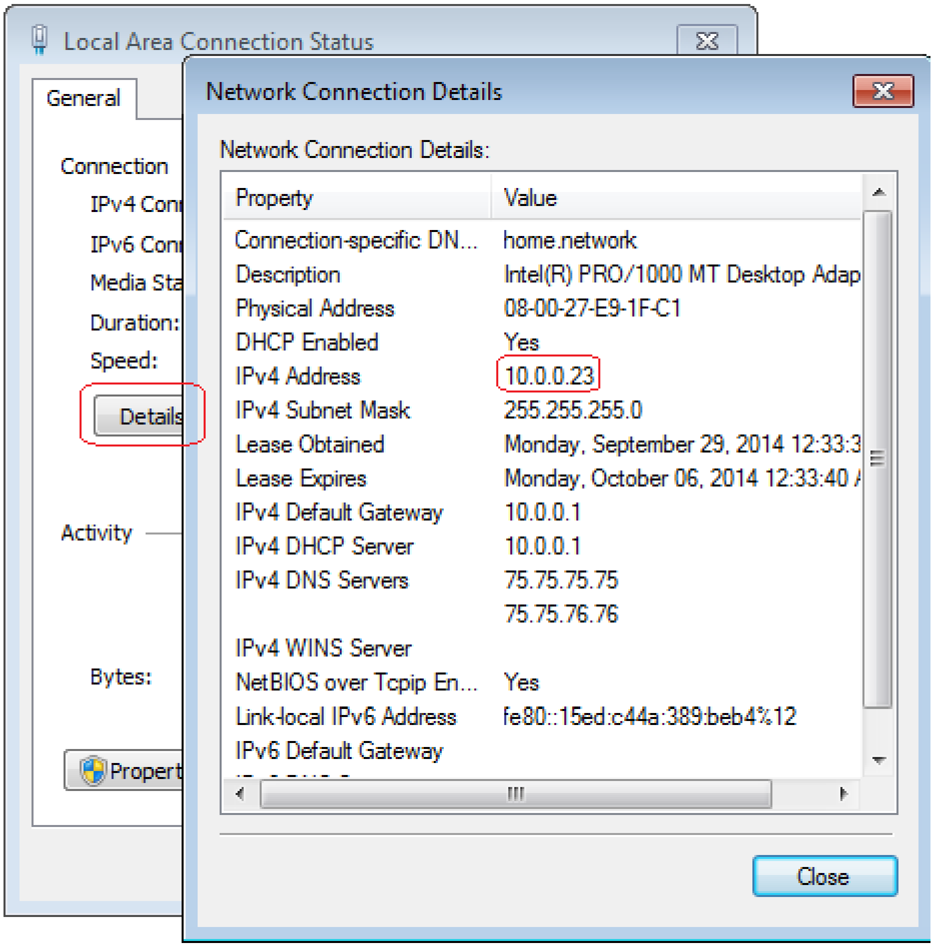



DC5VIN
MZTK-PI-EXT 2013.11.26
2013-03-04B
MADE IN CHINA
S1
C3
C6
C12
P6
D18
C14
R11

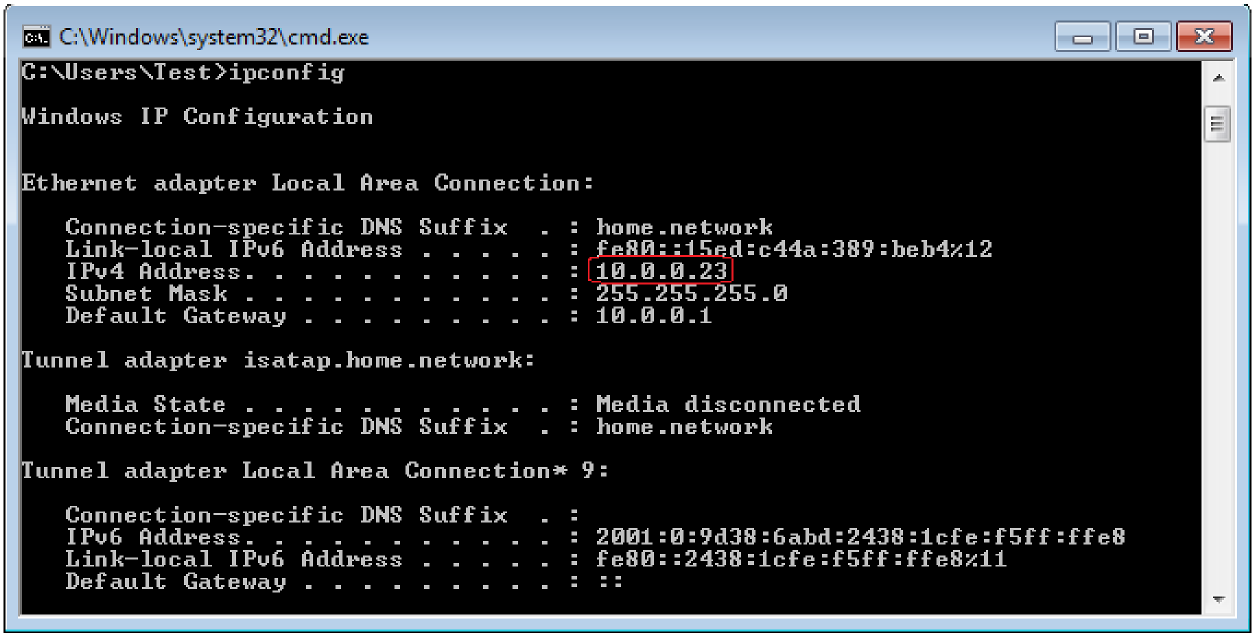

Tkinter + matplotlib
Temperature
Humidity
%
Light
lx
Start
Exit



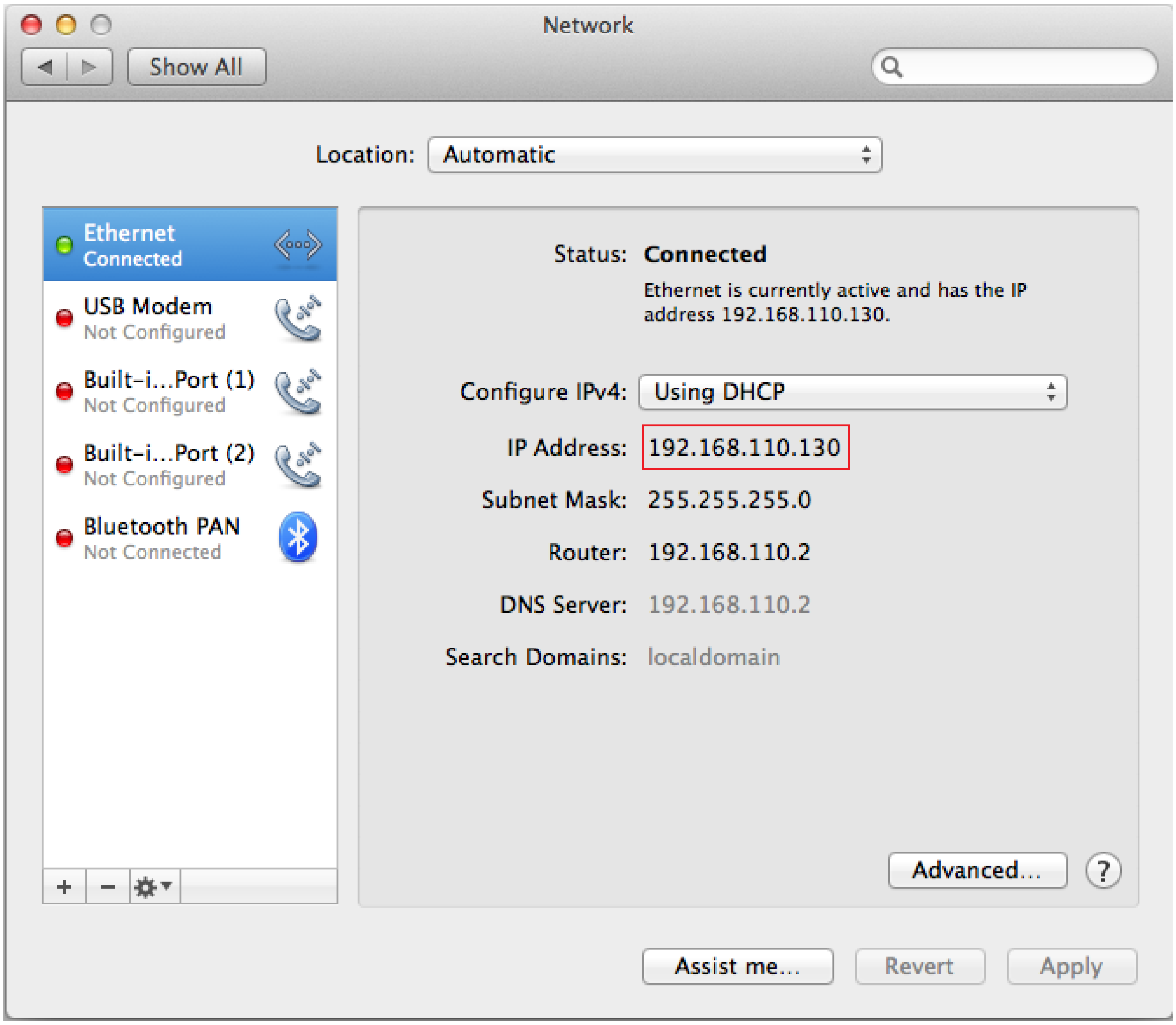
Chapter 8: Introduction to Arduino Networking



Property	Value
Connection-specific DN...	home.network
Description	Intel(R) PRO/1000 MT Desktop Adap
Physical Address	08-00-27-E9-1F-C1
DHCP Enabled	Yes
IPv4 Address	10.0.0.23
IPv4 Subnet Mask	255.255.255.0
Lease Obtained	Monday, September 29, 2014 12:33:3
Lease Expires	Monday, October 06, 2014 12:33:40 /
IPv4 Default Gateway	10.0.0.1
IPv4 DHCP Server	10.0.0.1
IPv4 DNS Servers	75.75.75.75 75.75.76.76
IPv4 WINS Server	
NetBIOS over Tcpip En...	Yes
Link-local IPv6 Address	fe80::15ed:c44a:389:beb4%12
IPv6 Default Gateway	



```
C:\Users\Test>ipconfig

Windows IP Configuration


Ethernet adapter Local Area Connection:

   Connection-specific DNS Suffix  . : home.network
   Link-local IPv6 Address . . . . . : fe80::15ed:c44a:389:beb4%12
   IPv4 Address. . . . . . . . . . . : 10.0.0.23
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : 10.0.0.1

Tunnel adapter isatap.home.network:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . : home.network

Tunnel adapter Local Area Connection* 9:

   Connection-specific DNS Suffix  . :
   IPv6 Address. . . . . . . . . . . : 2001:0:9d38:6abd:2438:1cfe:f5ff:ffe8
   Link-local IPv6 Address . . . . . : fe80::2438:1cfe:f5ff:ffe8%11
   Default Gateway . . . . . . . . . : ::
```



Location: Automatic

Status: **Connected**

Ethernet is currently active and has the IP address 192.168.110.130.

Configure IPv4: Using DHCP

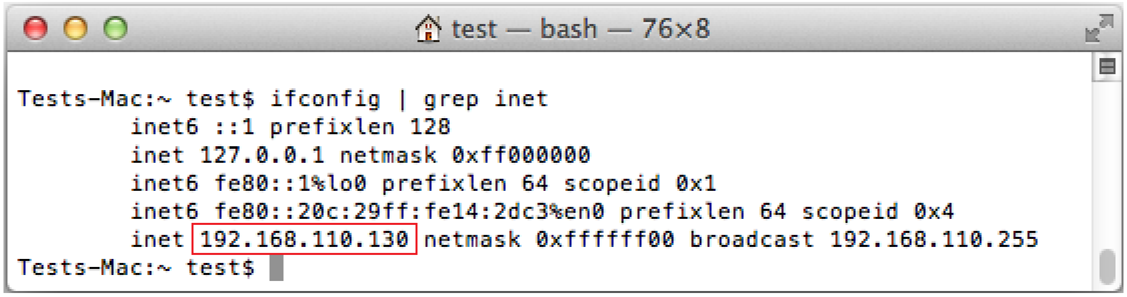
IP Address: 192.168.110.130

Subnet Mask: 255.255.255.0

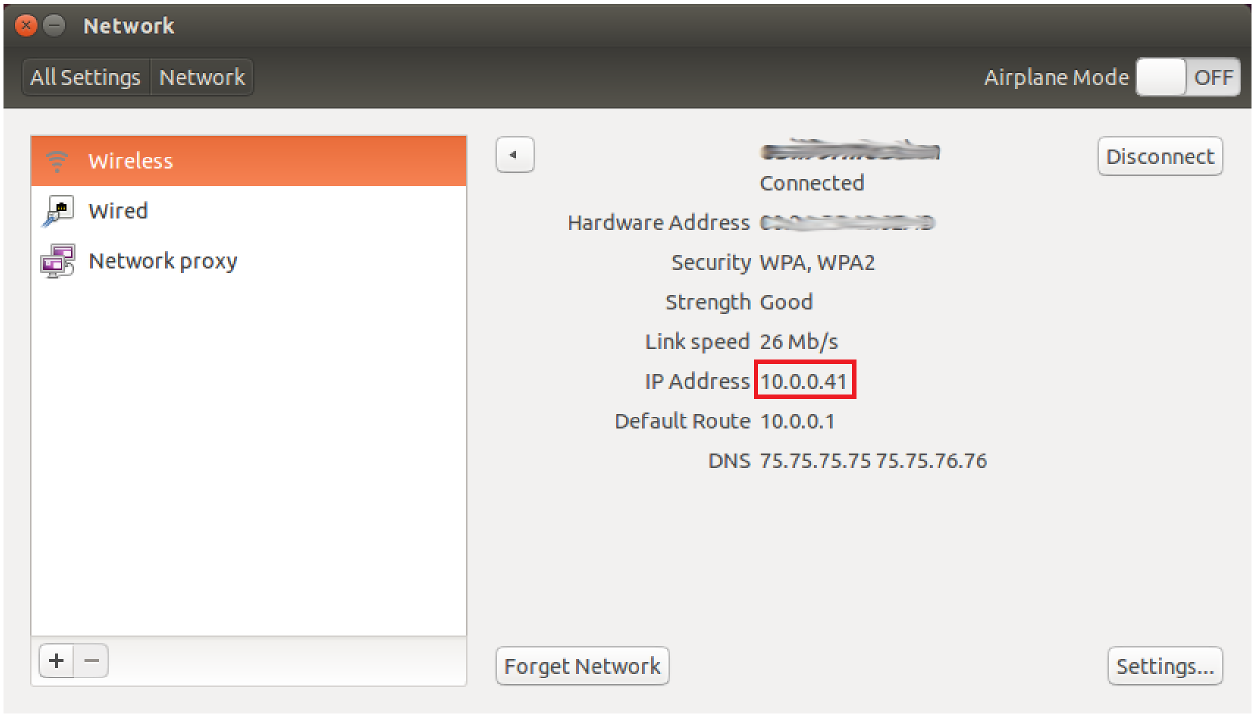
Router: 192.168.110.2

DNS Server: 192.168.110.2

Search Domains: localdomain

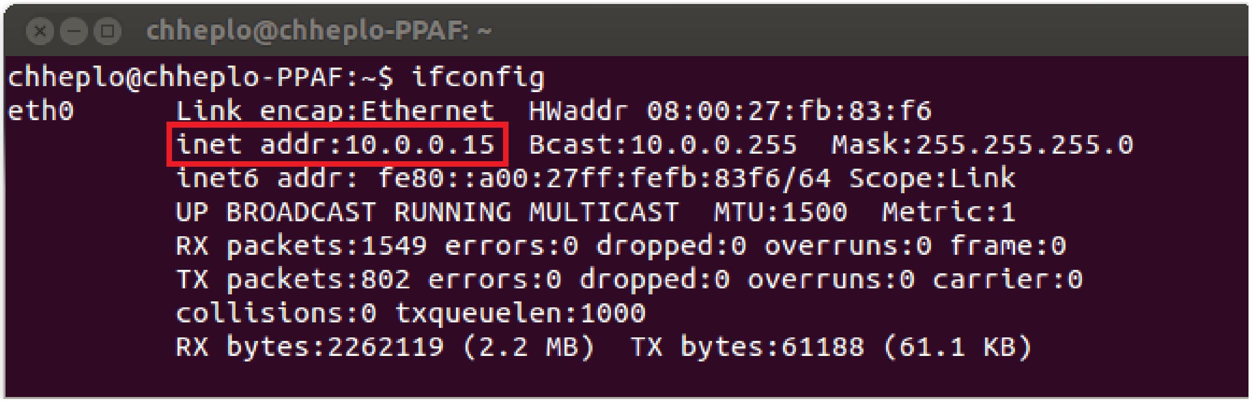


```
Tests-Mac:~ test$ ifconfig | grep inet
        inet6 ::1 prefixlen 128
        inet 127.0.0.1 netmask 0xff000000
        inet6 fe80::1%lo0 prefixlen 64 scopeid 0x1
        inet6 fe80::20c:29ff:fe14:2dc3%en0 prefixlen 64 scopeid 0x4
        inet 192.168.110.130 netmask 0xffffff00 broadcast 192.168.110.255
Tests-Mac:~ test$ 
```

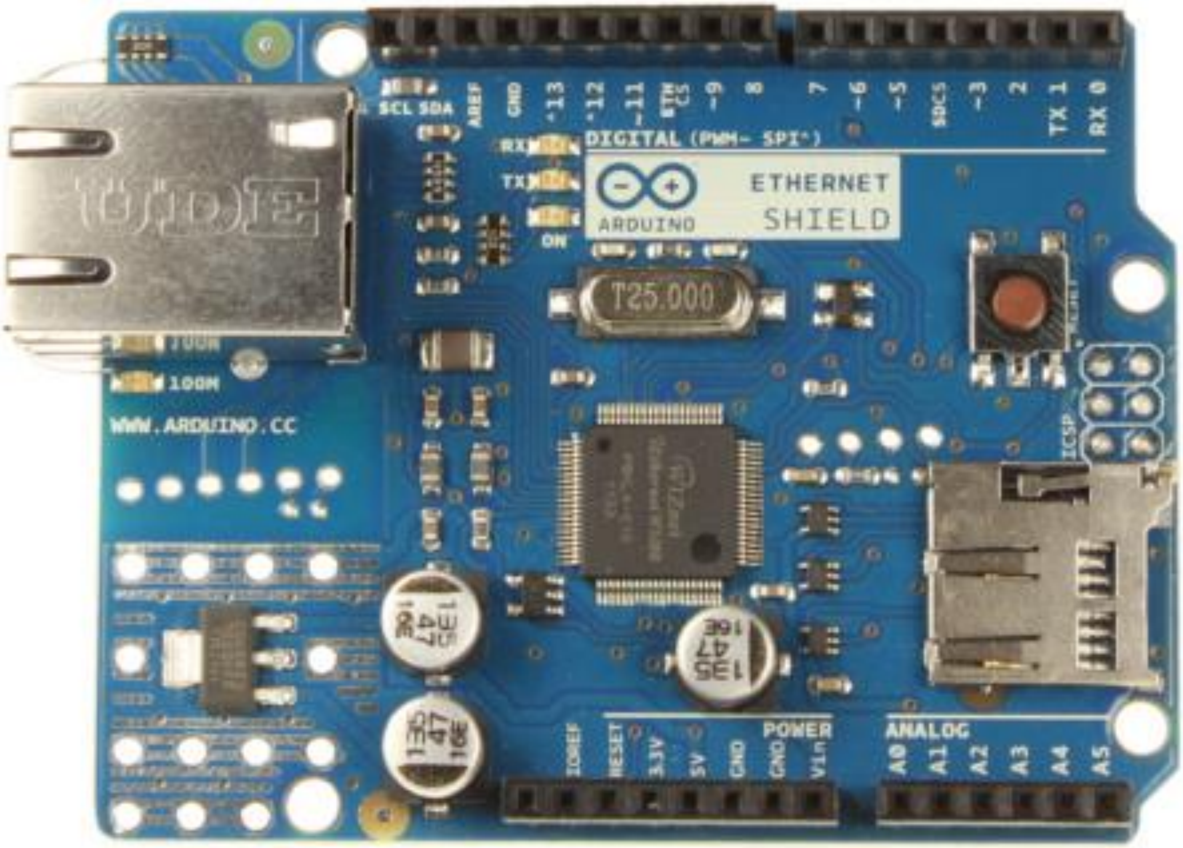


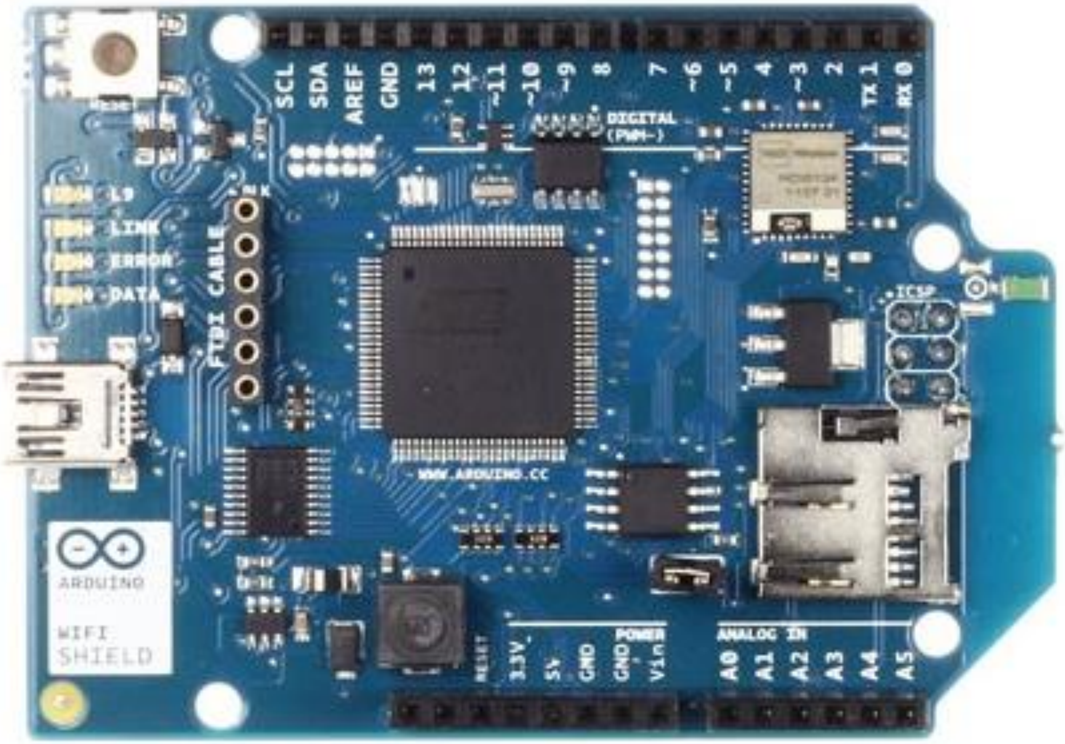
[redacted]
Connected

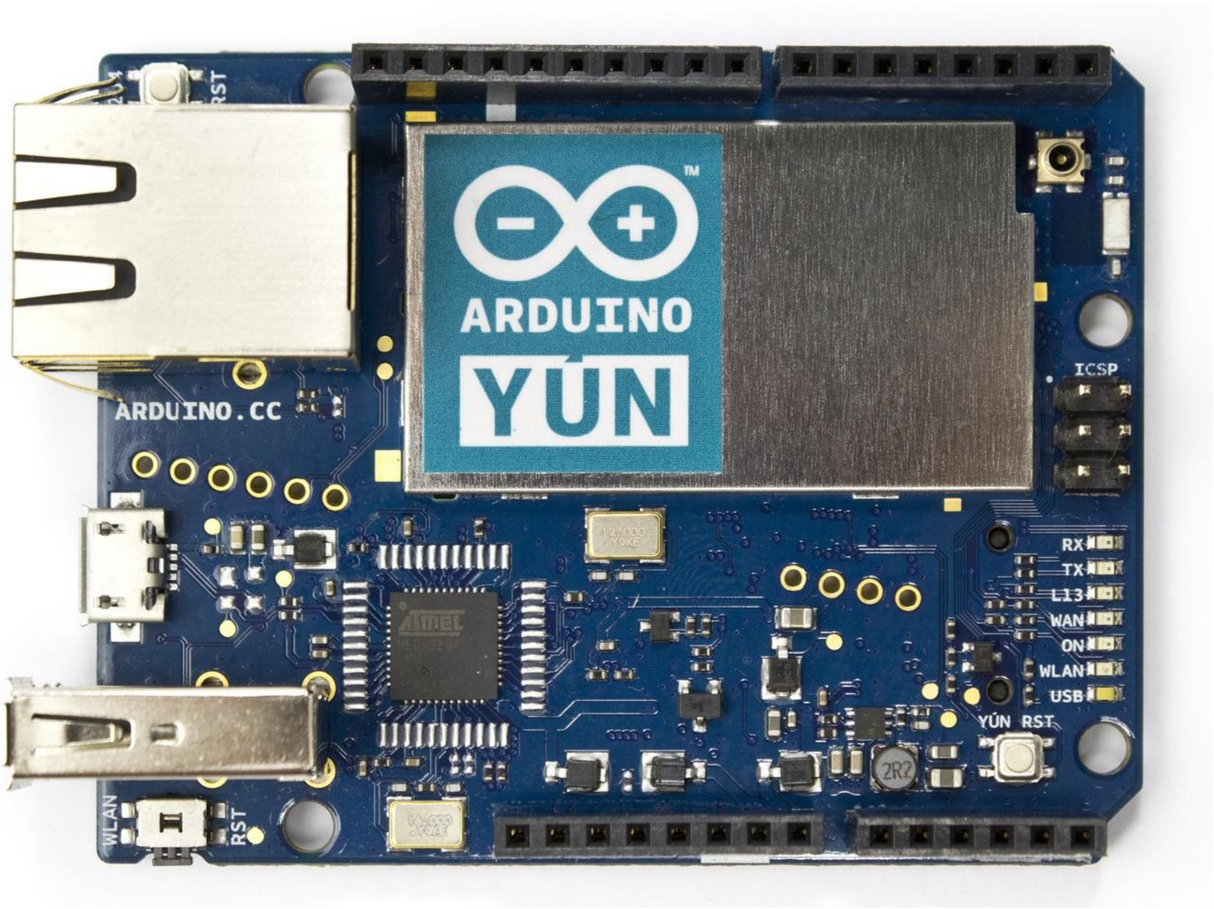
Hardware Address [redacted]
Security WPA, WPA2
Strength Good
Link speed 26 Mb/s
IP Address 10.0.0.41
Default Route 10.0.0.1
DNS 75.75.75.75 75.75.76.76



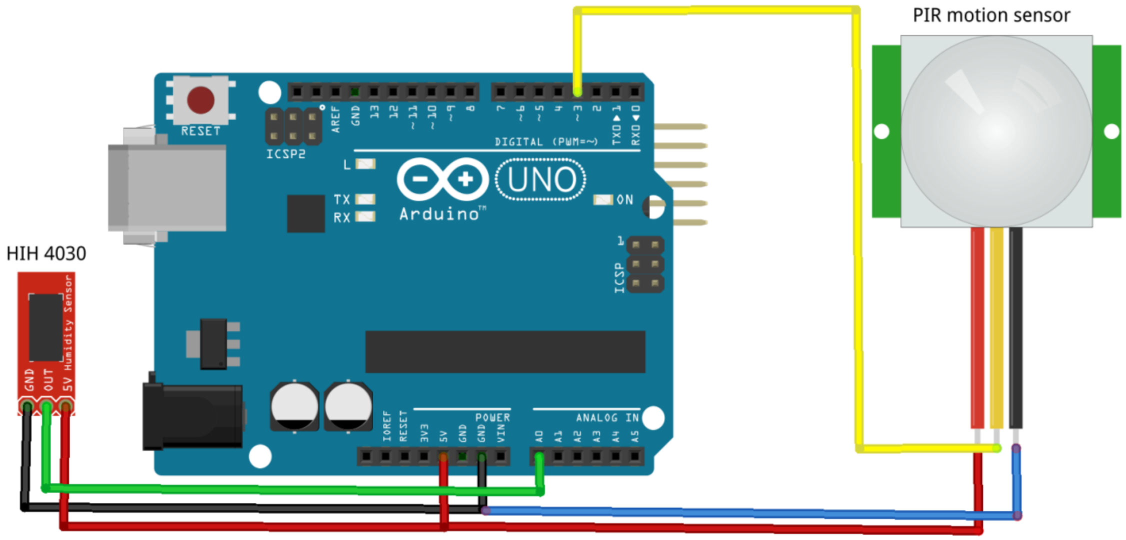
```
chheplo@chheplo-PPAF:~$ ifconfig
eth0      Link encap:Ethernet  HWaddr 08:00:27:fb:83:f6
          inet addr:10.0.0.15  Bcast:10.0.0.255  Mask:255.255.255.0
          inet6 addr: fe80::a00:27ff:fefb:83f6/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:1549 errors:0 dropped:0 overruns:0 frame:0
          TX packets:802 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:2262119 (2.2 MB)  TX bytes:61188 (61.1 KB)
```


ARDUINO
ETHERNET
SHIELD
DIGITAL (PWM~ SPI*)
POWER
ANALOG
WWW.ARDUINO.CC
ICSP

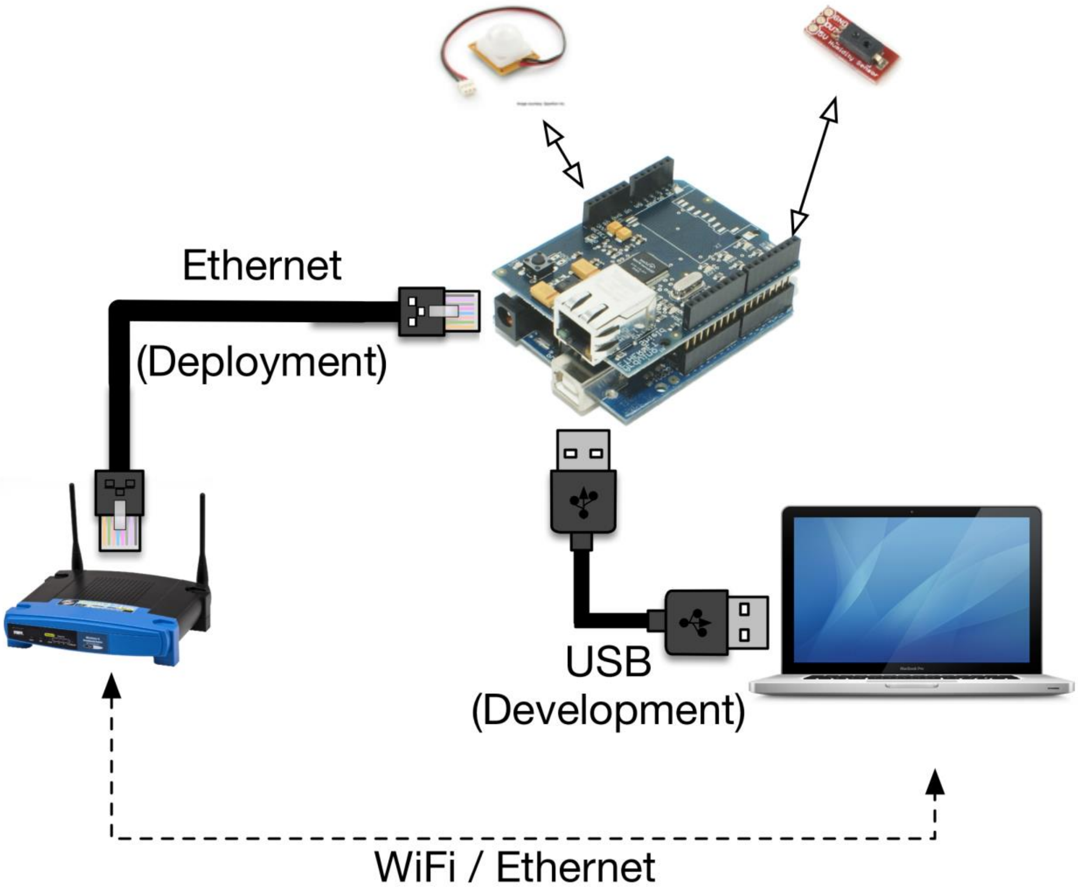

ARDUINO
WIFI
SHIELD
DIGITAL (PWM~)
FTDI CABLE
L9
LINK
ERROR
DATA
POWER
ANALOG IN
ICSP
WWW.ARDUINO.CC



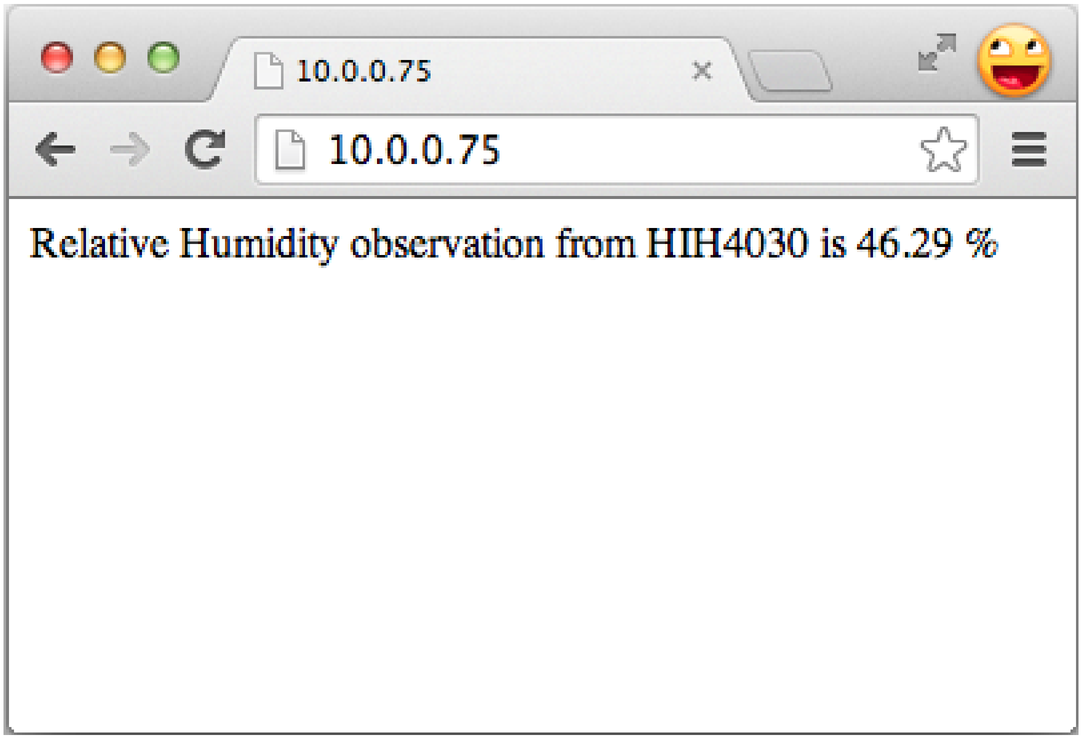
ARDUINO
YÚN
ARDUINO.CC
RST
ICSP
RX
TX
L13
WAN
ON
WLAN
USB
YÚN RST
WLAN
RST



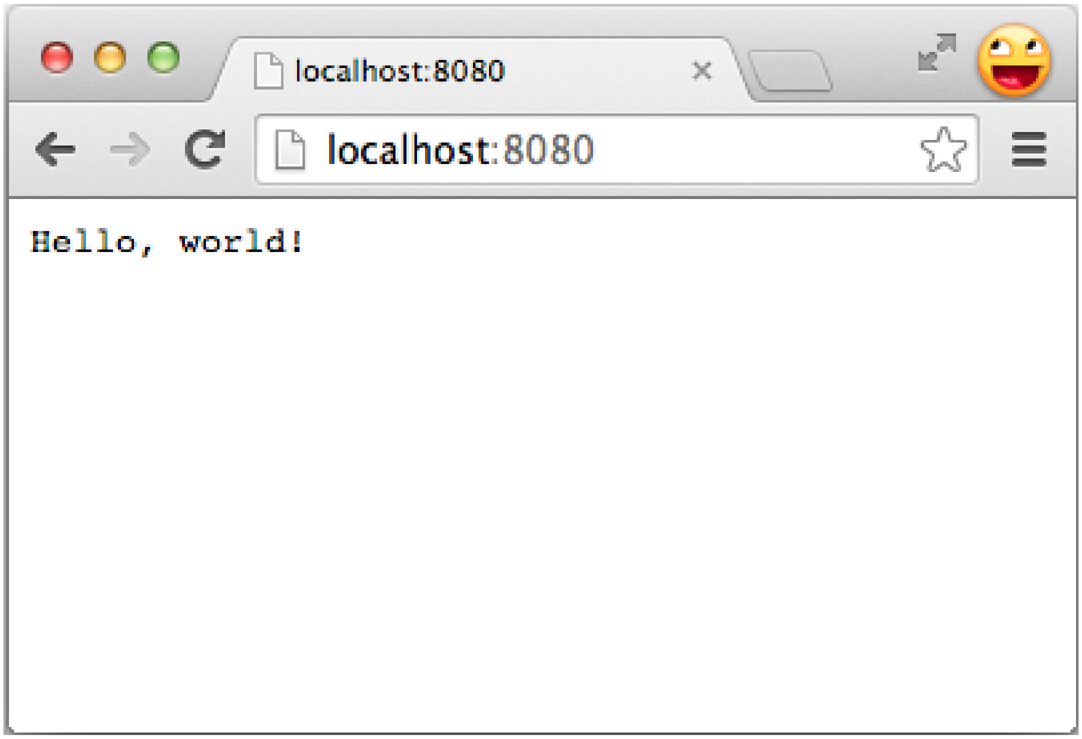
PIR motion sensor
HIH 4030
RESET
ICSP2
AREF
GND
13
12
~11
~10
~9
8
7
~6
~5
4
~3
2
TX▶1
RX◀0
DIGITAL (PWM=~)
L
TX
RX
UNO
Arduino
ON
ICSP
1
GND
OUT
5V
Humidity Sensor
IOREF
RESET
3V3
5V
GND
GND
VIN
POWER
ANALOG IN
A0
A1
A2
A3
A4
A5



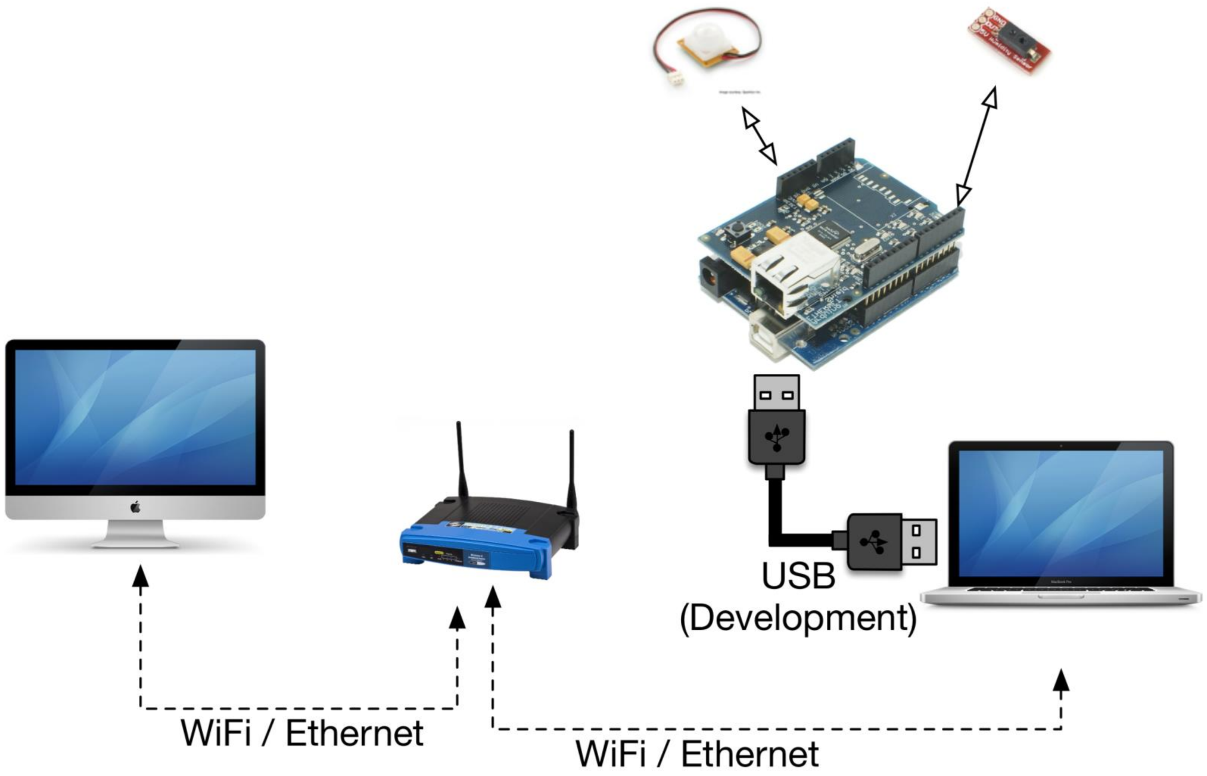
Ethernet
(Deployment)
USB
(Development)
WiFi / Ethernet

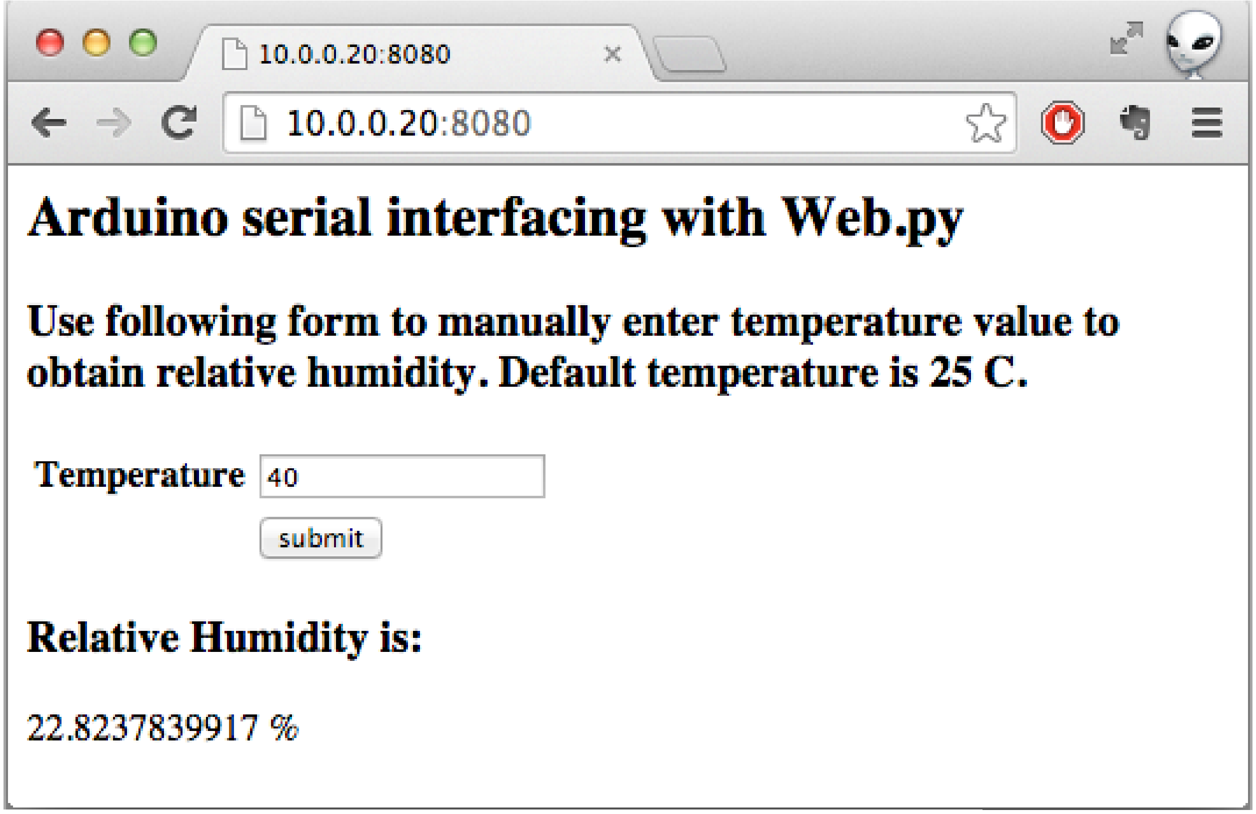


Relative Humidity observation from HIH4030 is 46.29 %



```
Hello, world!
```


USB
(Development)
WiFi / Ethernet
WiFi / Ethernet



Arduino serial interfacing with Web.py

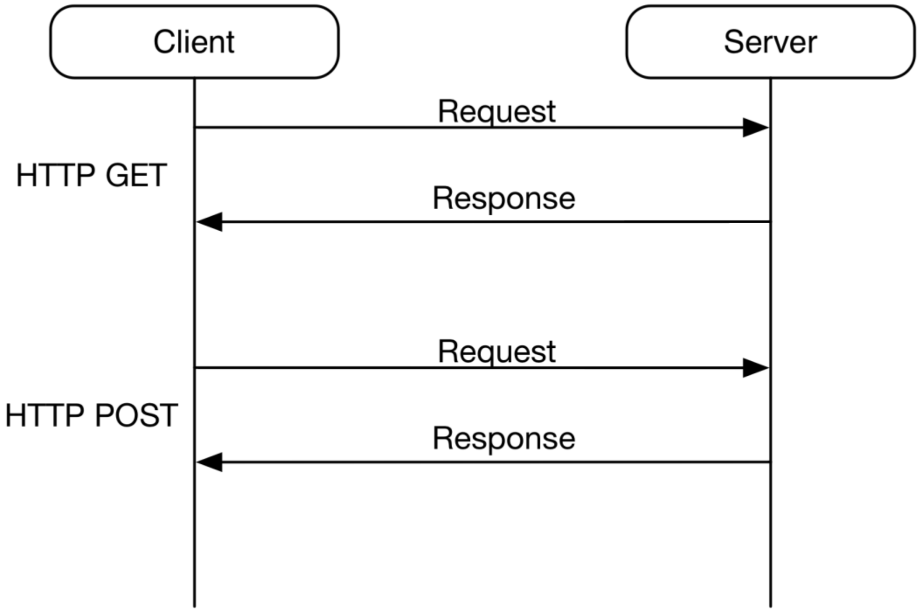
Use following form to manually enter temperature value to obtain relative humidity. Default temperature is 25 C.

Temperature 40

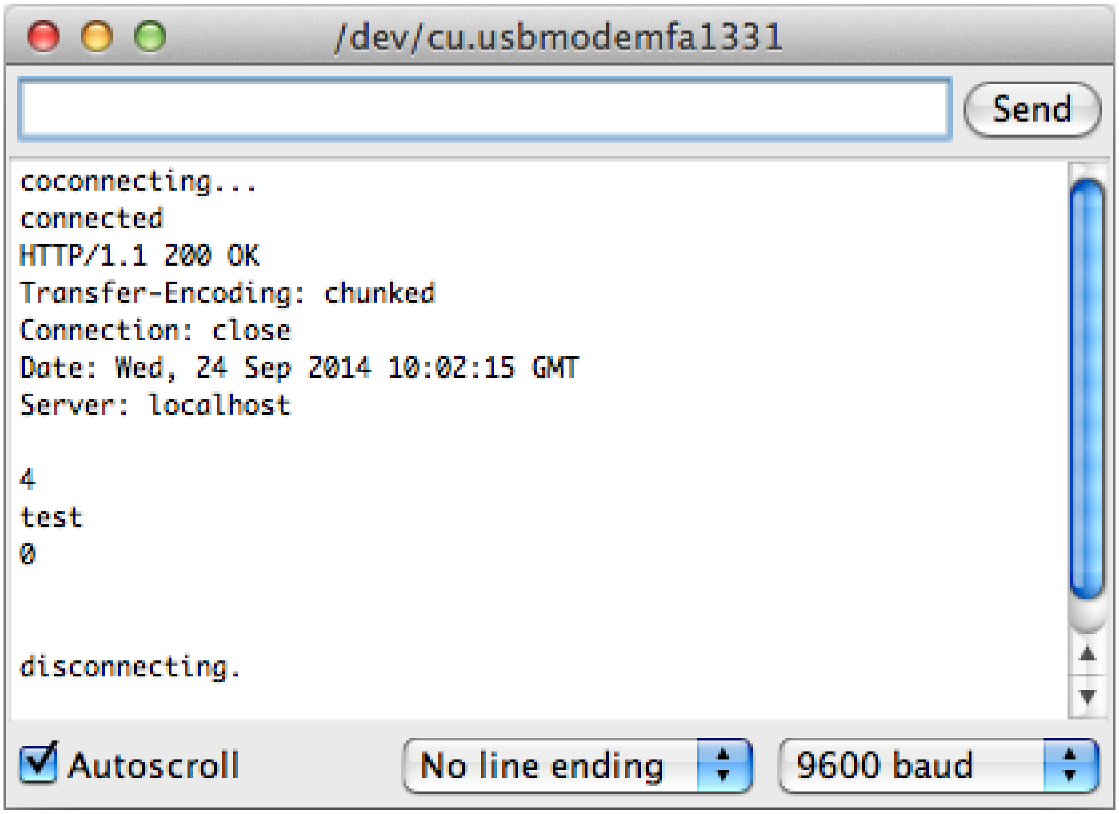
submit

Relative Humidity is:

22.8237839917 %

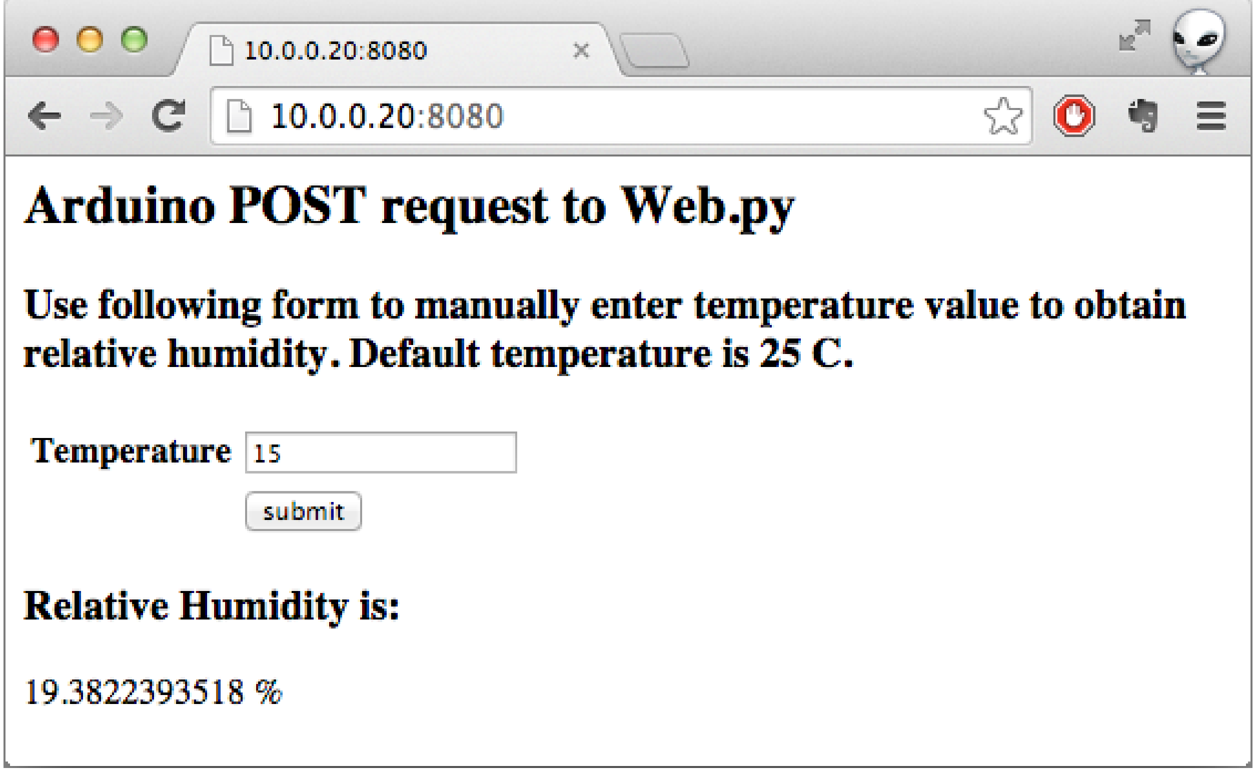


REST architecture



```
coconnecting...
connected
HTTP/1.1 200 OK
Transfer-Encoding: chunked
Connection: close
Date: Wed, 24 Sep 2014 10:02:15 GMT
Server: localhost

4
test
0


disconnecting.
```

☑ Autoscroll No line ending 9600 baud



Arduino POST request to Web.py

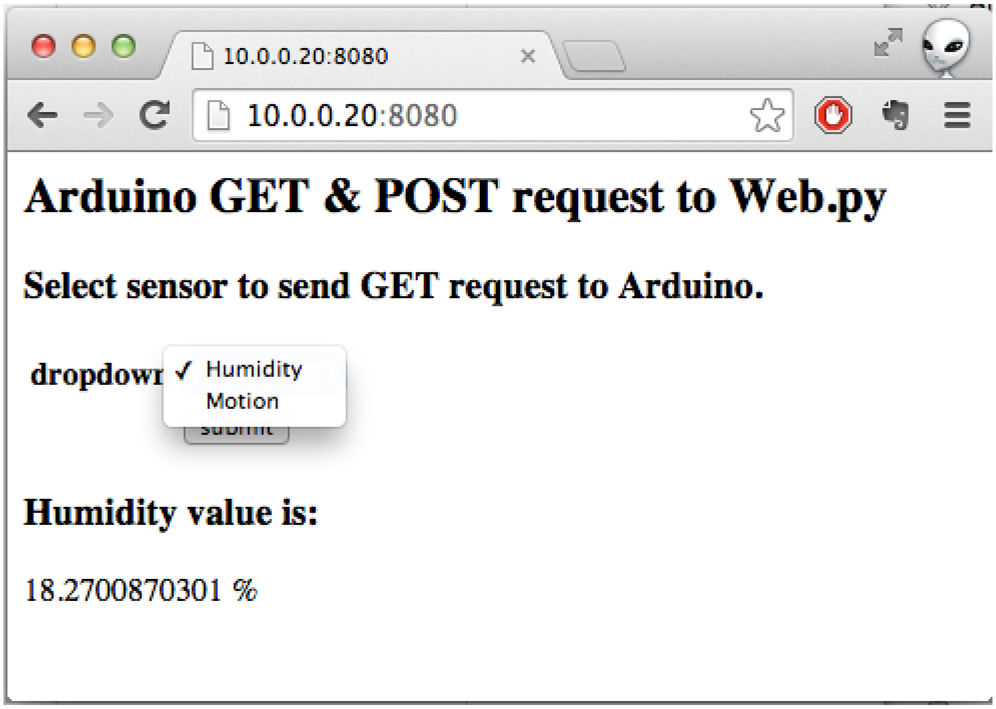
Use following form to manually enter temperature value to obtain relative humidity. Default temperature is 25 C.

Temperature 15

submit

Relative Humidity is:

19.3822393518 %



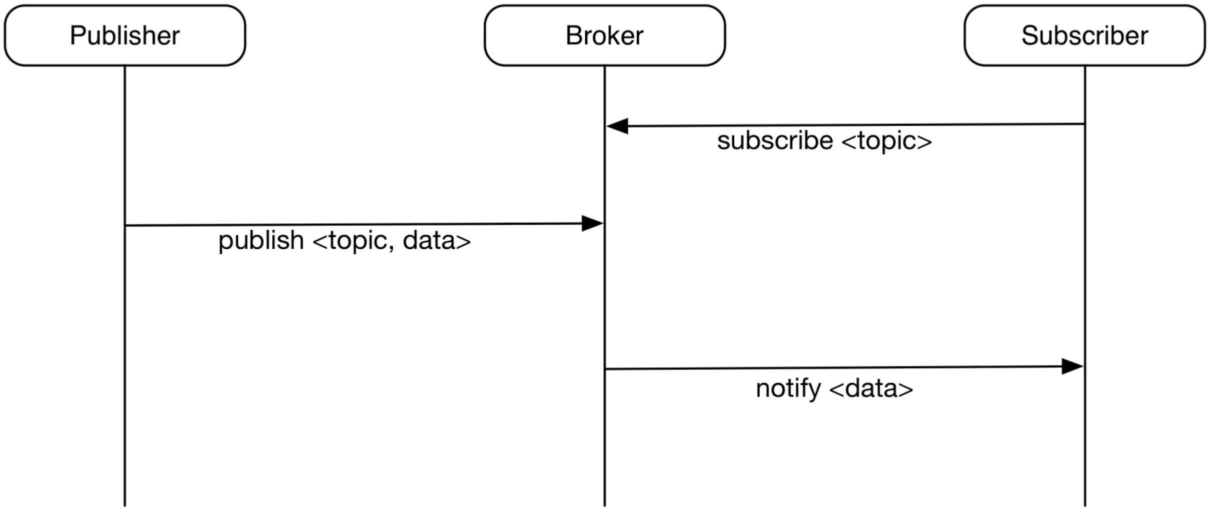
Arduino GET & POST request to Web.py

Select sensor to send GET request to Arduino.

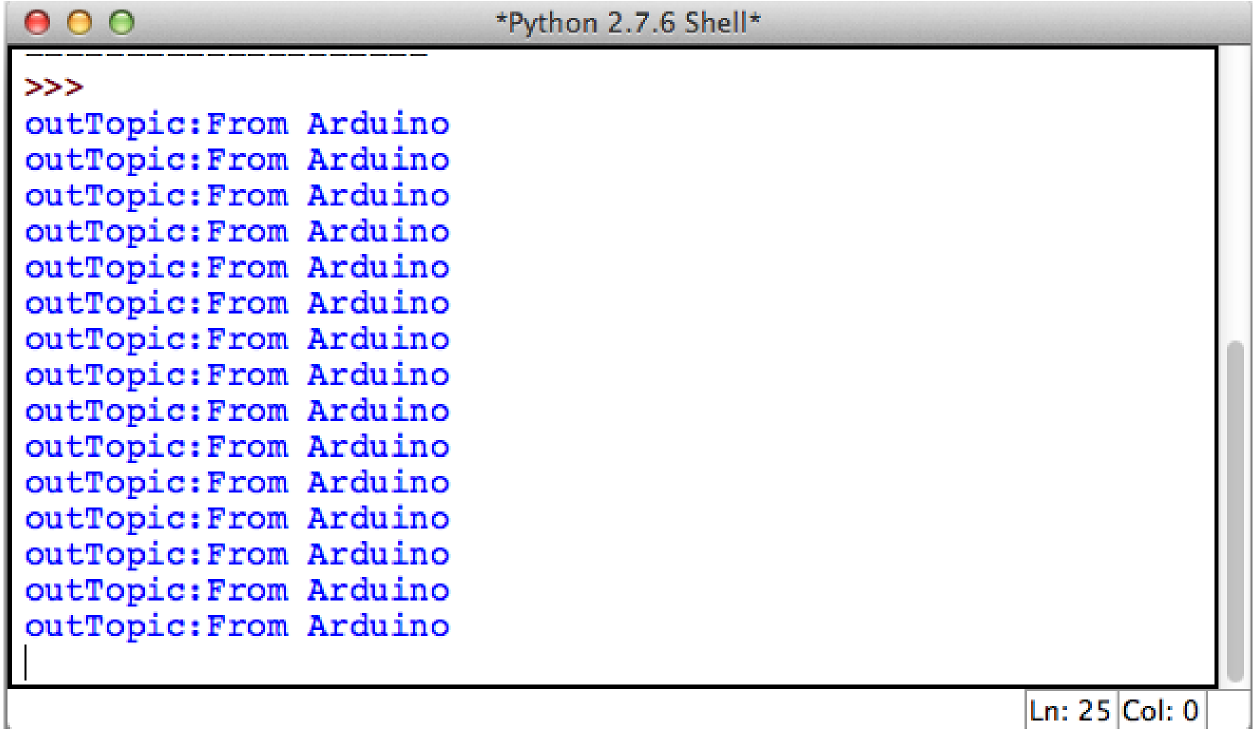
dropdowr

Humidity value is:

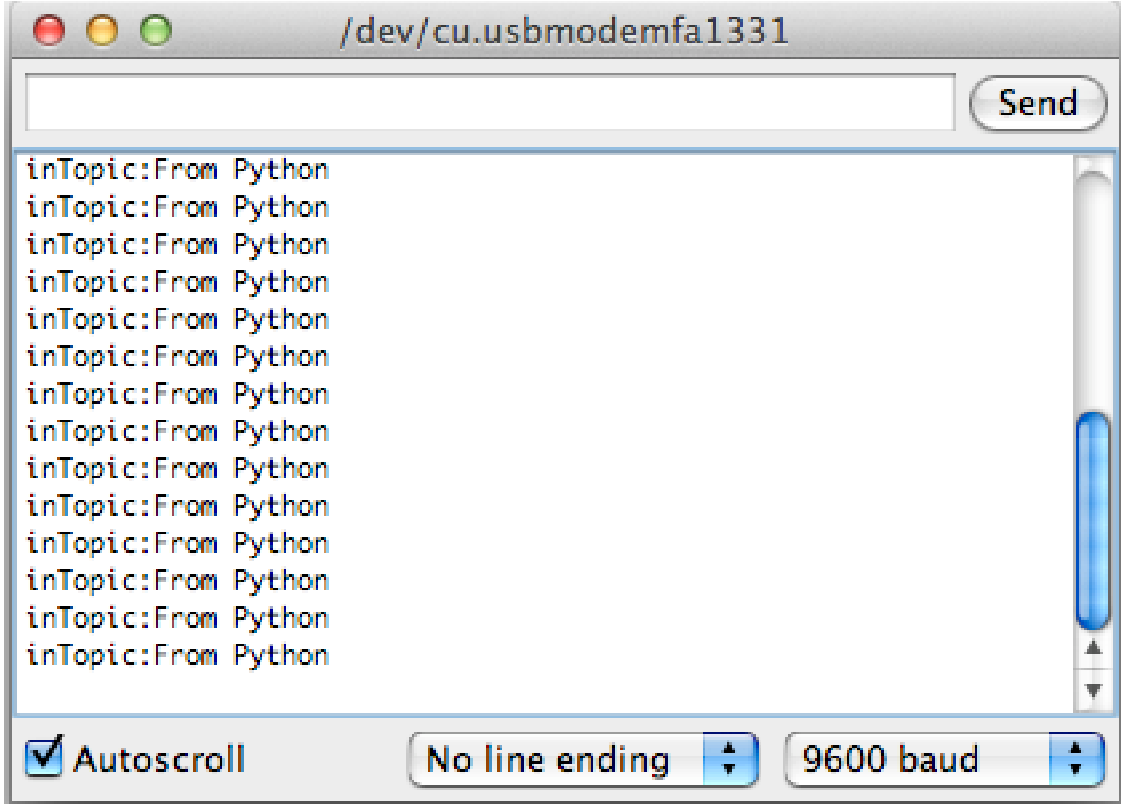
18.2700870301 %



Publisher-Subscriber architecture

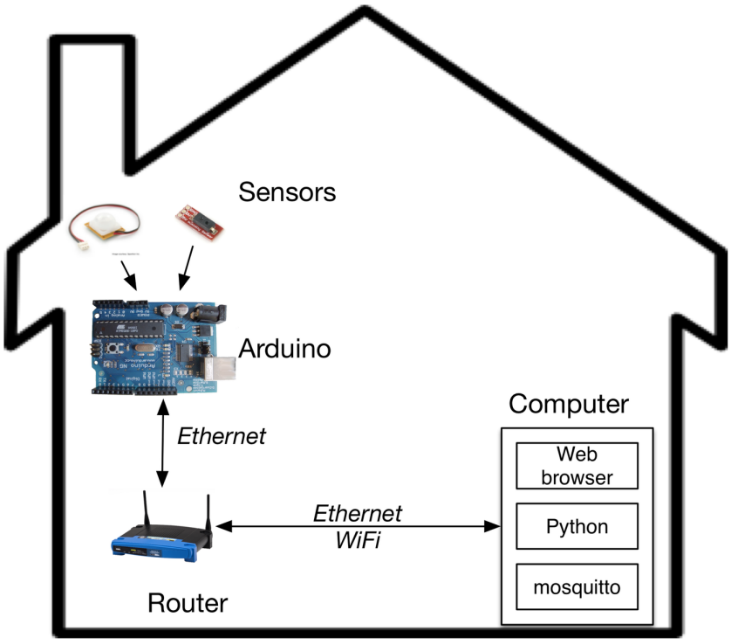


```
====================
>>>
outTopic:From Arduino
outTopic:From Arduino
outTopic:From Arduino
outTopic:From Arduino
outTopic:From Arduino
outTopic:From Arduino
outTopic:From Arduino
outTopic:From Arduino
outTopic:From Arduino
outTopic:From Arduino
outTopic:From Arduino
outTopic:From Arduino
outTopic:From Arduino
outTopic:From Arduino
outTopic:From Arduino
```

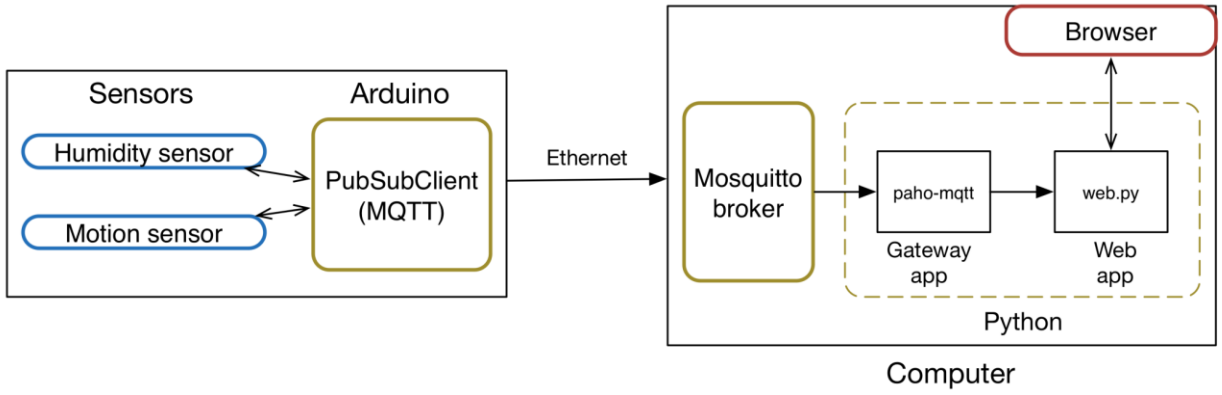


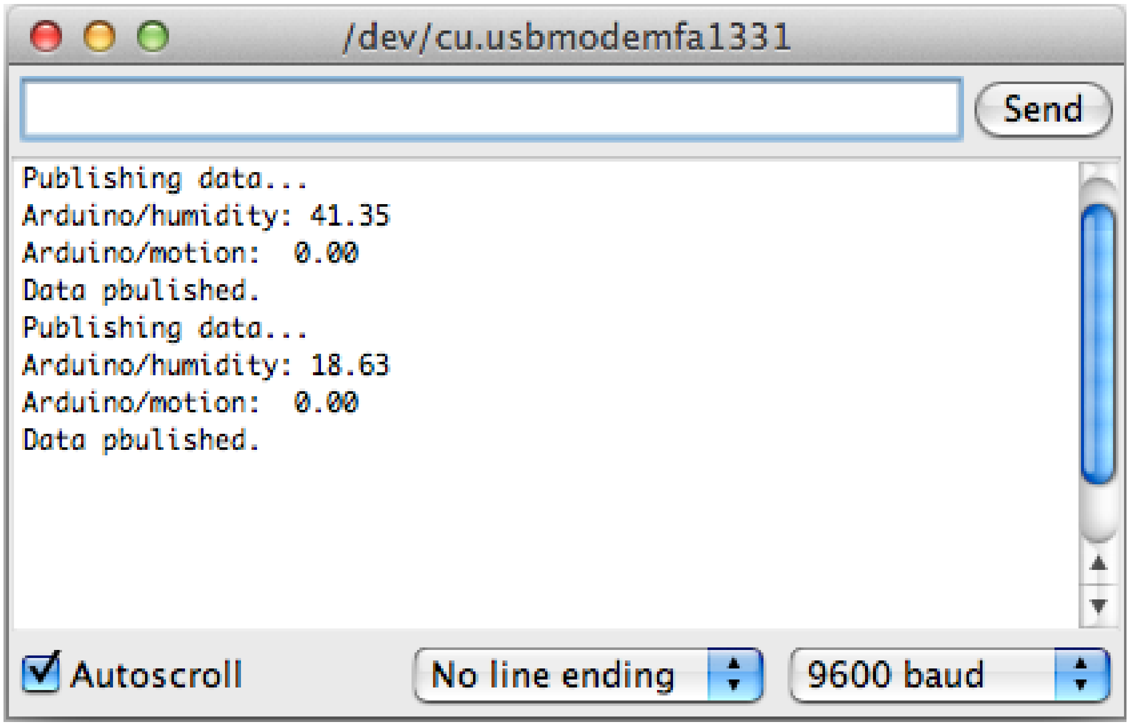
```
inTopic:From Python
inTopic:From Python
inTopic:From Python
inTopic:From Python
inTopic:From Python
inTopic:From Python
inTopic:From Python
inTopic:From Python
inTopic:From Python
inTopic:From Python
inTopic:From Python
inTopic:From Python
inTopic:From Python
inTopic:From Python
```

☑ Autoscroll
No line ending
9600 baud



System Architecture



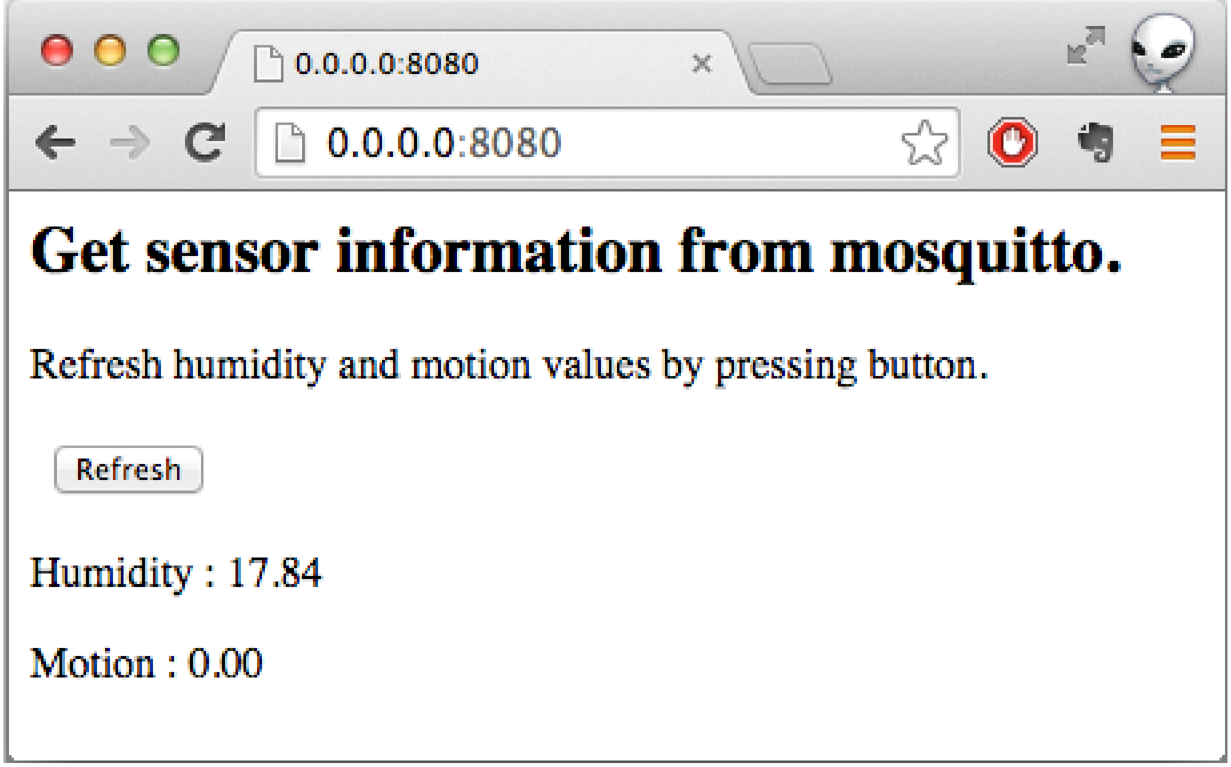


```
Publishing data...
Arduino/humidity: 41.35
Arduino/motion:  0.00
Data pbulished.
Publishing data...
Arduino/humidity: 18.63
Arduino/motion:  0.00
Data pbulished.
```

☑ Autoscroll

No line ending

9600 baud



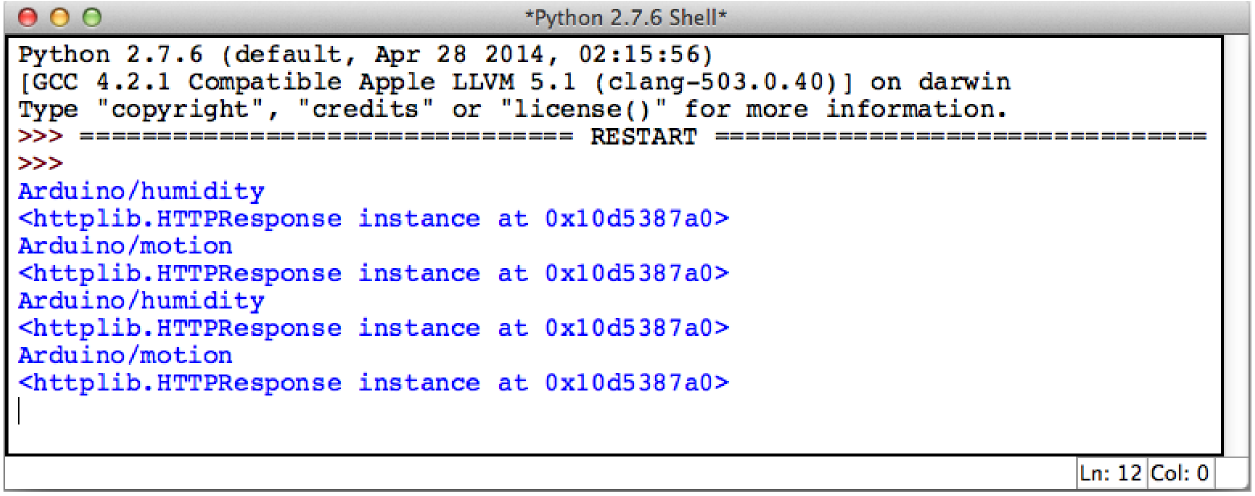
Get sensor information from mosquitto.

Refresh humidity and motion values by pressing button.

Refresh

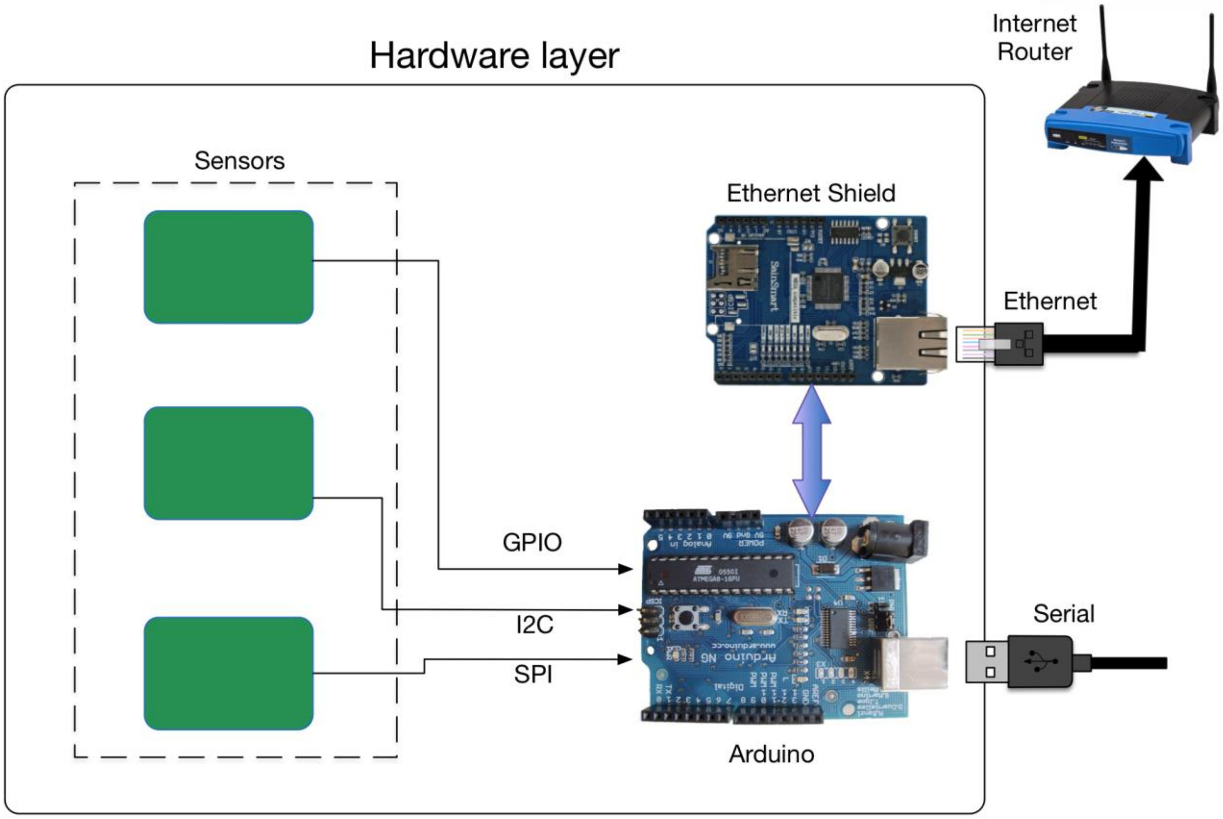
Humidity : 17.84

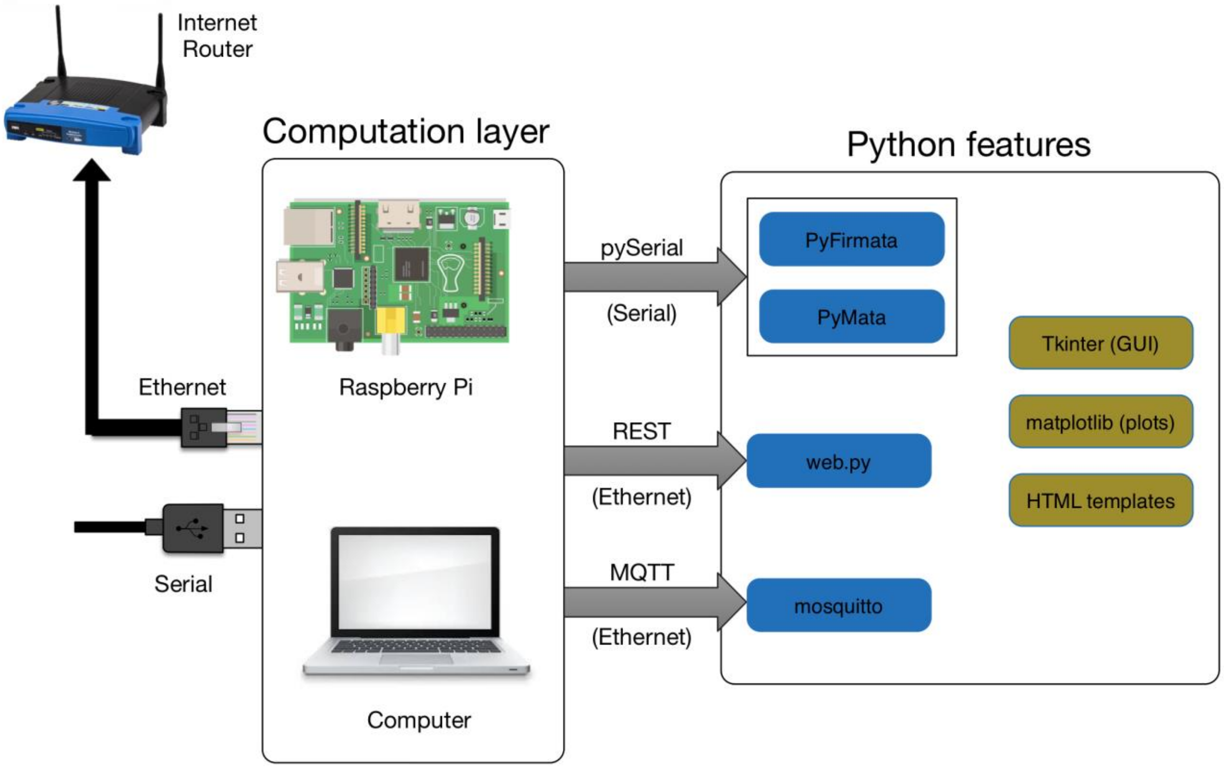
Motion : 0.00

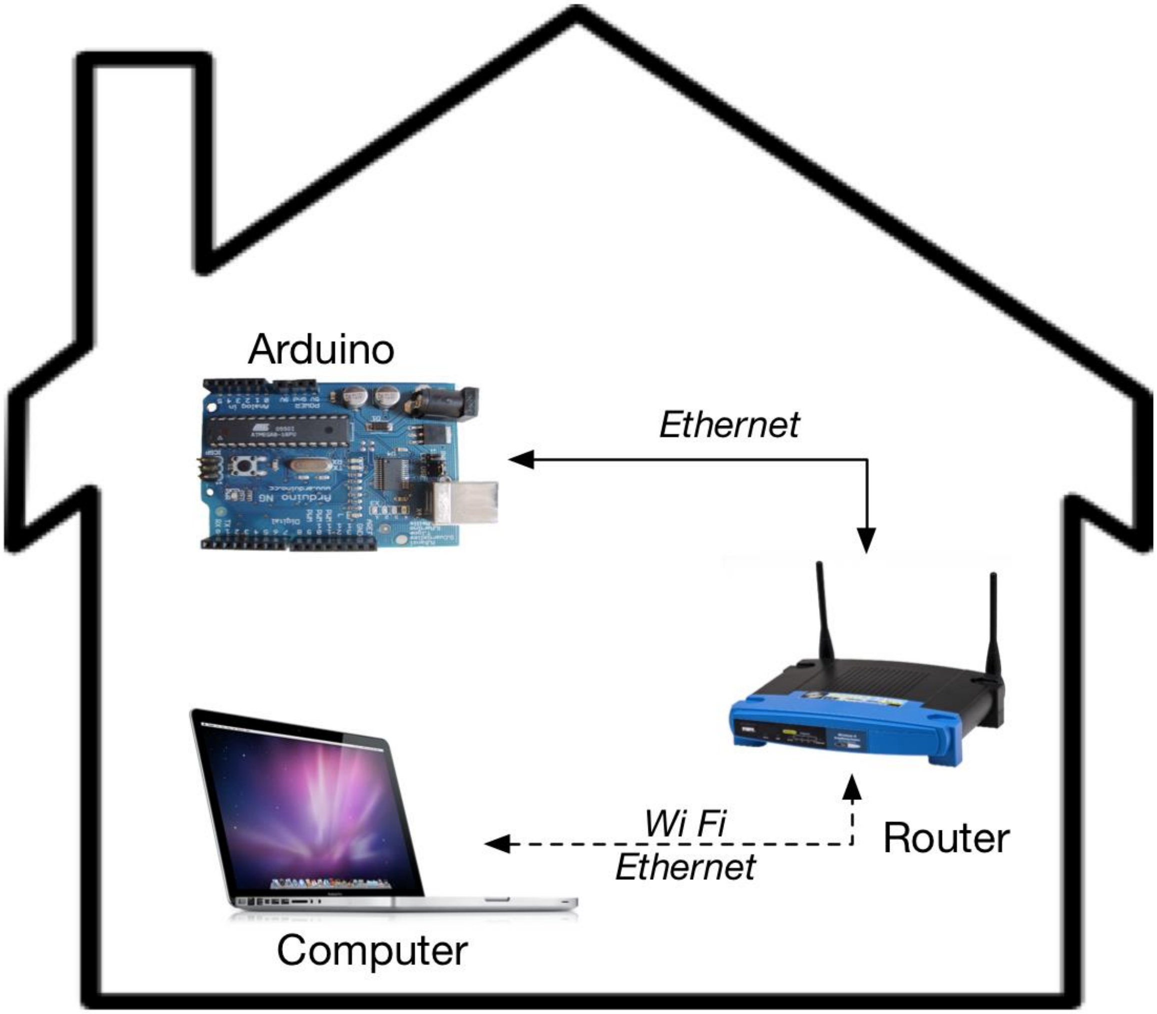


```
Python 2.7.6 (default, Apr 28 2014, 02:15:56)
[GCC 4.2.1 Compatible Apple LLVM 5.1 (clang-503.0.40)] on darwin
Type "copyright", "credits" or "license()" for more information.
>>> ================================ RESTART ================================
>>>
Arduino/humidity
<httplib.HTTPResponse instance at 0x10d5387a0>
Arduino/motion
<httplib.HTTPResponse instance at 0x10d5387a0>
Arduino/humidity
<httplib.HTTPResponse instance at 0x10d5387a0>
Arduino/motion
<httplib.HTTPResponse instance at 0x10d5387a0>
```

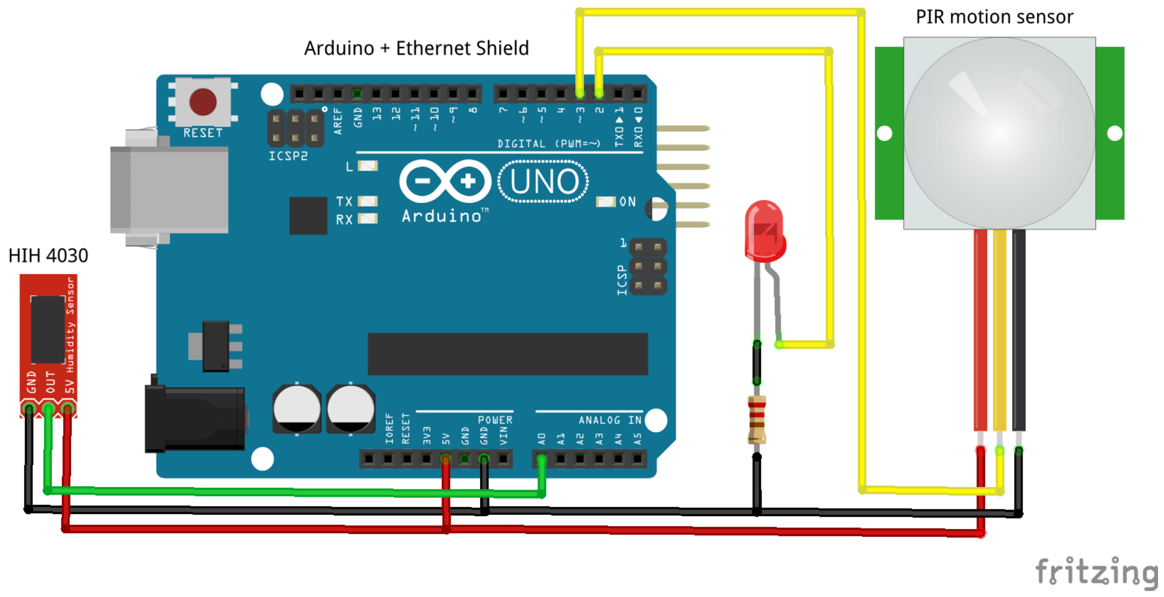
Chapter 9: Arduino and the Internet of Things

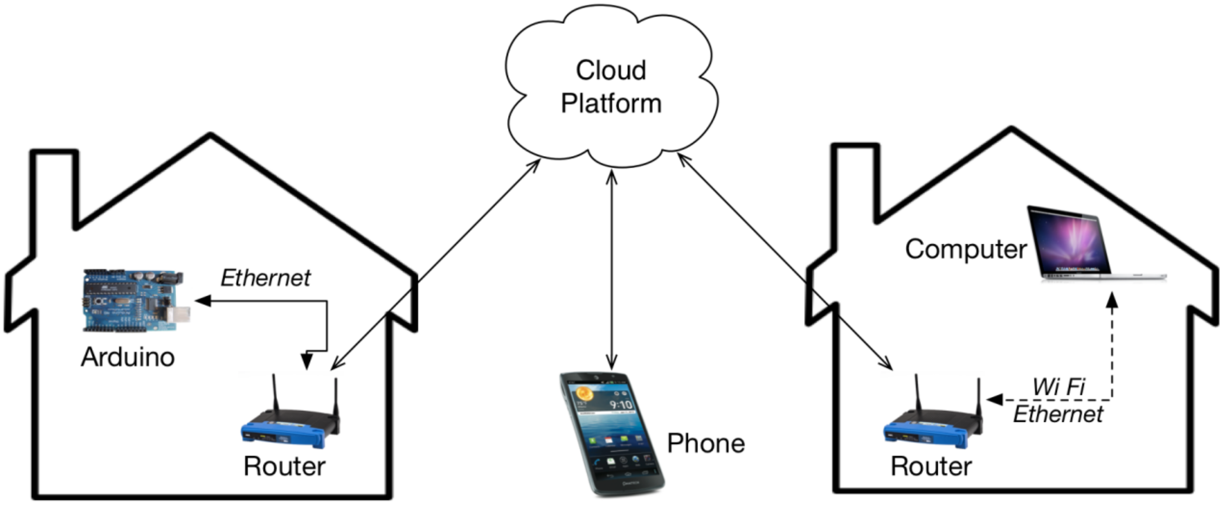



Internet
Router
Computation layer
Python features
Ethernet
Serial
Raspberry Pi
Computer
pySerial
(Serial)
REST
(Ethernet)
MQTT
(Ethernet)
PyFirmata
PyMata
web.py
mosquitto
Tkinter (GUI)
matplotlib (plots)
HTML templates

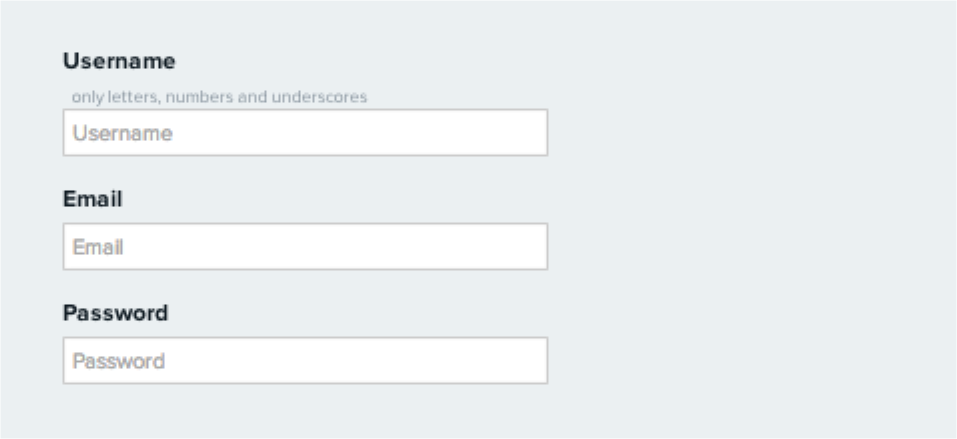


Sample architecture of home networking





Sample architecture of the Internet of Things



Username

only letters, numbers and underscores

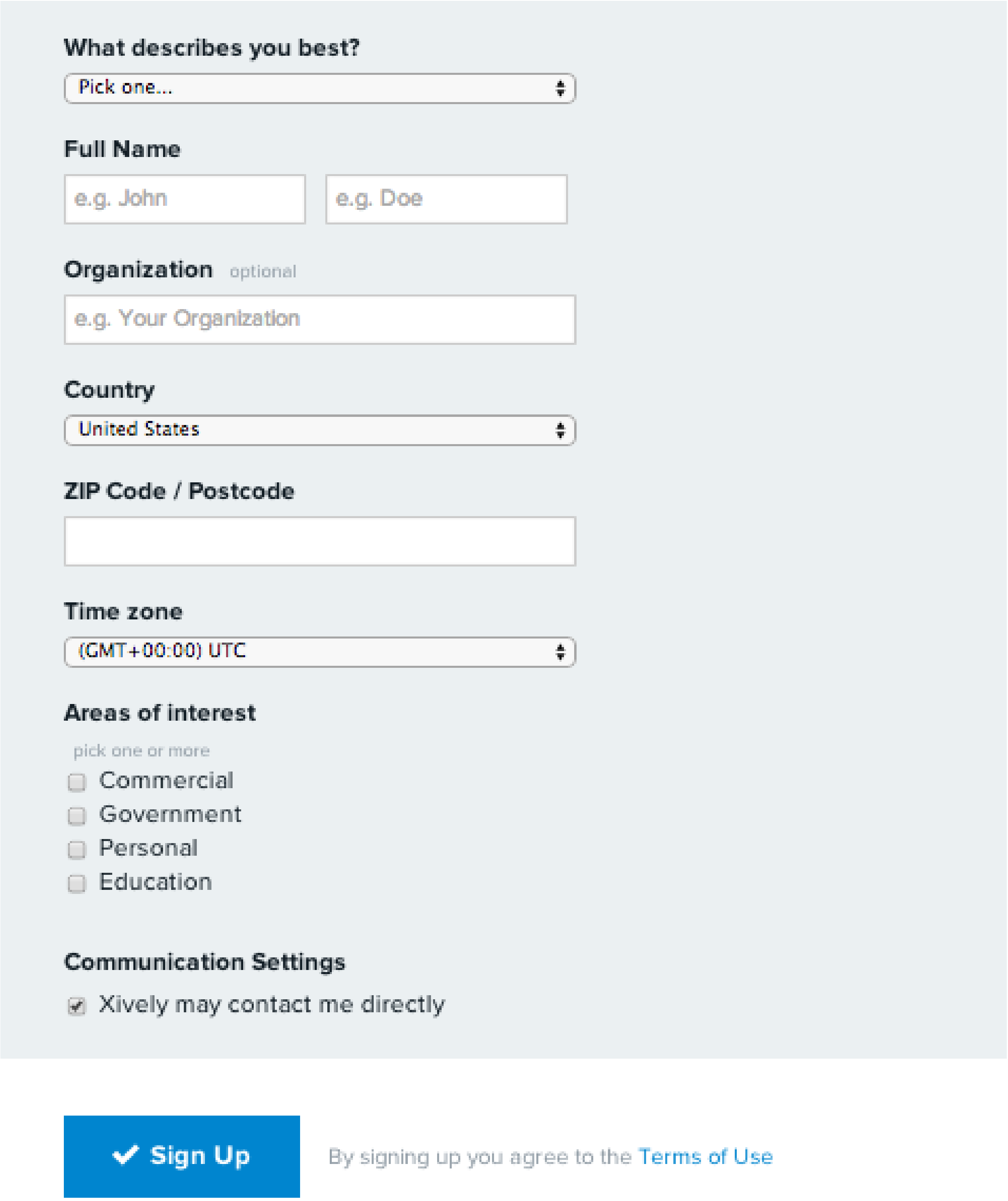
Username

Email

Email

Password

Password



What describes you best?

Pick one...

Full Name

e.g. John

e.g. Doe

Organization optional

e.g. Your Organization

Country

United States

ZIP Code / Postcode

Time zone

(GMT+00:00) UTC

Areas of interest

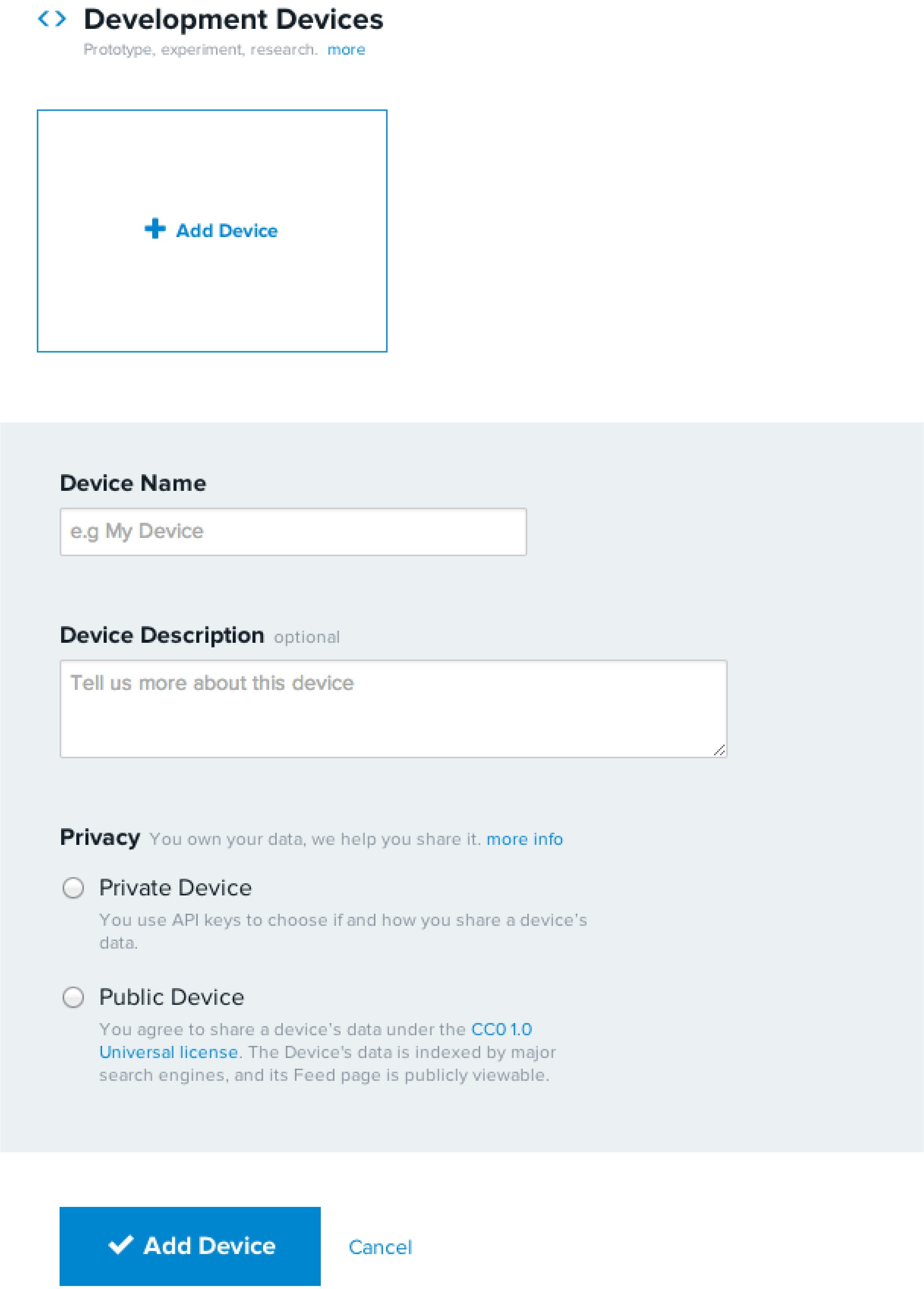
pick one or more

- □ Commercial
- □ Government
- □ Personal
- □ Education

Communication Settings

☑ Xively may contact me directly

By signing up you agree to the Terms of Use



<> Development Devices

Prototype, experiment, research. more

+ Add Device

Device Name

e.g My Device

Device Description optional

Tell us more about this device

Privacy You own your data, we help you share it. more info

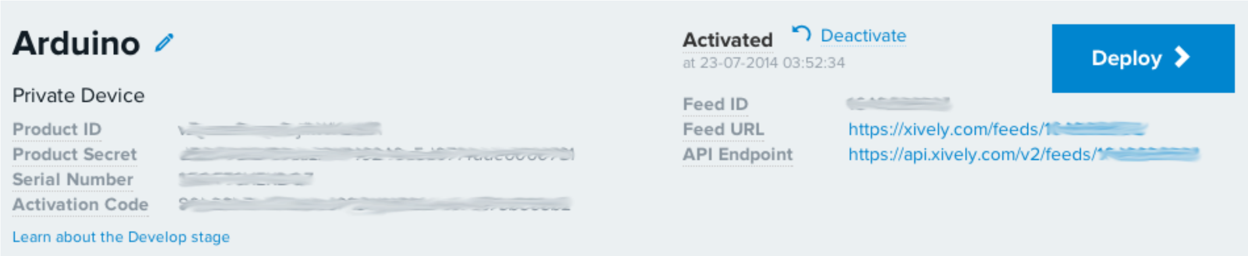
○ Private Device

You use API keys to choose if and how you share a device's data.

○ Public Device

You agree to share a device's data under the CC0 1.0 Universal license. The Device's data is indexed by major search engines, and its Feed page is publicly viewable.

✓ Add Device   Cancel



Arduino

Private Device

Product ID [redacted]

Product Secret [redacted]

Serial Number [redacted]

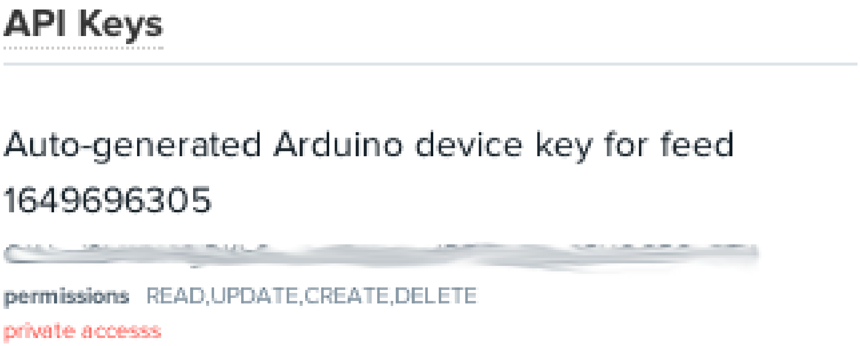
Activation Code [redacted]

Activated
at 23-07-2014 03:52:34

Feed ID [redacted]

Feed URL https://xively.com/feeds/[redacted]

API Endpoint https://api.xively.com/v2/feeds/[redacted]



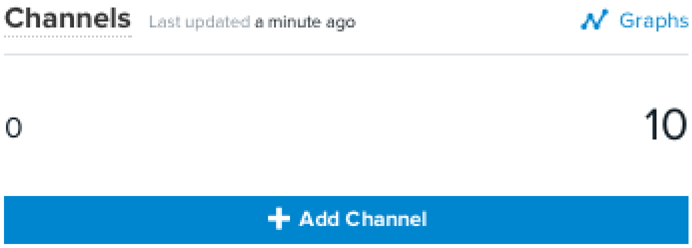
API Keys

Auto-generated Arduino device key for feed 1649696305

[redacted]

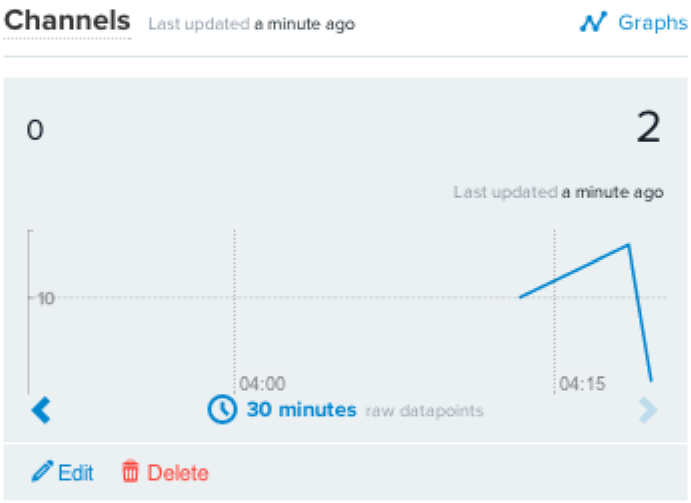
permissions READ,UPDATE,CREATE,DELETE

private accesss



Channels Last updated a minute ago

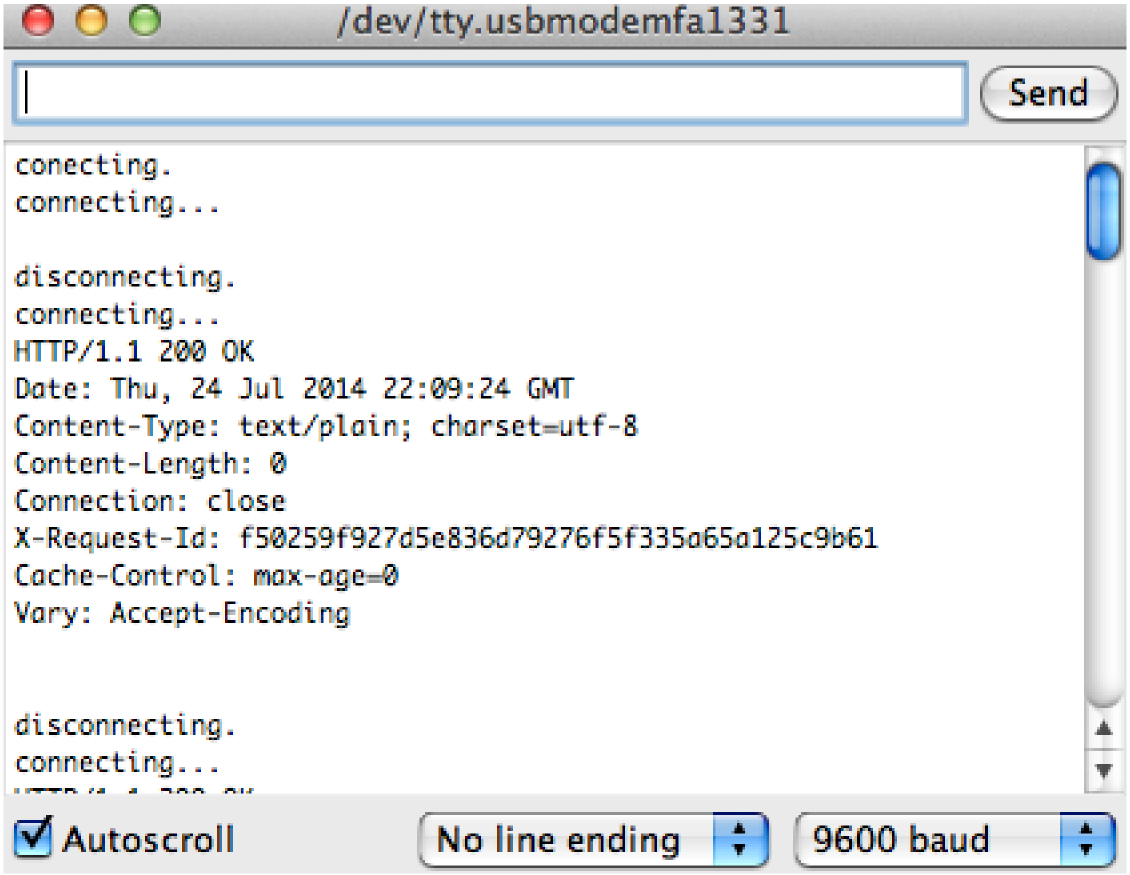
0 10



Channels Last updated a minute ago

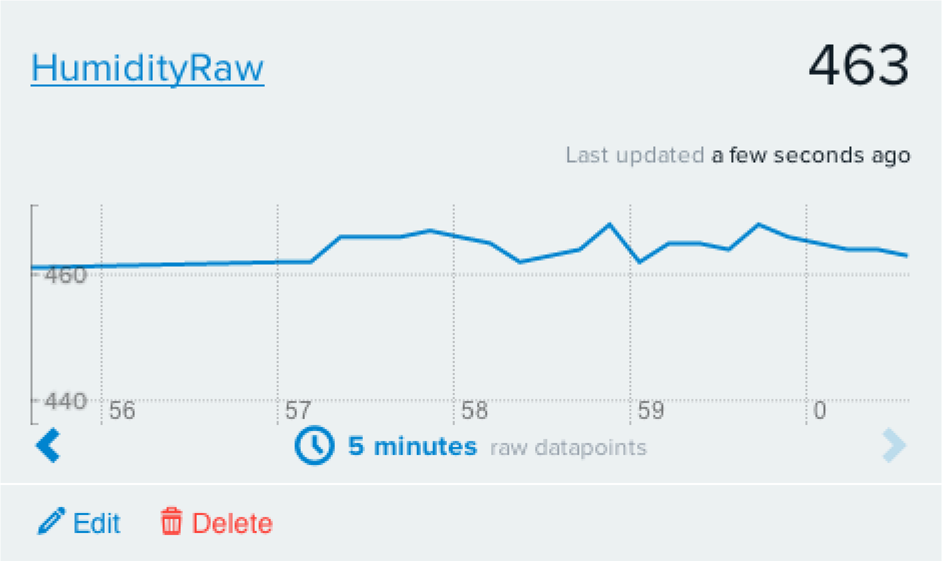
0 2

Last updated a minute ago



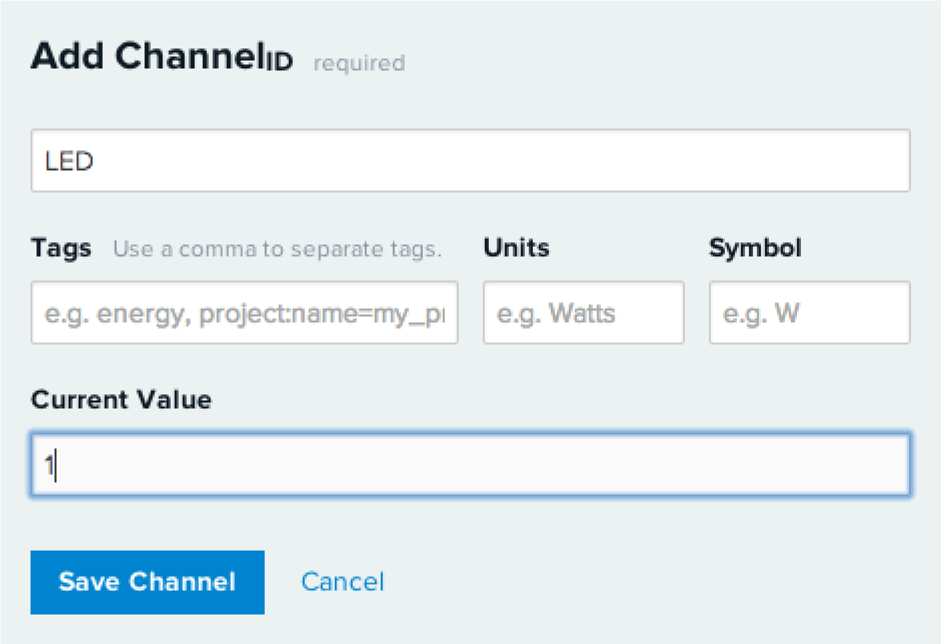
```
conecting.
connecting...

disconnecting.
connecting...
HTTP/1.1 200 OK
Date: Thu, 24 Jul 2014 22:09:24 GMT
Content-Type: text/plain; charset=utf-8
Content-Length: 0
Connection: close
X-Request-Id: f50259f927d5e836d79276f5f335a65a125c9b61
Cache-Control: max-age=0
Vary: Accept-Encoding


disconnecting.
connecting...
HTTP/1.1 200 OK
```

☑ Autoscroll No line ending 9600 baud



HumidityRaw 463

Last updated a few seconds ago



Add Channel ID required

LED

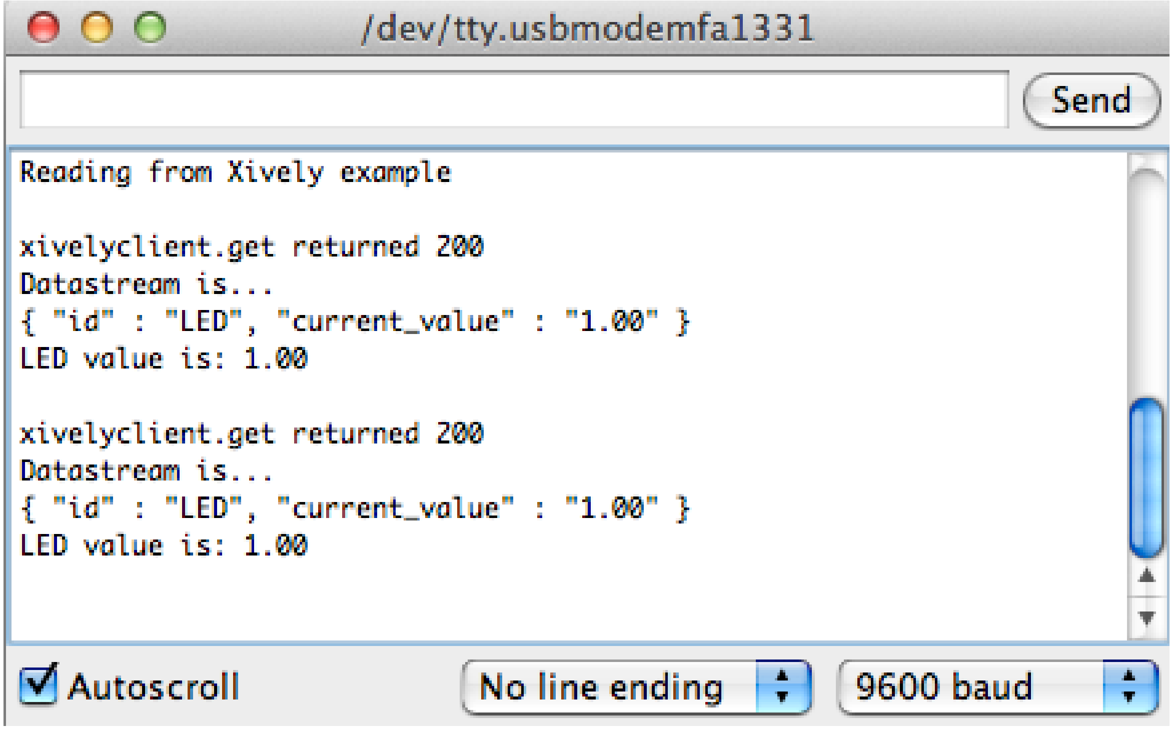
Tags Use a comma to separate tags. e.g. energy, project:name=my_pı

Units e.g. Watts

Symbol e.g. W

Current Value

1



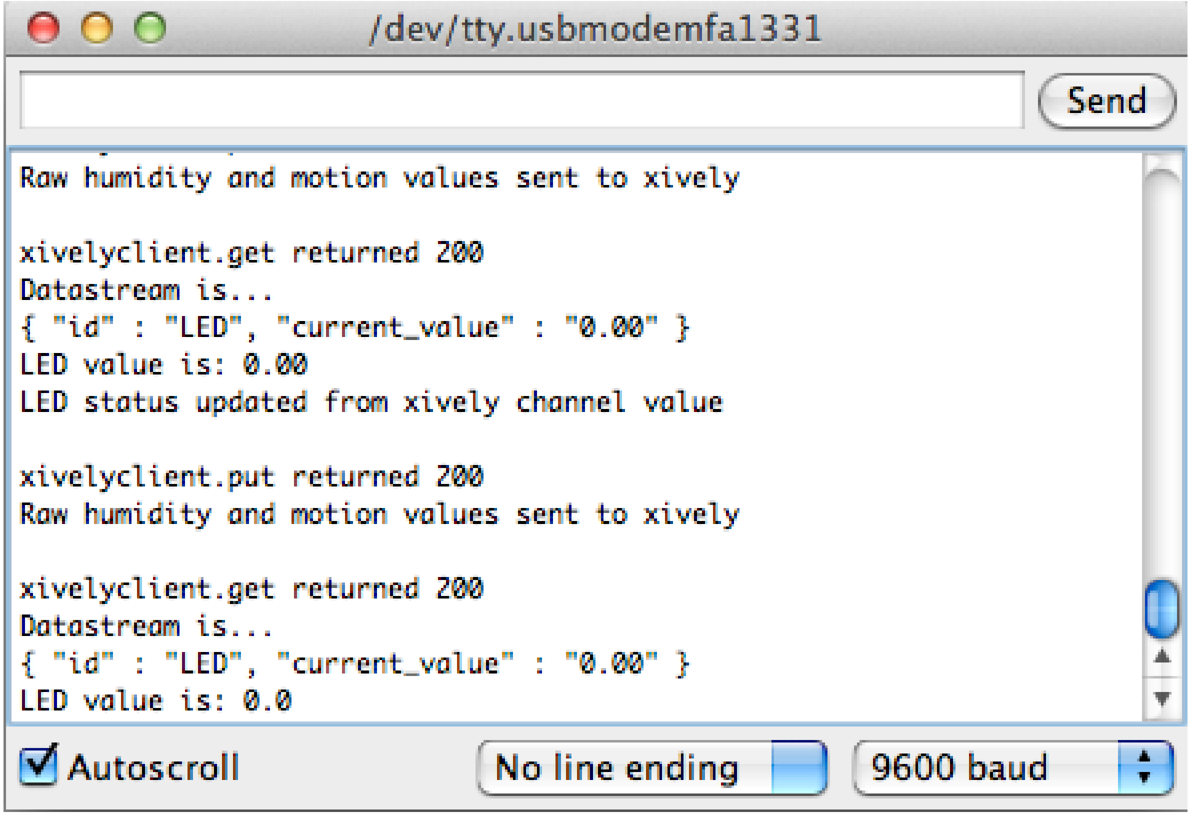
/dev/tty.usbmodemfa1331

```
Reading from Xively example

xivelyclient.get returned 200
Datastream is...
{ "id" : "LED", "current_value" : "1.00" }
LED value is: 1.00

xivelyclient.get returned 200
Datastream is...
{ "id" : "LED", "current_value" : "1.00" }
LED value is: 1.00
```

☑ Autoscroll

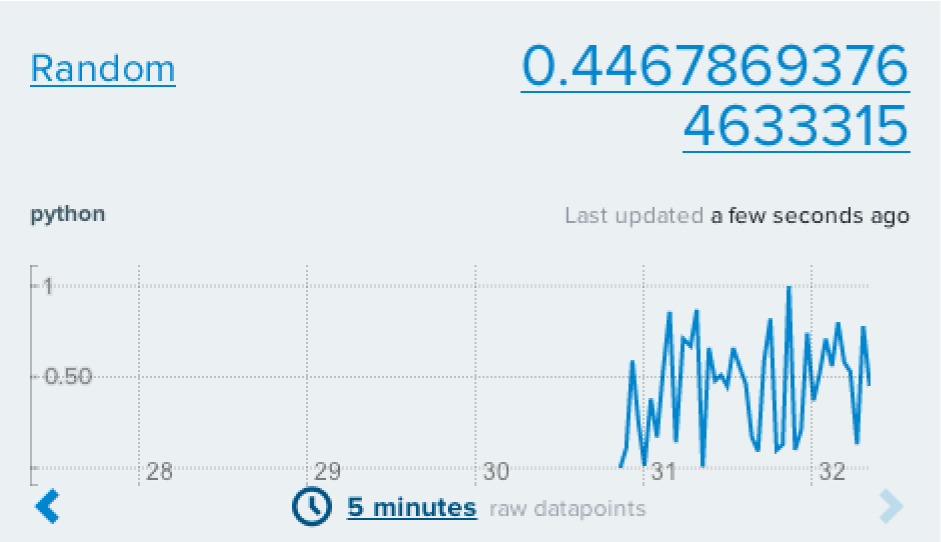
No line ending

9600 baud



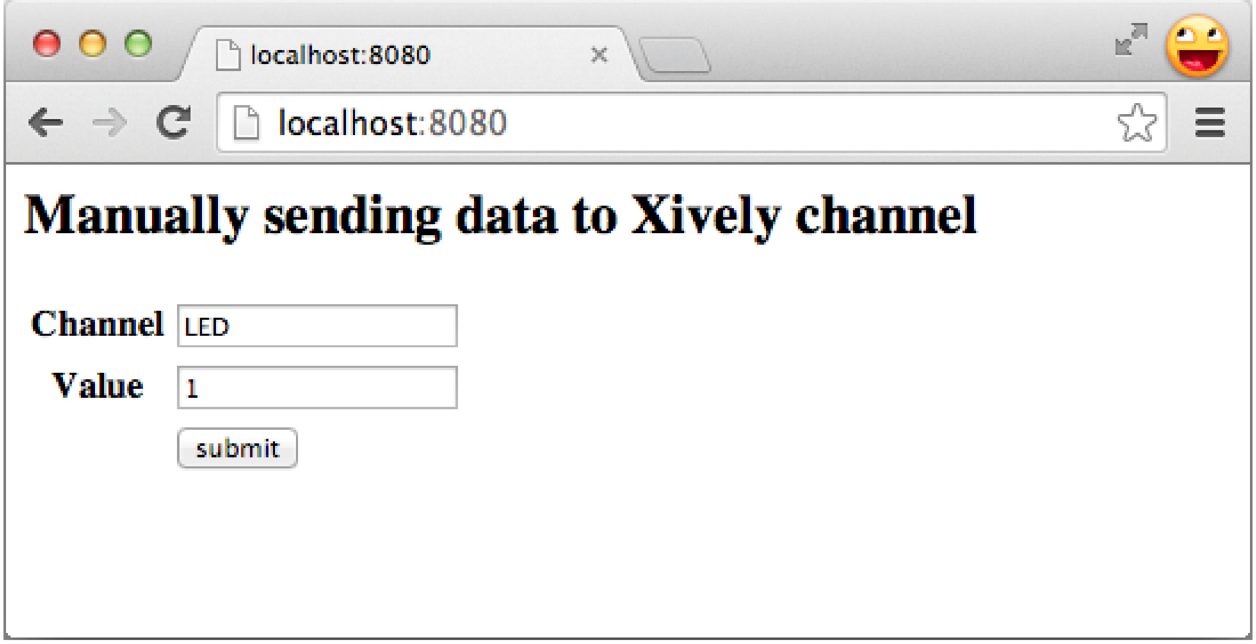
```
Raw humidity and motion values sent to xively

xivelyclient.get returned 200
Datastream is...
{ "id" : "LED", "current_value" : "0.00" }
LED value is: 0.00
LED status updated from xively channel value

xivelyclient.put returned 200
Raw humidity and motion values sent to xively

xivelyclient.get returned 200
Datastream is...
{ "id" : "LED", "current_value" : "0.00" }
LED value is: 0.0
```

☑ Autoscroll No line ending 9600 baud



Random 0.4467869376
4633315

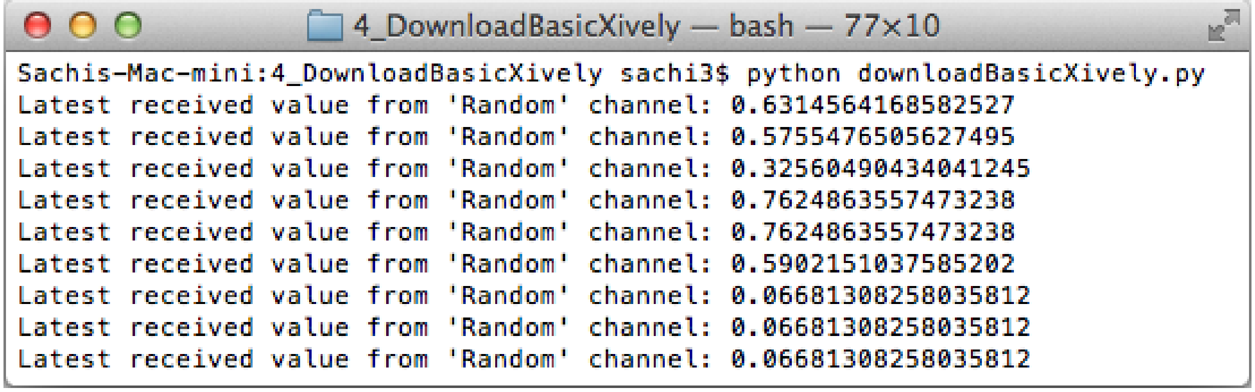
python Last updated a few seconds ago



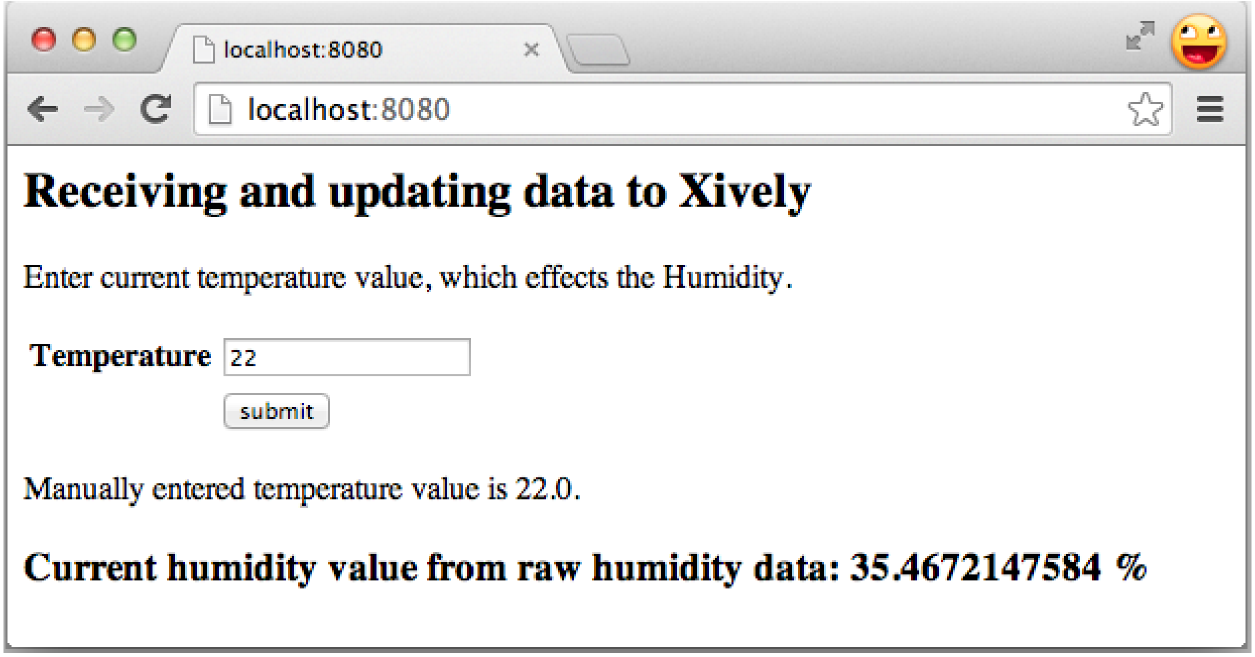
Manually sending data to Xively channel

Channel: LED

Value: 1



```
Sachis-Mac-mini:4_DownloadBasicXively sachi3$ python downloadBasicXively.py
Latest received value from 'Random' channel: 0.6314564168582527
Latest received value from 'Random' channel: 0.5755476505627495
Latest received value from 'Random' channel: 0.32560490434041245
Latest received value from 'Random' channel: 0.7624863557473238
Latest received value from 'Random' channel: 0.7624863557473238
Latest received value from 'Random' channel: 0.5902151037585202
Latest received value from 'Random' channel: 0.06681308258035812
Latest received value from 'Random' channel: 0.06681308258035812
Latest received value from 'Random' channel: 0.06681308258035812
```



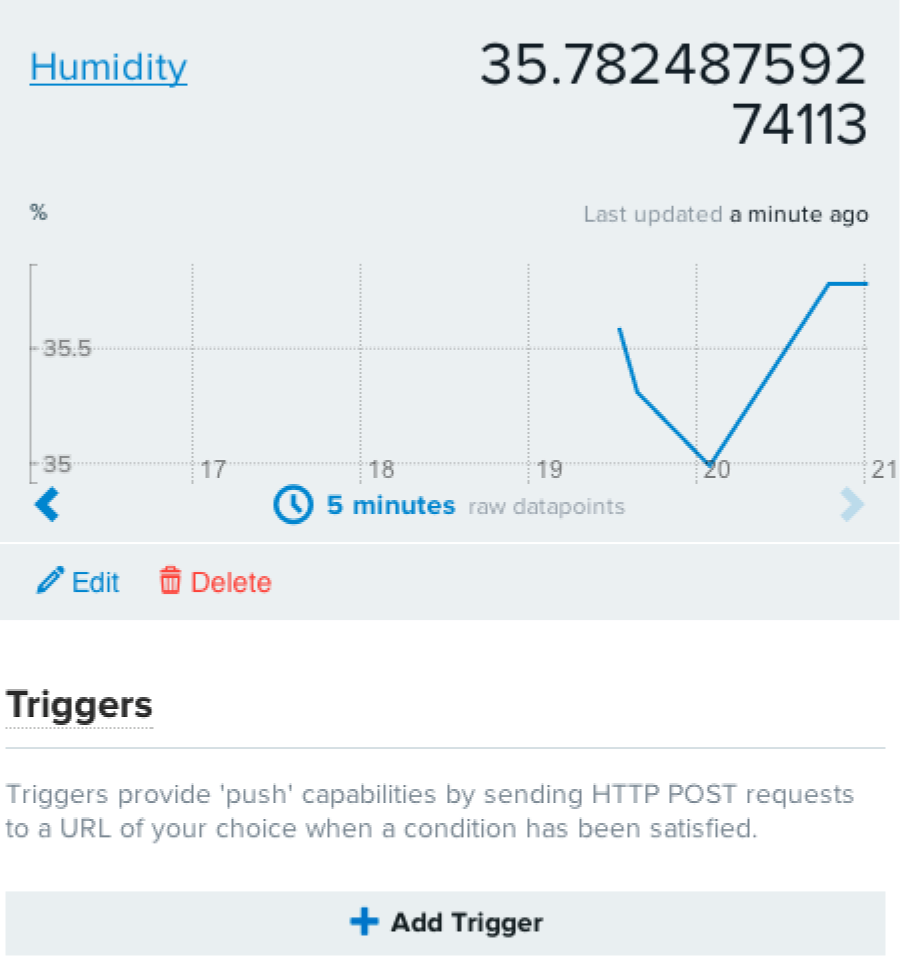
Receiving and updating data to Xively

Enter current temperature value, which effects the Humidity.

Temperature 22

Manually entered temperature value is 22.0.

Current humidity value from raw humidity data: 35.4672147584 %

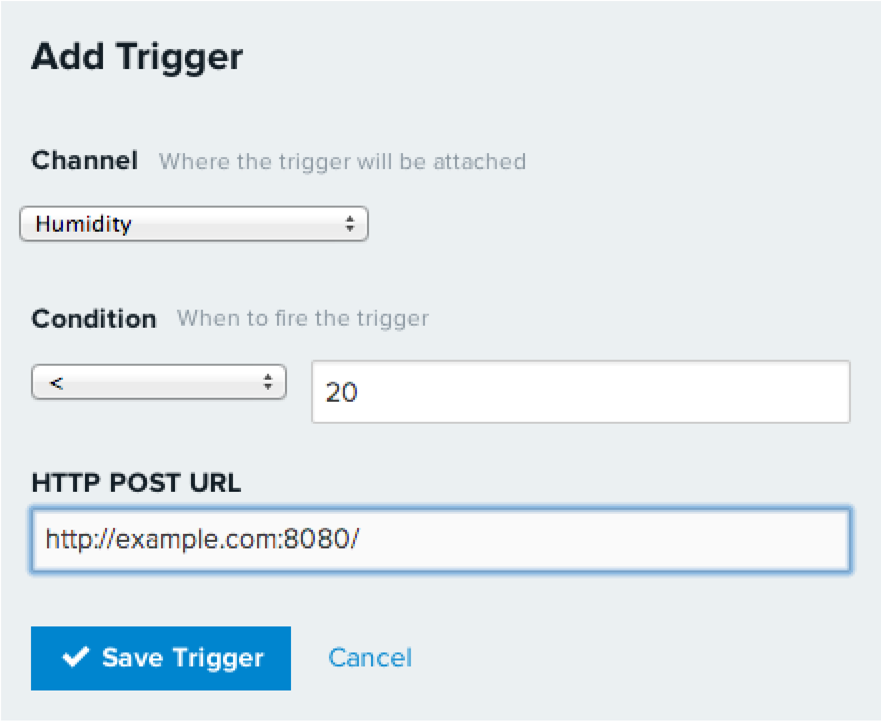


Humidity 35.78248759274113

Last updated a minute ago

Triggers

Triggers provide 'push' capabilities by sending HTTP POST requests to a URL of your choice when a condition has been satisfied.



Add Trigger

Channel Where the trigger will be attached

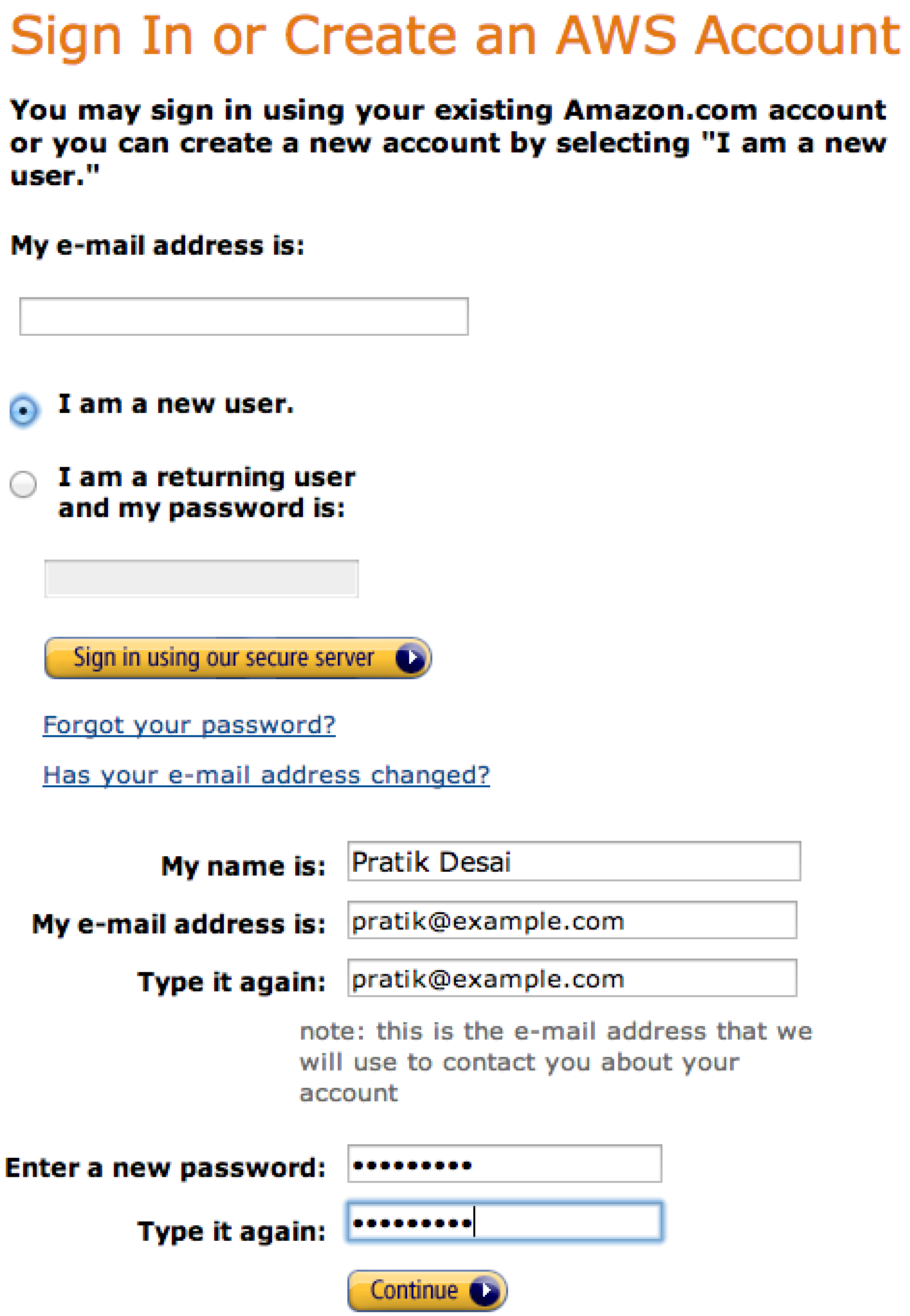
Humidity

Condition When to fire the trigger

< 20

HTTP POST URL

http://example.com:8080/



Sign In or Create an AWS Account

You may sign in using your existing Amazon.com account or you can create a new account by selecting "I am a new user."

My e-mail address is:

● **I am a new user.**

○ **I am a returning user and my password is:**

Forgot your password?

Has your e-mail address changed?

My name is: Pratik Desai

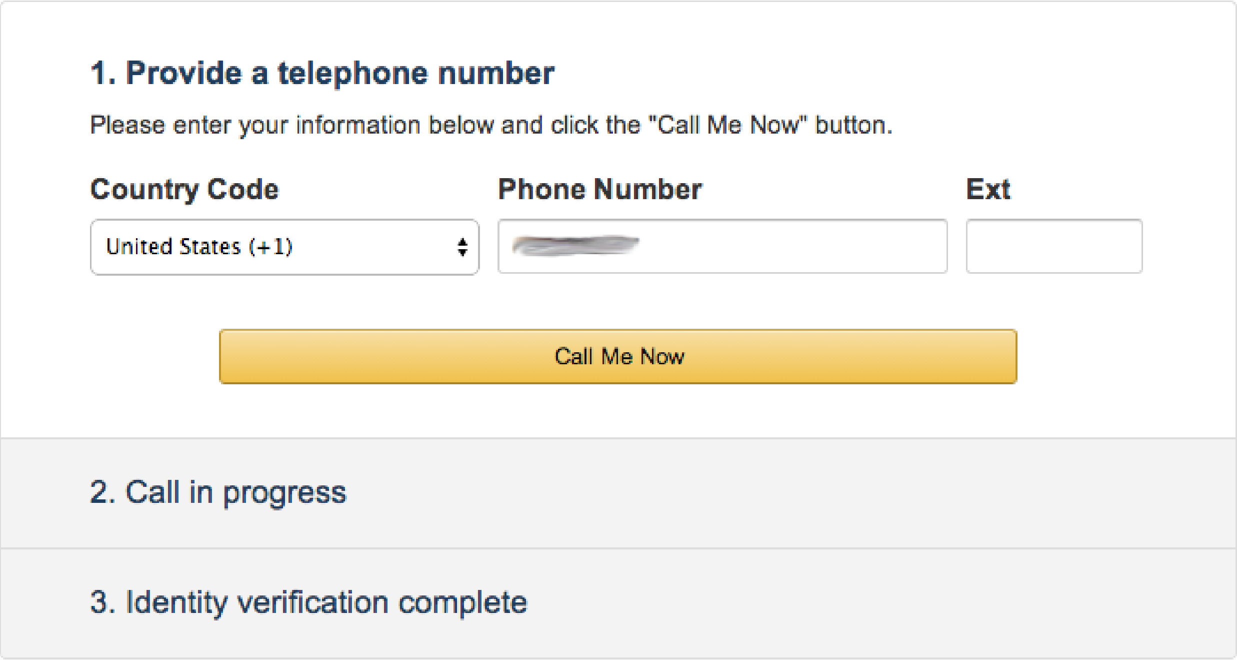
My e-mail address is: pratik@example.com

Type it again: pratik@example.com

note: this is the e-mail address that we will use to contact you about your account

Enter a new password: ••••••••••

Type it again: ••••••••••



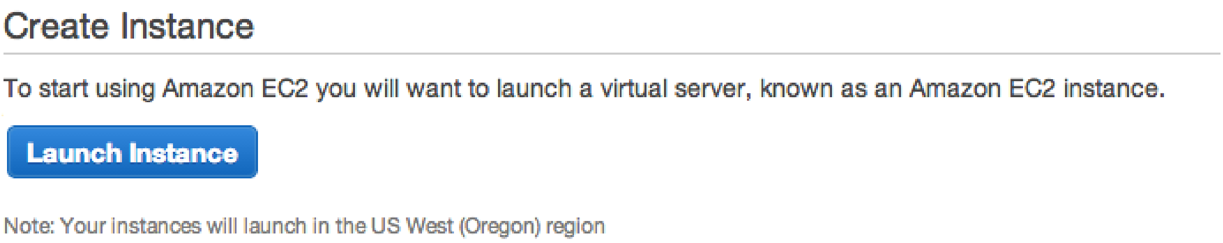
1. Provide a telephone number

Please enter your information below and click the "Call Me Now" button.

Country Code	Phone Number	Ext
United States (+1)	[redacted]	

2. Call in progress

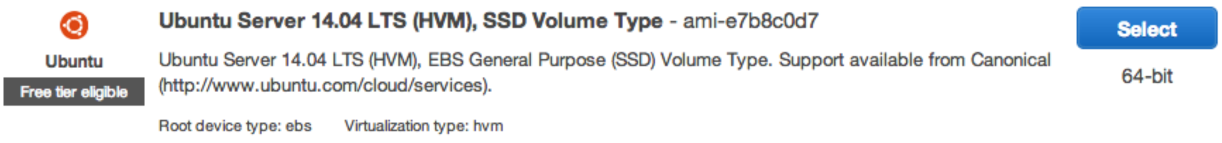
3. Identity verification complete



Create Instance

To start using Amazon EC2 you will want to launch a virtual server, known as an Amazon EC2 instance.

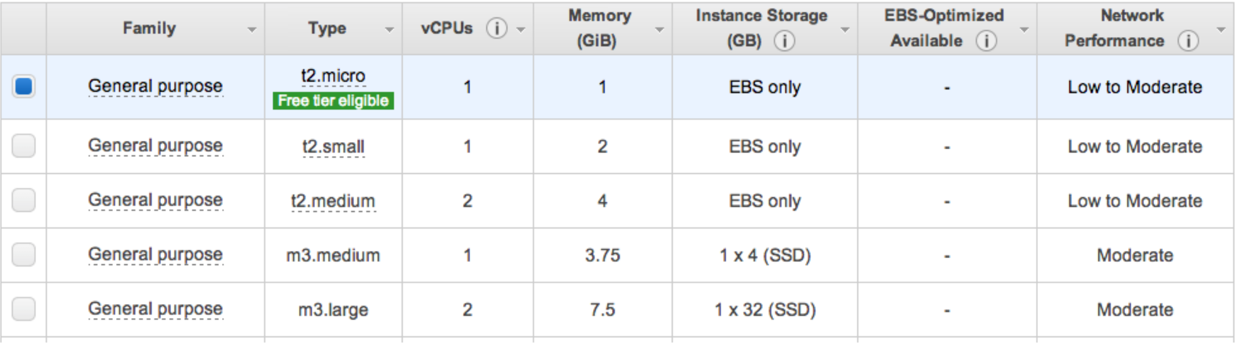
Note: Your instances will launch in the US West (Oregon) region



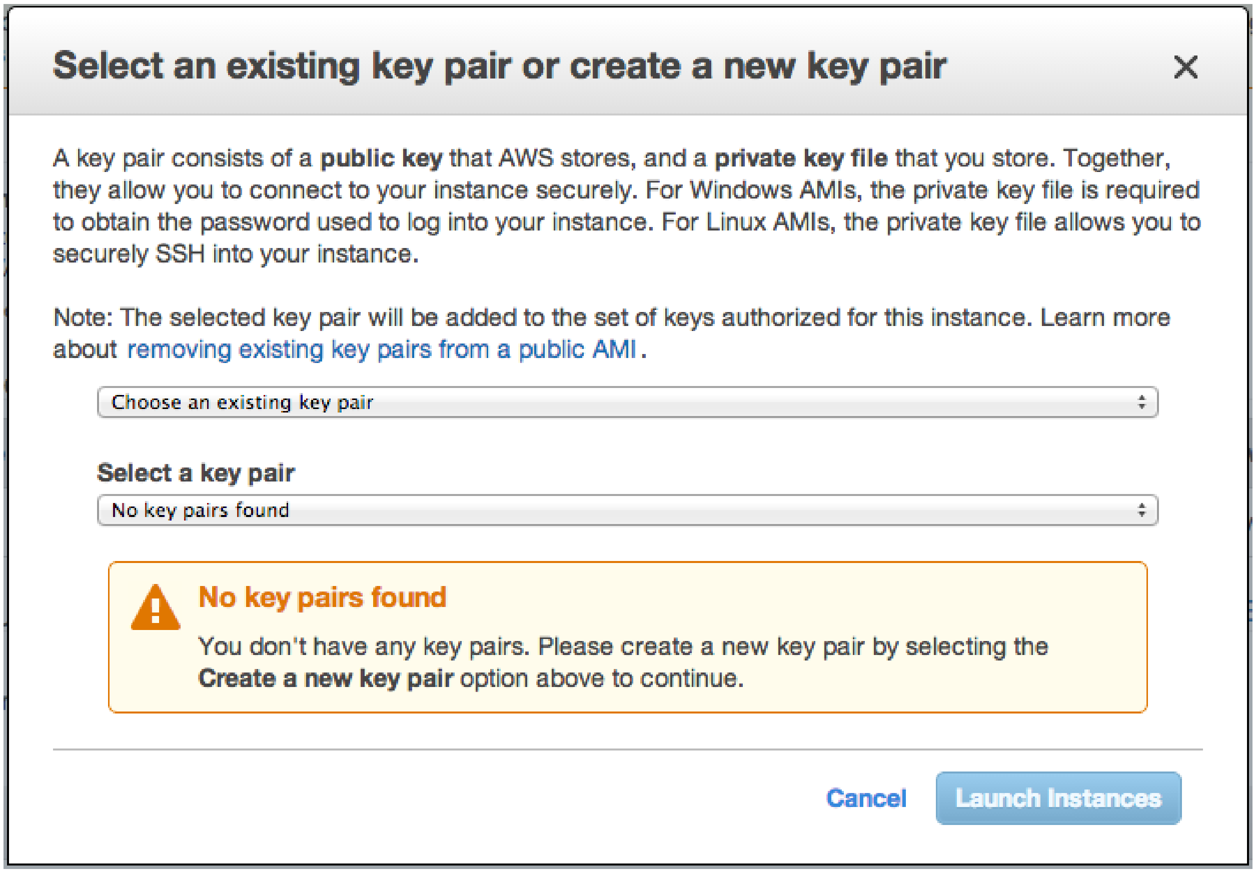
Ubuntu Server 14.04 LTS (HVM), SSD Volume Type - ami-e7b8c0d7

Ubuntu Server 14.04 LTS (HVM), EBS General Purpose (SSD) Volume Type. Support available from Canonical (http://www.ubuntu.com/cloud/services).

Root device type: ebs Virtualization type: hvm



	Family	Type	vCPUs ⓘ	Memory (GiB)	Instance Storage (GB) ⓘ	EBS-Optimized Available ⓘ	Network Performance ⓘ
■	General purpose	t2.micro Free tier eligible	1	1	EBS only	-	Low to Moderate
□	General purpose	t2.small	1	2	EBS only	-	Low to Moderate
□	General purpose	t2.medium	2	4	EBS only	-	Low to Moderate
□	General purpose	m3.medium	1	3.75	1 x 4 (SSD)	-	Moderate
□	General purpose	m3.large	2	7.5	1 x 32 (SSD)	-	Moderate



Select an existing key pair or create a new key pair

A key pair consists of a **public key** that AWS stores, and a **private key file** that you store. Together, they allow you to connect to your instance securely. For Windows AMIs, the private key file is required to obtain the password used to log into your instance. For Linux AMIs, the private key file allows you to securely SSH into your instance.

Note: The selected key pair will be added to the set of keys authorized for this instance. Learn more about removing existing key pairs from a public AMI .

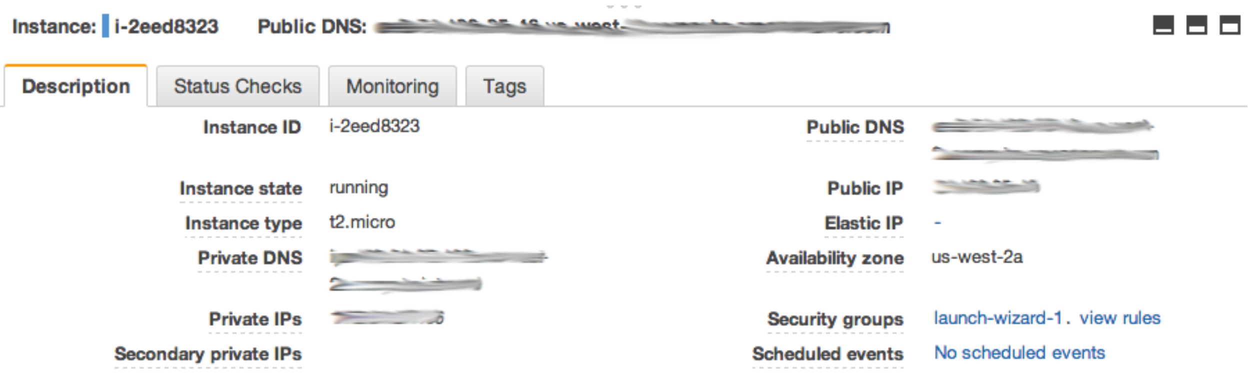
Choose an existing key pair

Select a key pair

No key pairs found

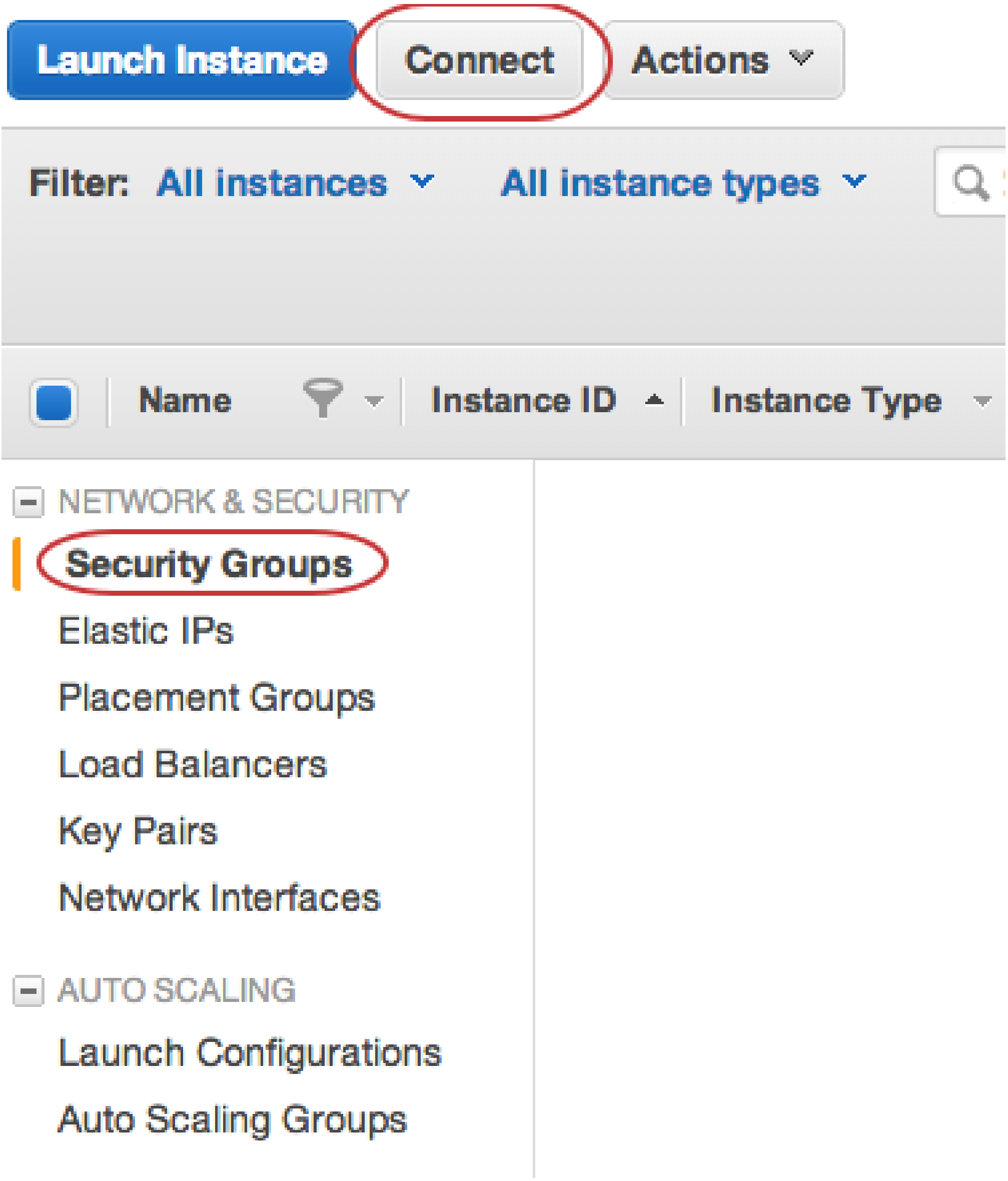
No key pairs found

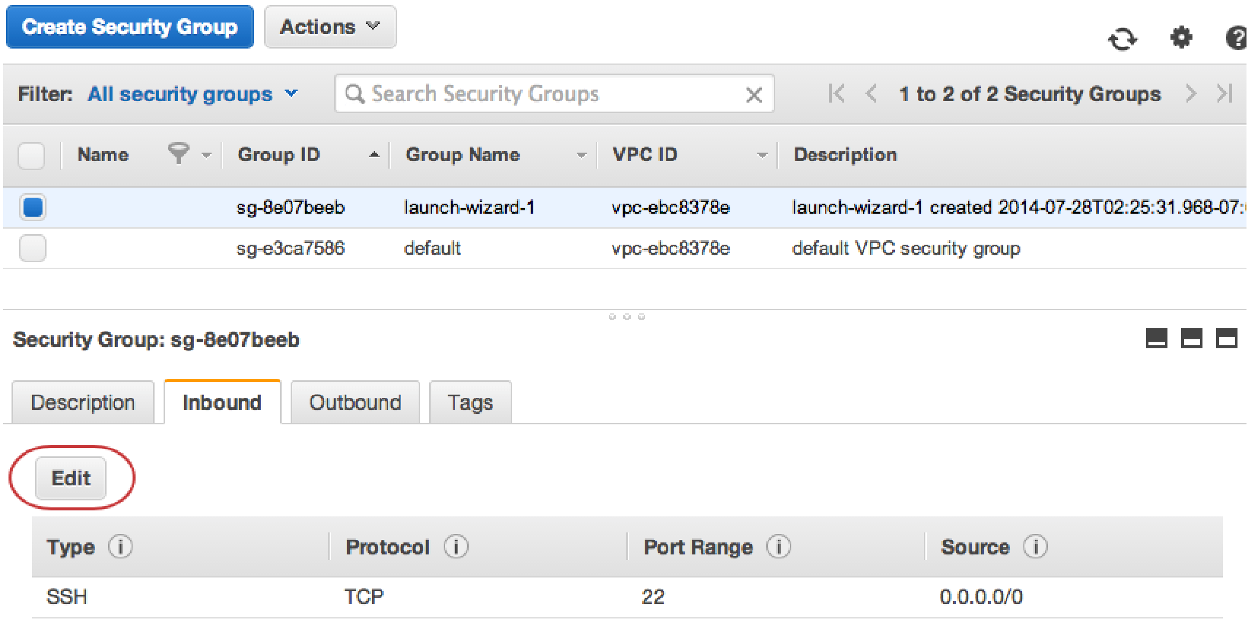
You don't have any key pairs. Please create a new key pair by selecting the **Create a new key pair** option above to continue.



Instance: i-2eed8323 **Public DNS:** [redacted]

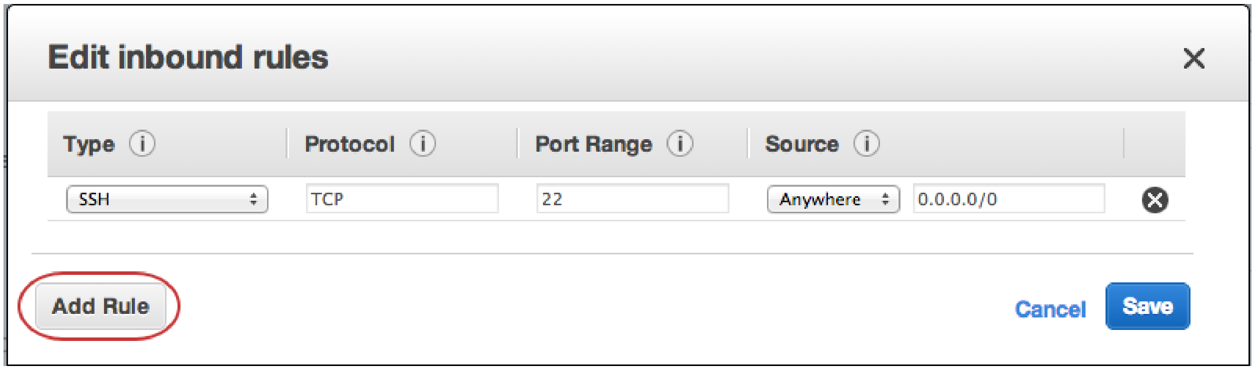
Instance ID	i-2eed8323	**Public DNS**	[redacted]
Instance state	running	**Public IP**	[redacted]
Instance type	t2.micro	**Elastic IP**	-
Private DNS	[redacted]	**Availability zone**	us-west-2a
Private IPs	[redacted]	**Security groups**	launch-wizard-1 . view rules
Secondary private IPs		**Scheduled events**	No scheduled events


Launch Instance
Connect
Actions
Filter: All instances
All instance types
Name
Instance ID
Instance Type
NETWORK & SECURITY
Security Groups
Elastic IPs
Placement Groups
Load Balancers
Key Pairs
Network Interfaces
AUTO SCALING
Launch Configurations
Auto Scaling Groups

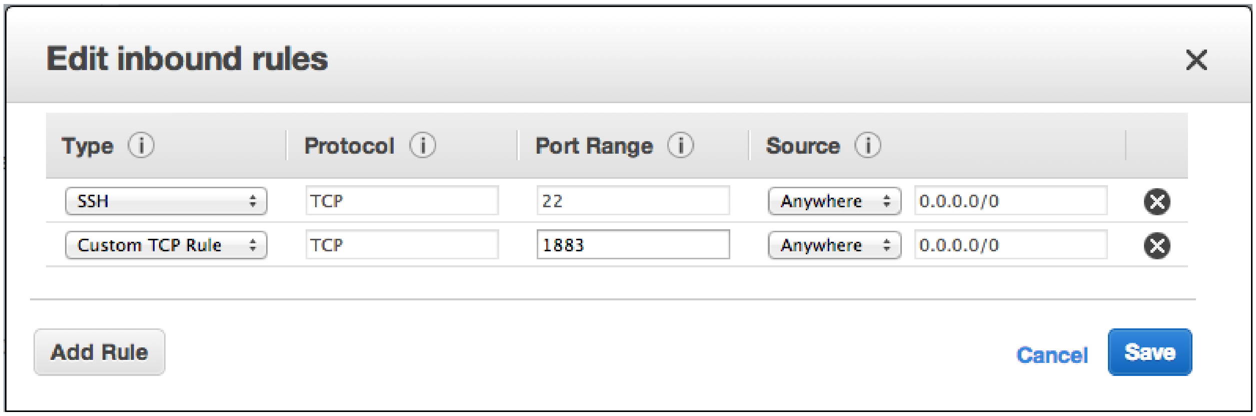


☐	Name	Group ID	Group Name	VPC ID	Description
■		sg-8e07beeb	launch-wizard-1	vpc-ebc8378e	launch-wizard-1 created 2014-07-28T02:25:31.968-07:
☐		sg-e3ca7586	default	vpc-ebc8378e	default VPC security group

Type	Protocol	Port Range	Source
SSH	TCP	22	0.0.0.0/0

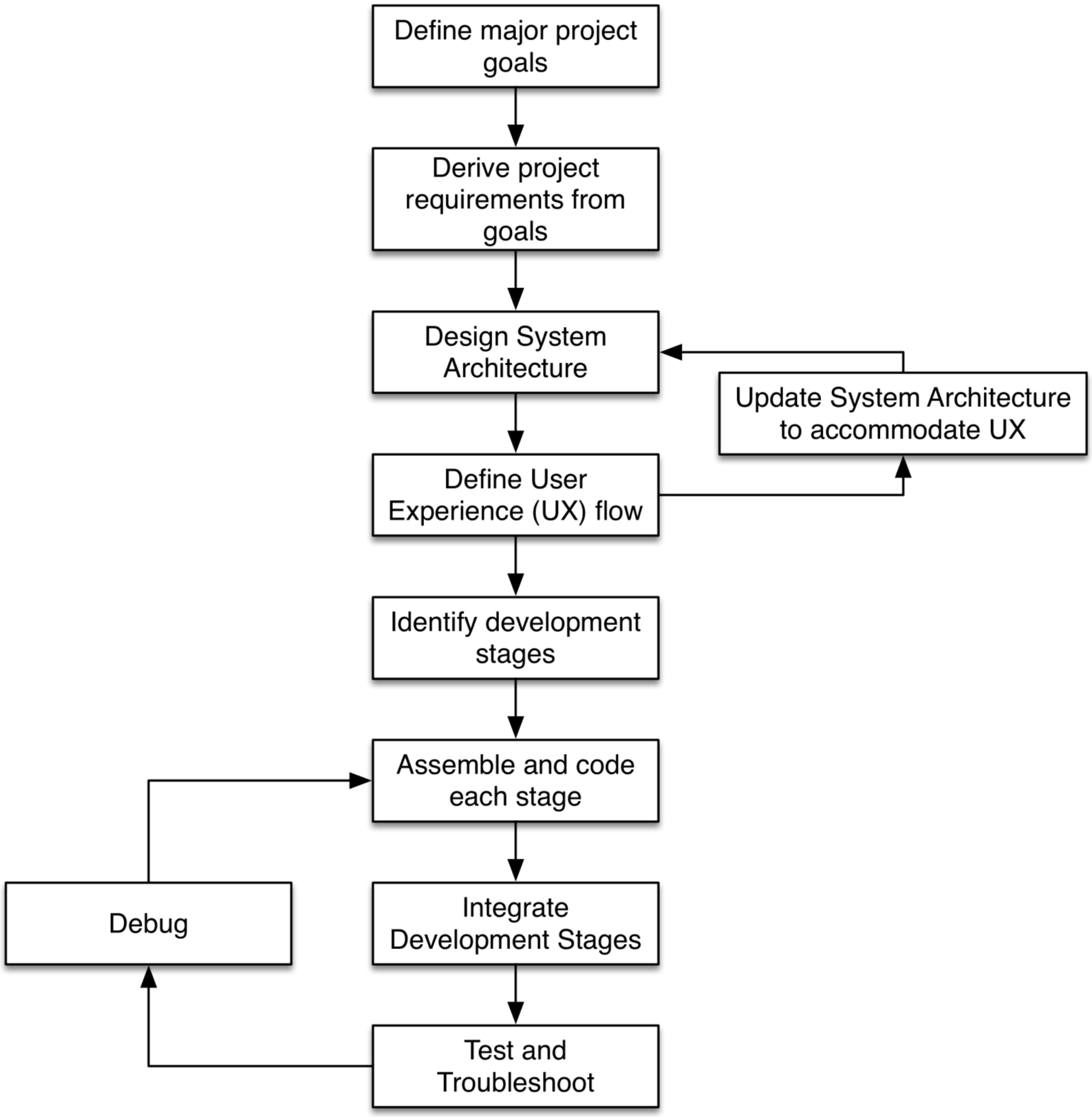


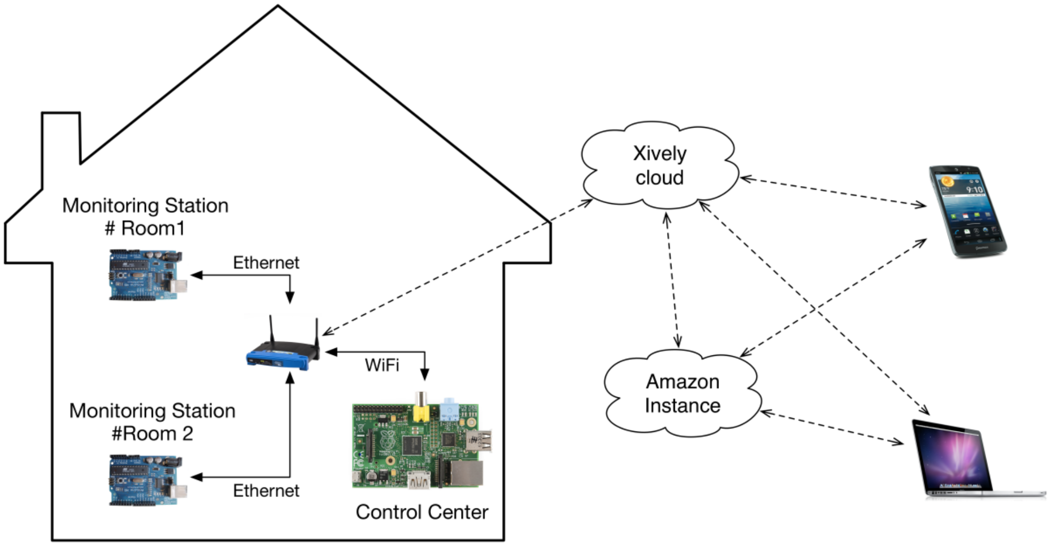
Type	Protocol	Port Range	Source	
SSH	TCP	22	Anywhere	0.0.0.0/0

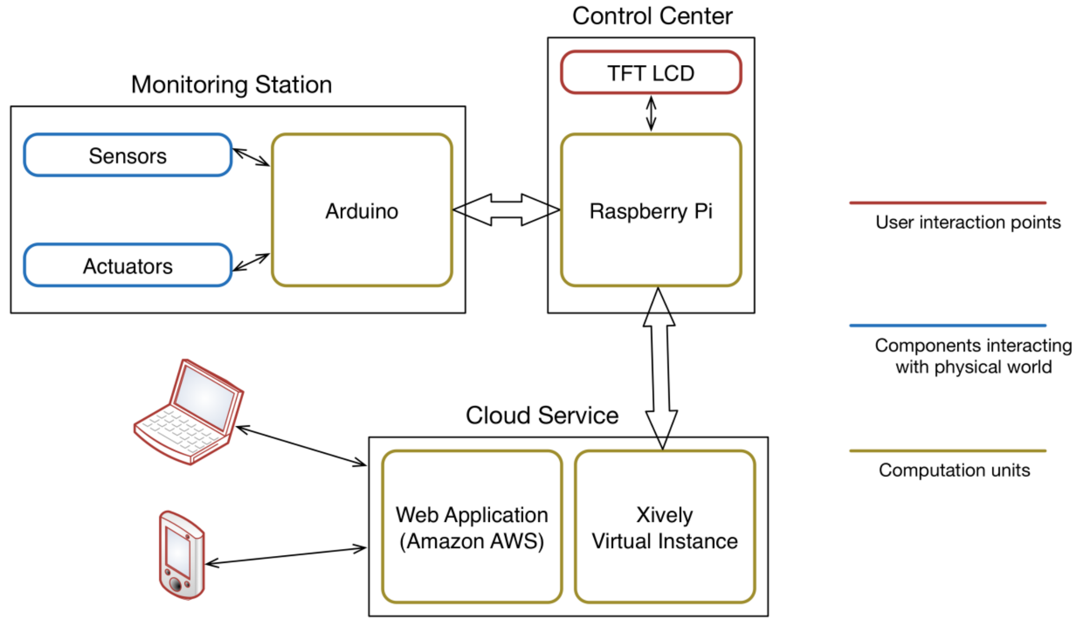


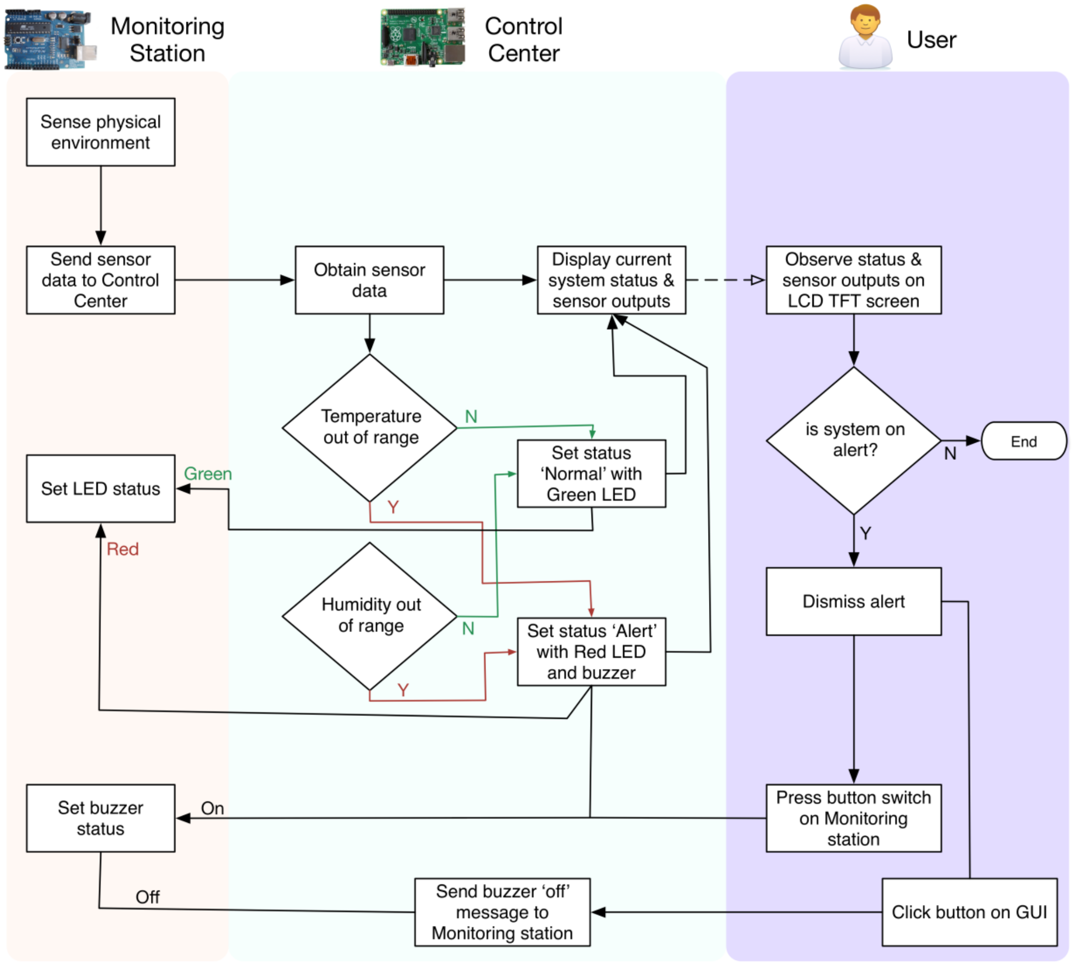
Type	Protocol	Port Range	Source	
SSH	TCP	22	Anywhere	0.0.0.0/0
Custom TCP Rule	TCP	1883	Anywhere	0.0.0.0/0

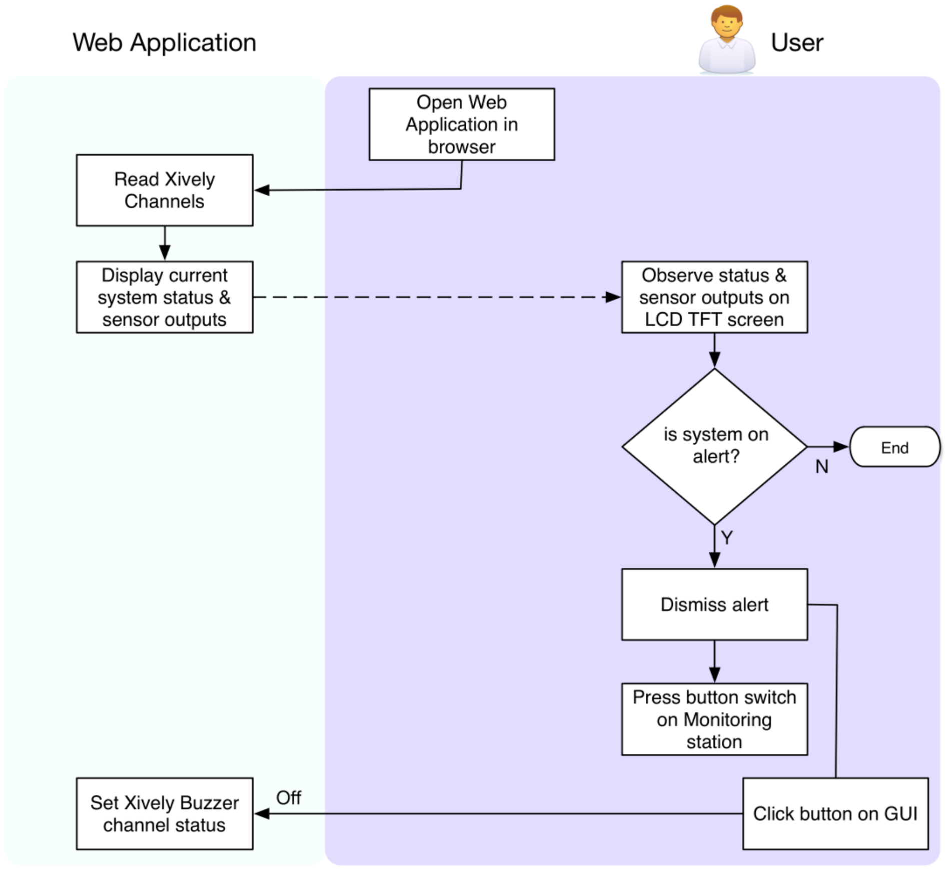
Chapter 10: The Final Project – a Remote Home Monitoring System

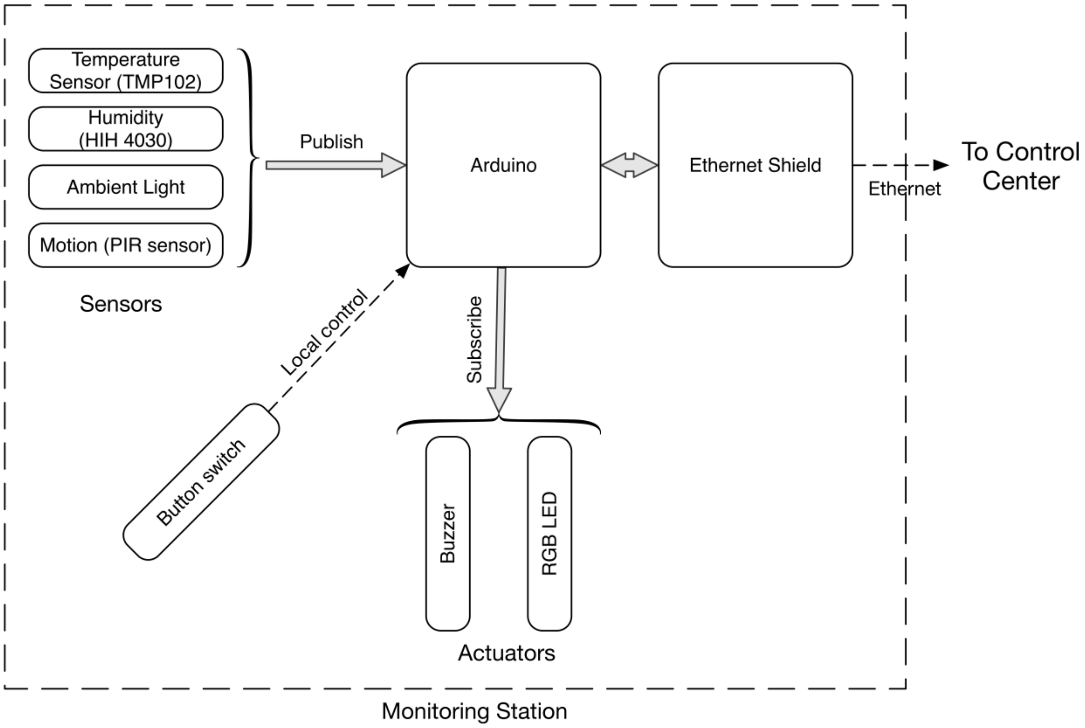

Define major project goals
Derive project requirements from goals
Design System Architecture
Update System Architecture to accommodate UX
Define User Experience (UX) flow
Identify development stages
Assemble and code each stage
Debug
Integrate Development Stages
Test and Troubleshoot

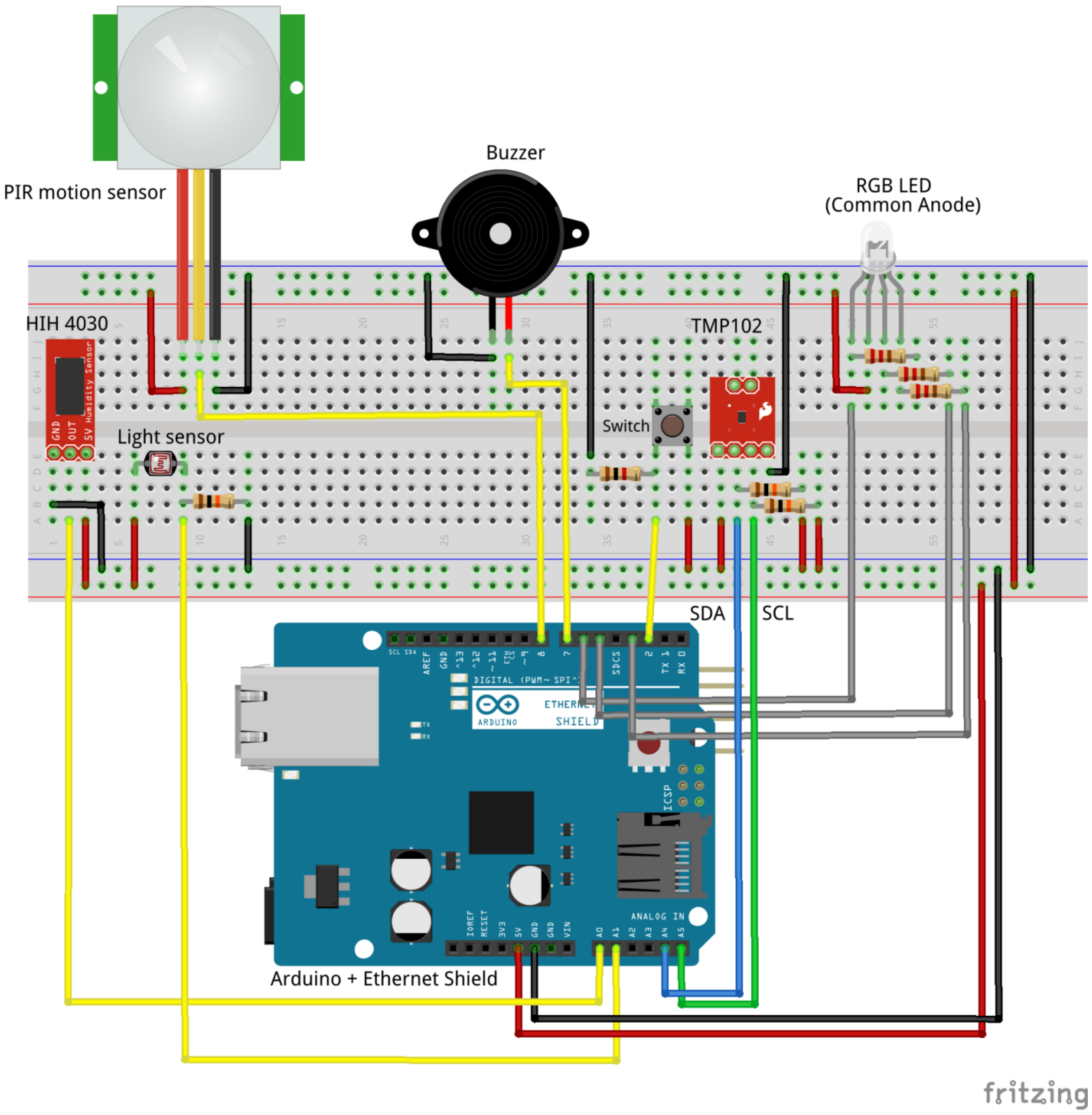

Monitoring Station
# Room1
Ethernet
WiFi
Monitoring Station
#Room 2
Ethernet
Control Center
Xively
cloud
Amazon
Instance

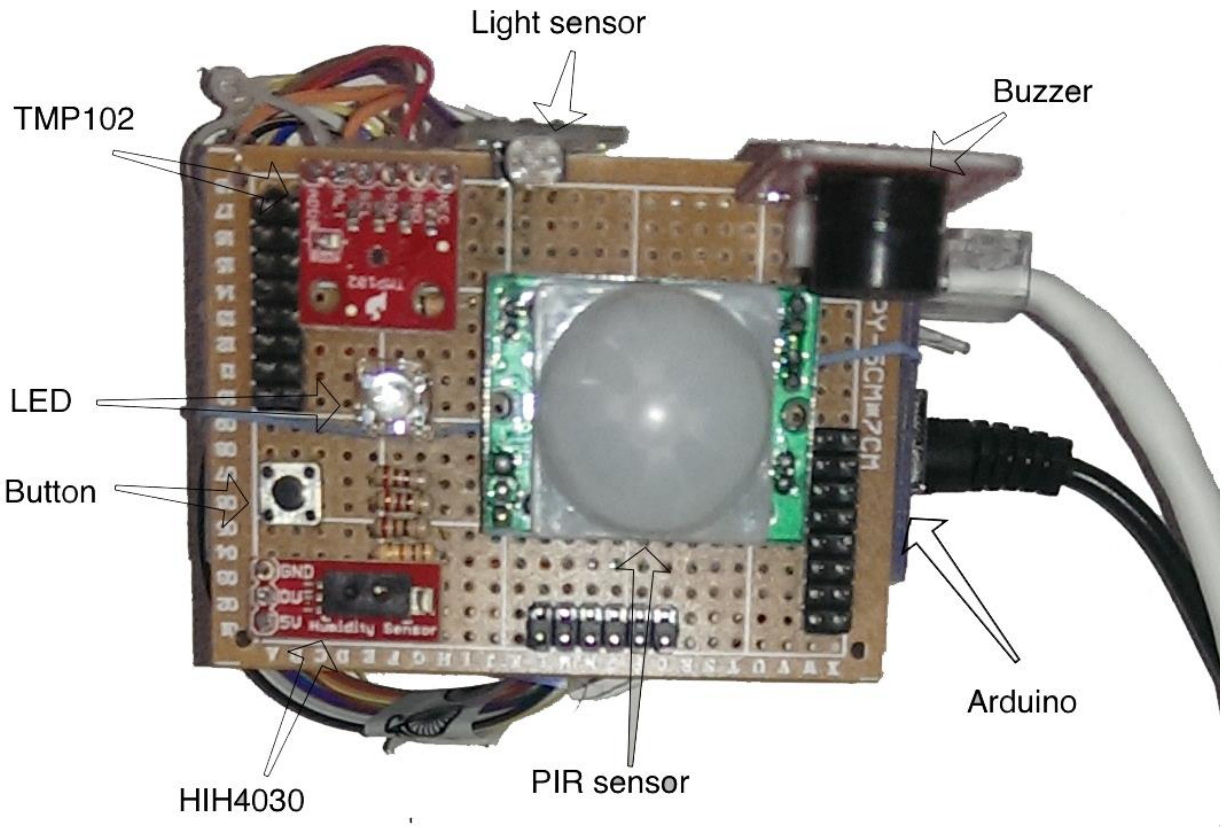

Control Center
TFT LCD
Monitoring Station
Sensors
Arduino
Actuators
Raspberry Pi
Cloud Service
Web Application
(Amazon AWS)
Xively
Virtual Instance
User interaction points
Components interacting
with physical world
Computation units

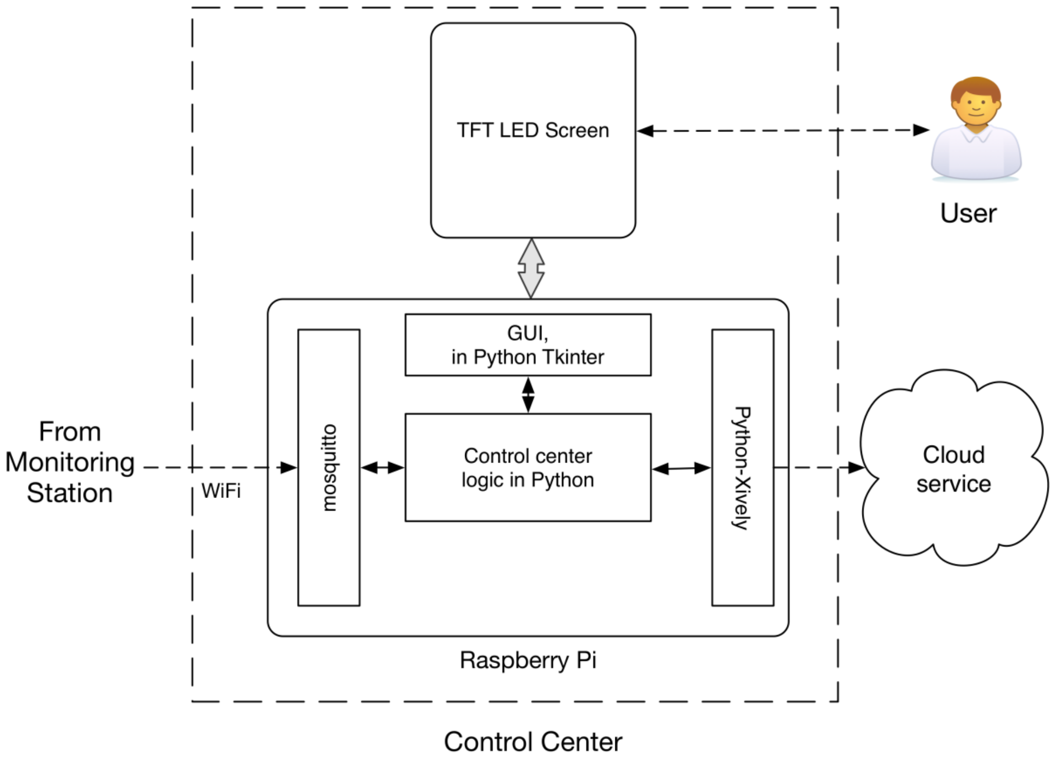

Monitoring Station
Control Center
User
Sense physical environment
Send sensor data to Control Center
Obtain sensor data
Display current system status & sensor outputs
Observe status & sensor outputs on LCD TFT screen
Temperature out of range
N
Y
Set status 'Normal' with Green LED
Set LED status
Green
Red
Humidity out of range
N
Y
Set status 'Alert' with Red LED and buzzer
is system on alert?
N
End
Y
Dismiss alert
Set buzzer status
On
Press button switch on Monitoring station
Off
Send buzzer 'off' message to Monitoring station
Click button on GUI

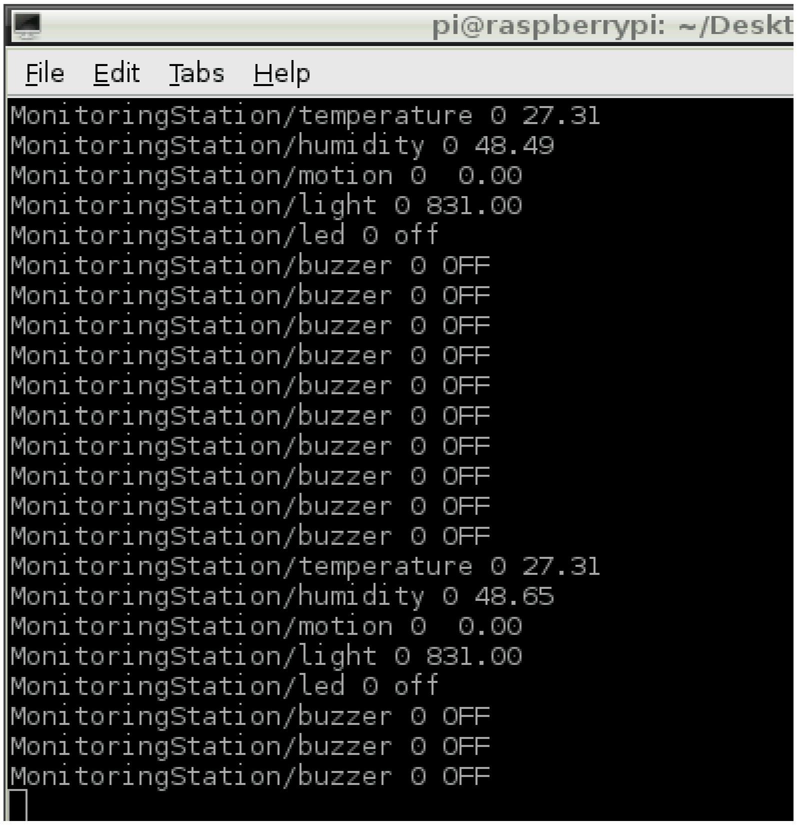

Web Application
User
Open Web Application in browser
Read Xively Channels
Display current system status & sensor outputs
Observe status & sensor outputs on LCD TFT screen
is system on alert?
N
End
Y
Dismiss alert
Press button switch on Monitoring station
Click button on GUI
Off
Set Xively Buzzer channel status


Temperature Sensor (TMP102)
Humidity (HIH 4030)
Ambient Light
Motion (PIR sensor)
Sensors
Publish
Arduino
Ethernet Shield
Ethernet
To Control Center
Local control
Button switch
Subscribe
Buzzer
RGB LED
Actuators
Monitoring Station

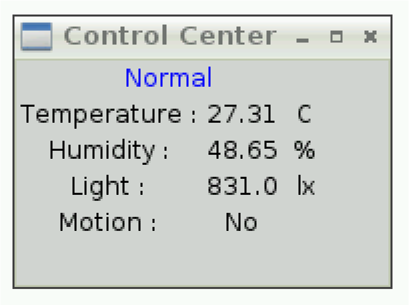

PIR motion sensor
Buzzer
RGB LED
(Common Anode)
HIH 4030
TMP102
Light sensor
Switch
SDA
SCL
Arduino + Ethernet Shield
fritzing


Light sensor
TMP102
Buzzer
LED
Button
Arduino
HIH4030
PIR sensor





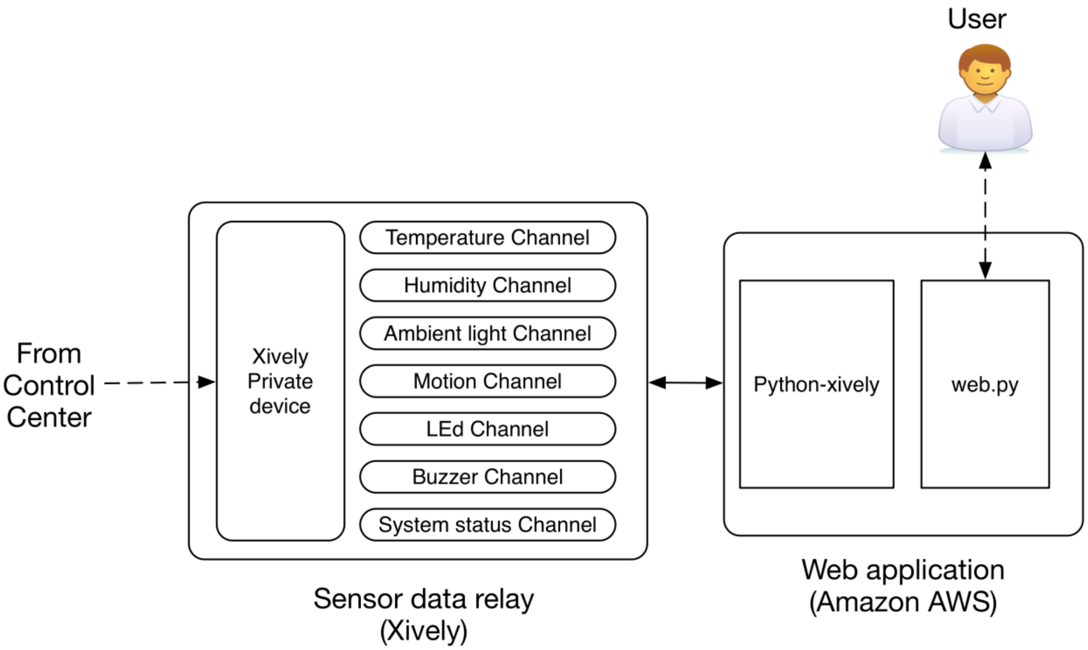
```
MonitoringStation/temperature 0 27.31
MonitoringStation/humidity 0 48.49
MonitoringStation/motion 0  0.00
MonitoringStation/light 0 831.00
MonitoringStation/led 0 off
MonitoringStation/buzzer 0 OFF
MonitoringStation/buzzer 0 OFF
MonitoringStation/buzzer 0 OFF
MonitoringStation/buzzer 0 OFF
MonitoringStation/buzzer 0 OFF
MonitoringStation/buzzer 0 OFF
MonitoringStation/buzzer 0 OFF
MonitoringStation/buzzer 0 OFF
MonitoringStation/buzzer 0 OFF
MonitoringStation/buzzer 0 OFF
MonitoringStation/temperature 0 27.31
MonitoringStation/humidity 0 48.65
MonitoringStation/motion 0  0.00
MonitoringStation/light 0 831.00
MonitoringStation/led 0 off
MonitoringStation/buzzer 0 OFF
MonitoringStation/buzzer 0 OFF
MonitoringStation/buzzer 0 OFF
```

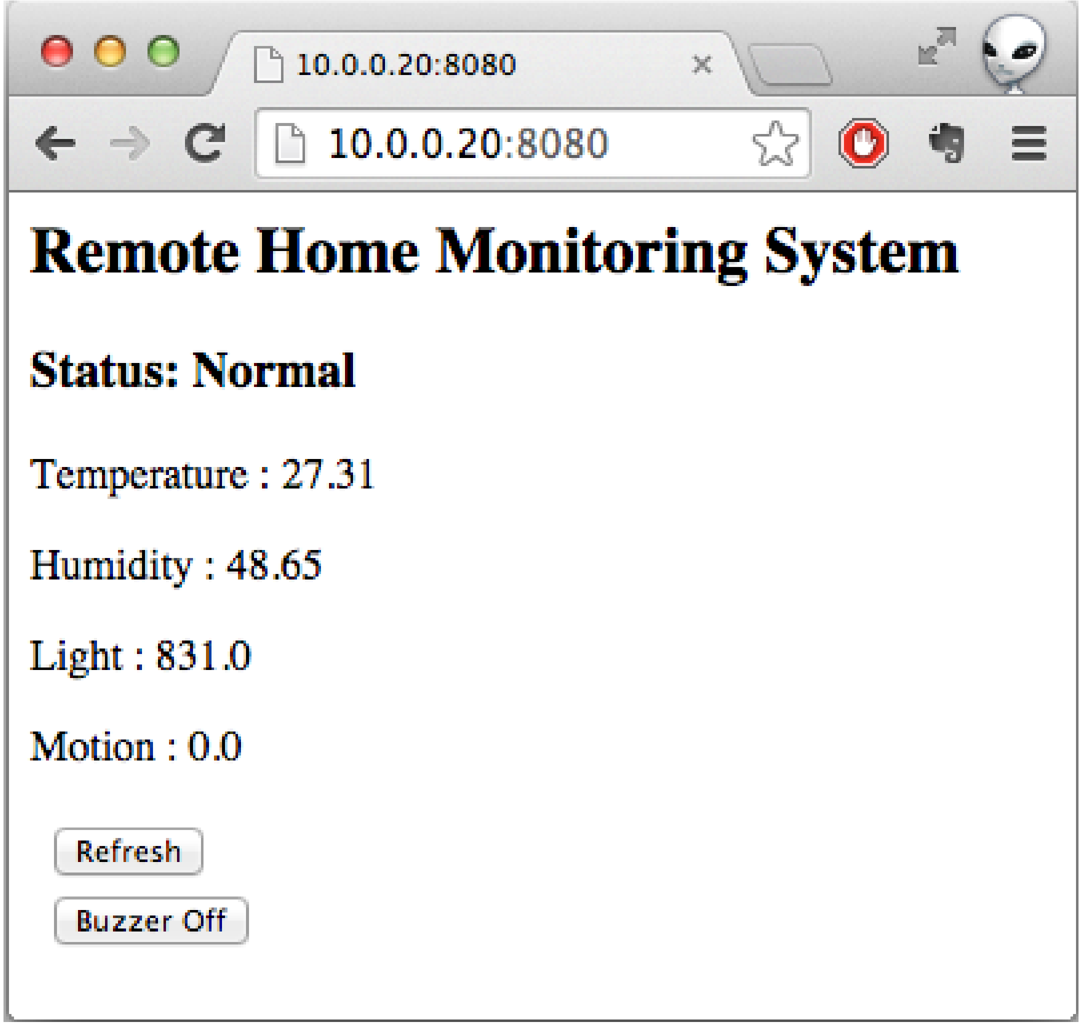


Control Center

Normal

Temperature : 27.31 C
Humidity : 48.65 %
Light : 831.0 lx
Motion : No





Remote Home Monitoring System

Status: Normal

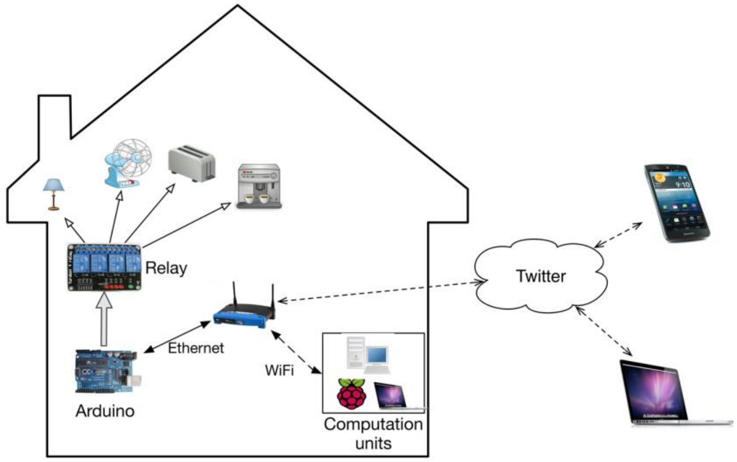
Temperature : 27.31

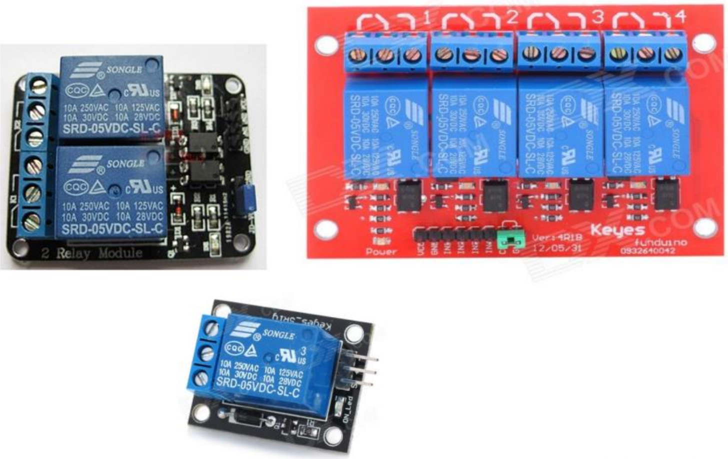
Humidity : 48.65

Light : 831.0

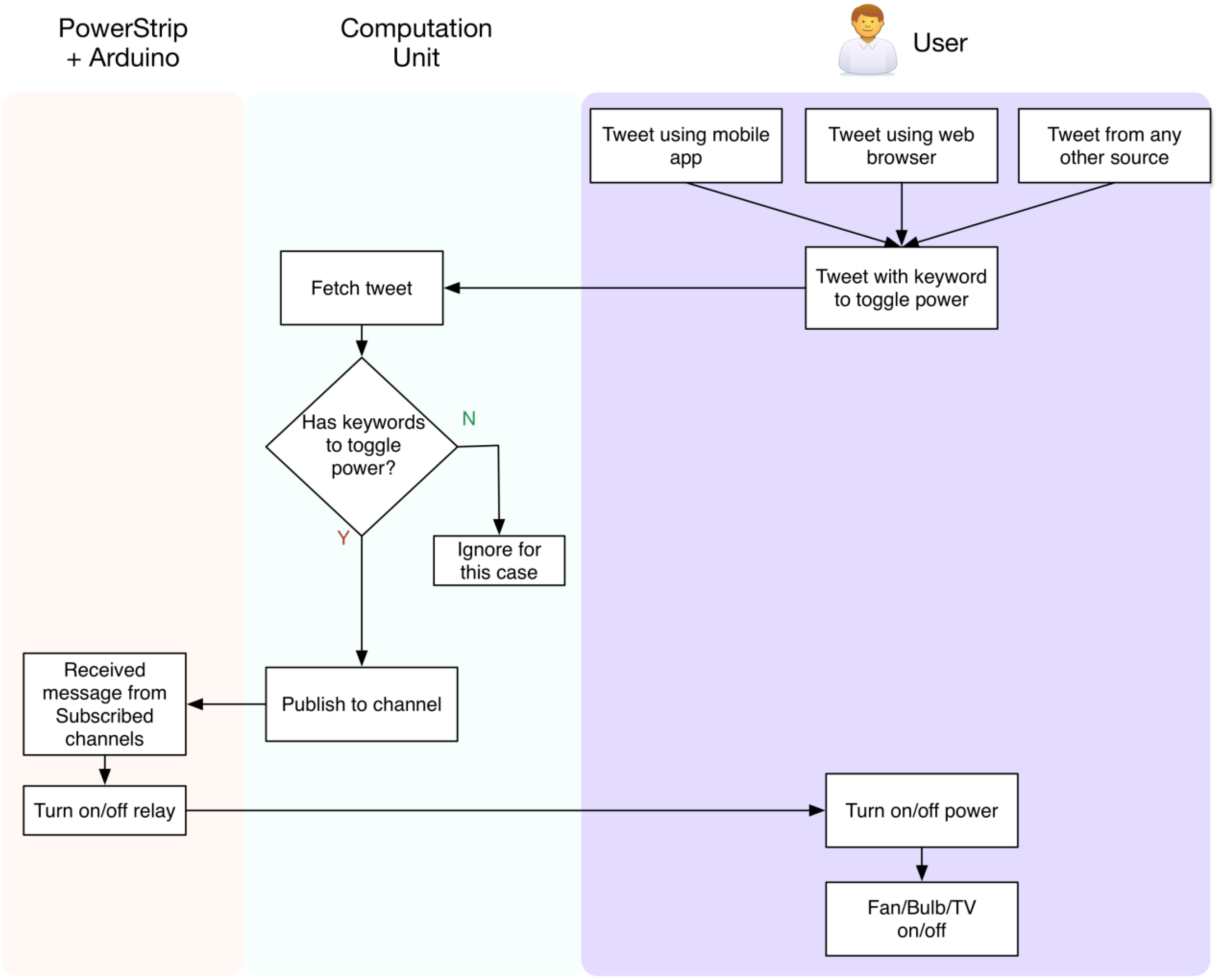
Motion : 0.0

Chapter 11: Tweet-a-PowerStrip

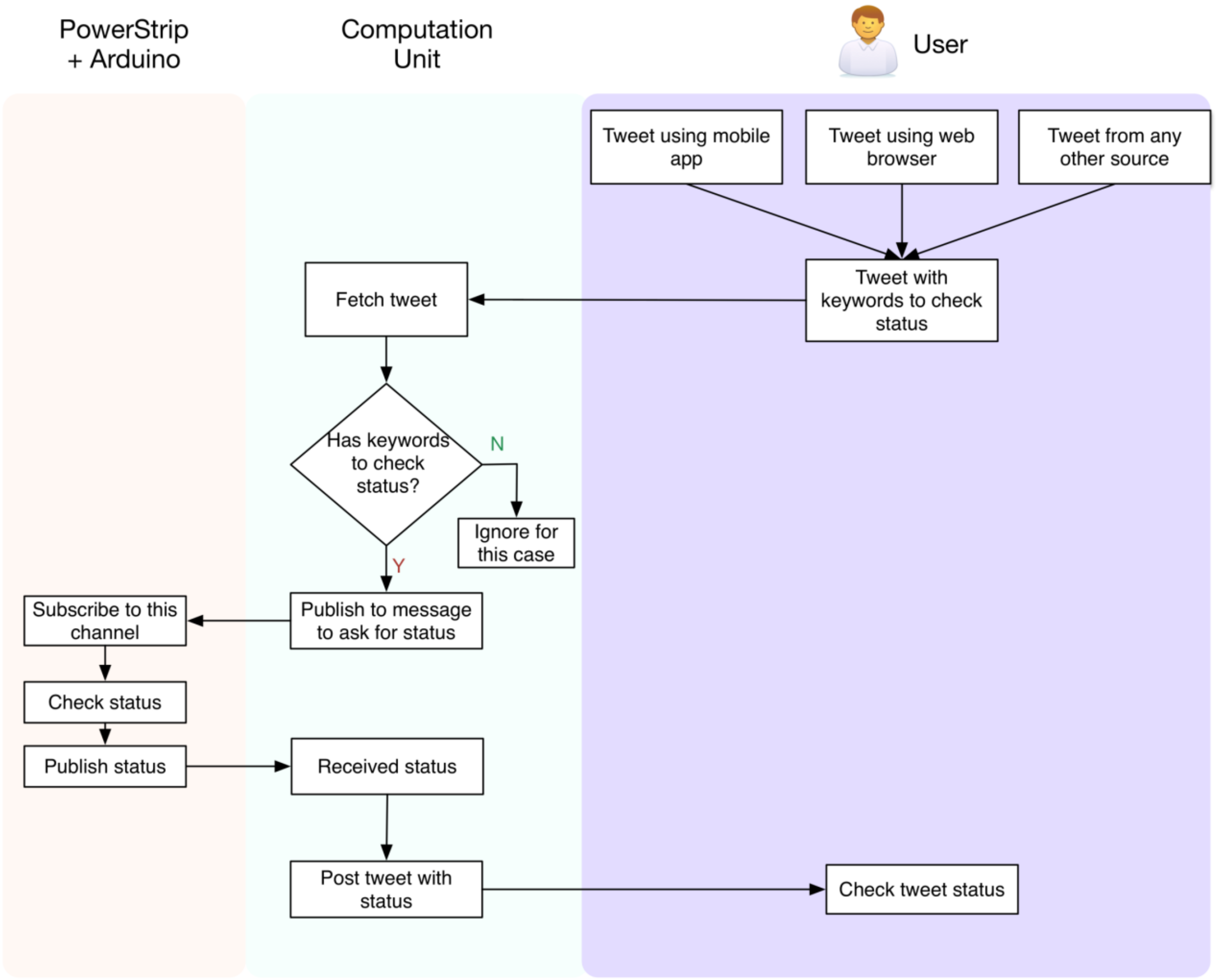




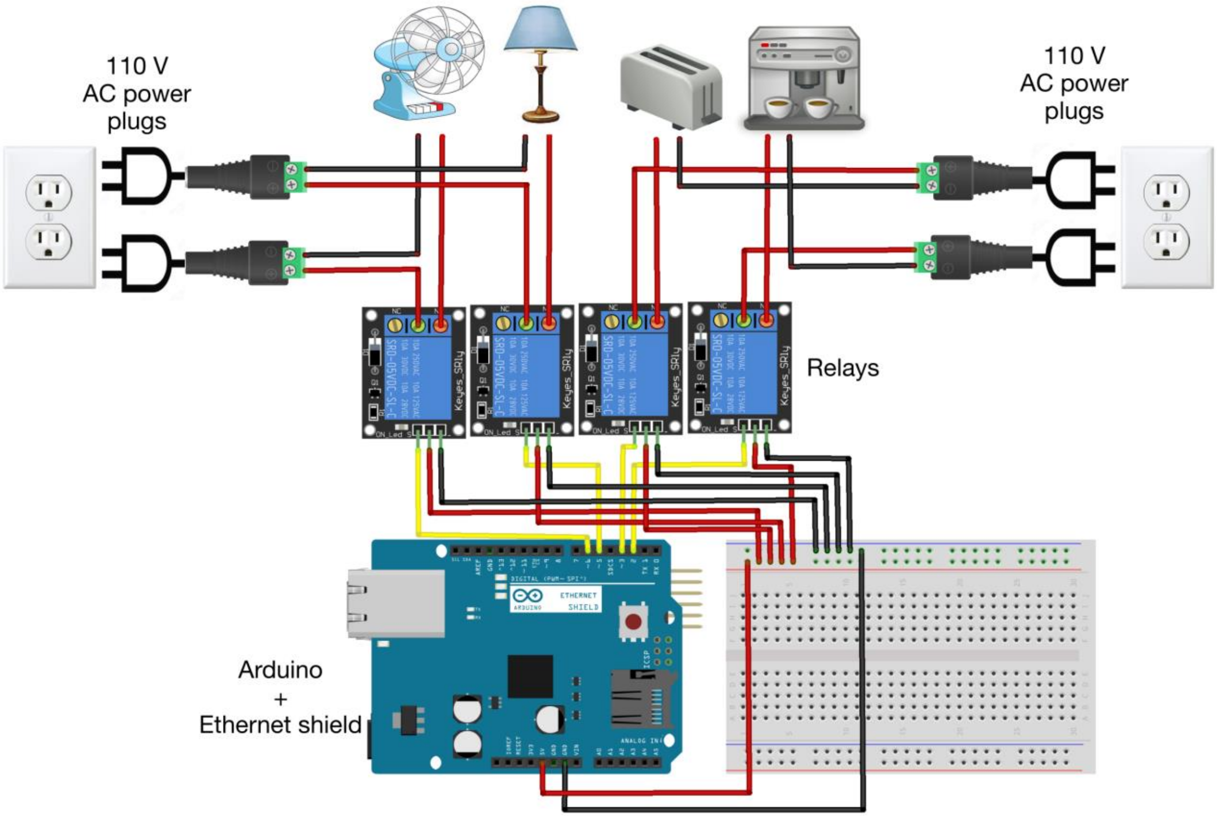
Images courtesy : www.dx.com

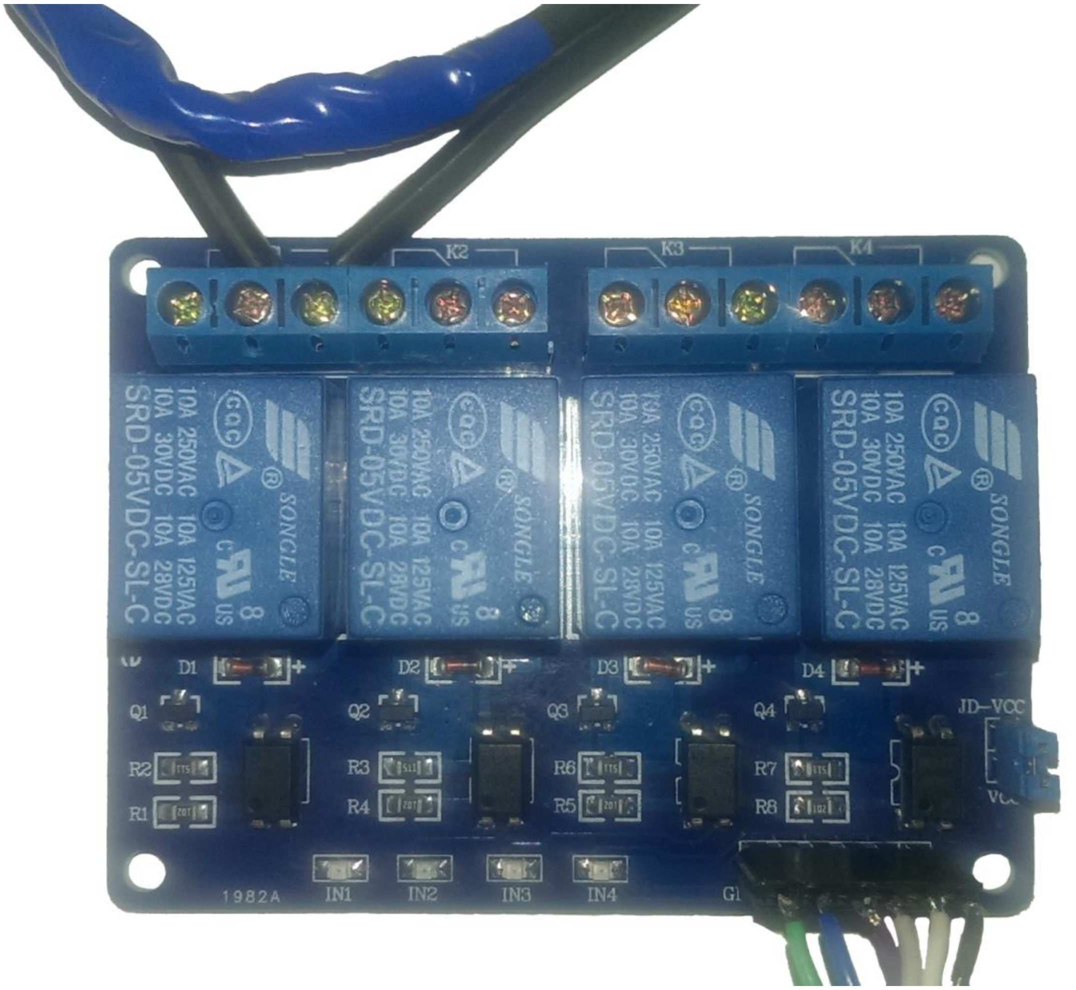


Toggle power port

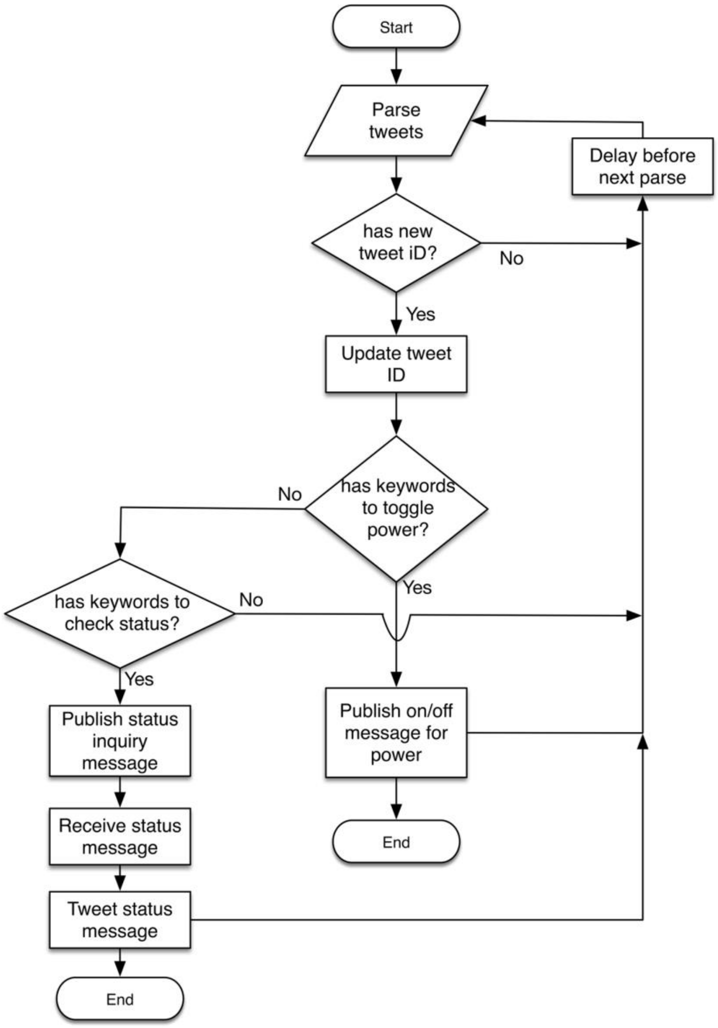


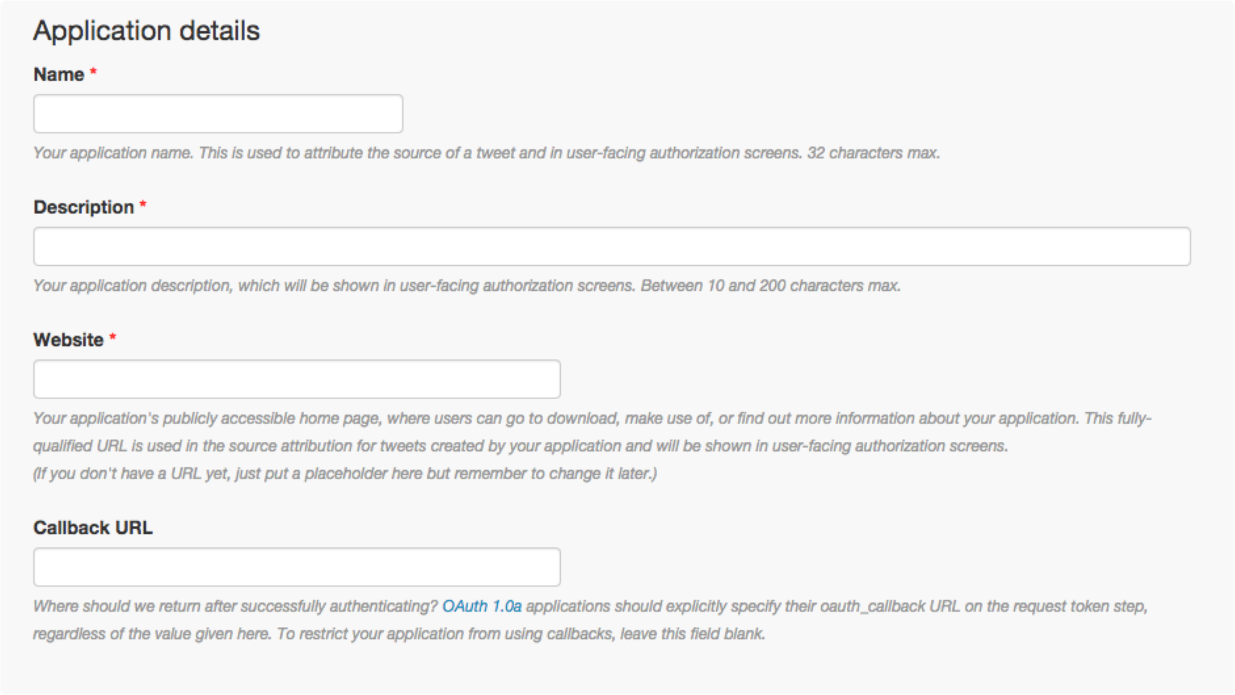
Check port status


110 V
AC power
plugs
110 V
AC power
plugs
Relays
Arduino
+
Ethernet shield



K2
K3
K4
SONGLE
10A 250VAC 10A 125VAC
10A 30VDC 10A 28VDC
SRD-05VDC-SL-C
D1
D2
D3
D4
Q1
Q2
Q3
Q4
R1
R2
R3
R4
R5
R6
R7
R8
JD-VCC
VCC
1982A
IN1
IN2
IN3
IN4
GI


Start
Parse tweets
Delay before next parse
has new tweet iD?
No
Yes
Update tweet ID
has keywords to toggle power?
No
has keywords to check status?
No
Yes
Yes
Publish status inquiry message
Publish on/off message for power
Receive status message
End
Tweet status message
End



Application details

Name *

Your application name. This is used to attribute the source of a tweet and in user-facing authorization screens. 32 characters max.

Description *

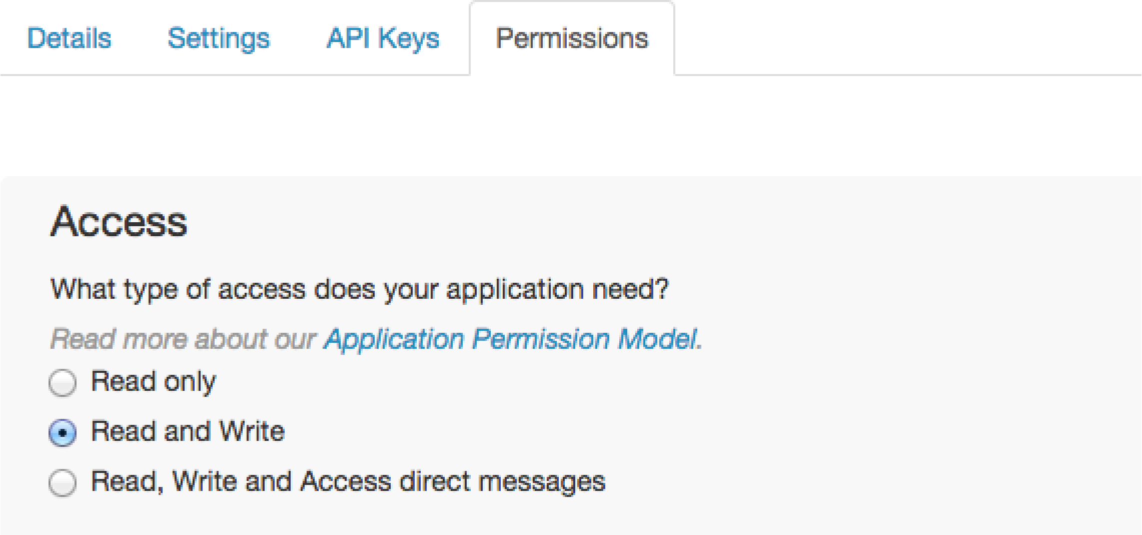
Your application description, which will be shown in user-facing authorization screens. Between 10 and 200 characters max.

Website *

Your application's publicly accessible home page, where users can go to download, make use of, or find out more information about your application. This fully-qualified URL is used in the source attribution for tweets created by your application and will be shown in user-facing authorization screens.
(If you don't have a URL yet, just put a placeholder here but remember to change it later.)

Callback URL

Where should we return after successfully authenticating? OAuth 1.0a applications should explicitly specify their oauth_callback URL on the request token step, regardless of the value given here. To restrict your application from using callbacks, leave this field blank.



Access

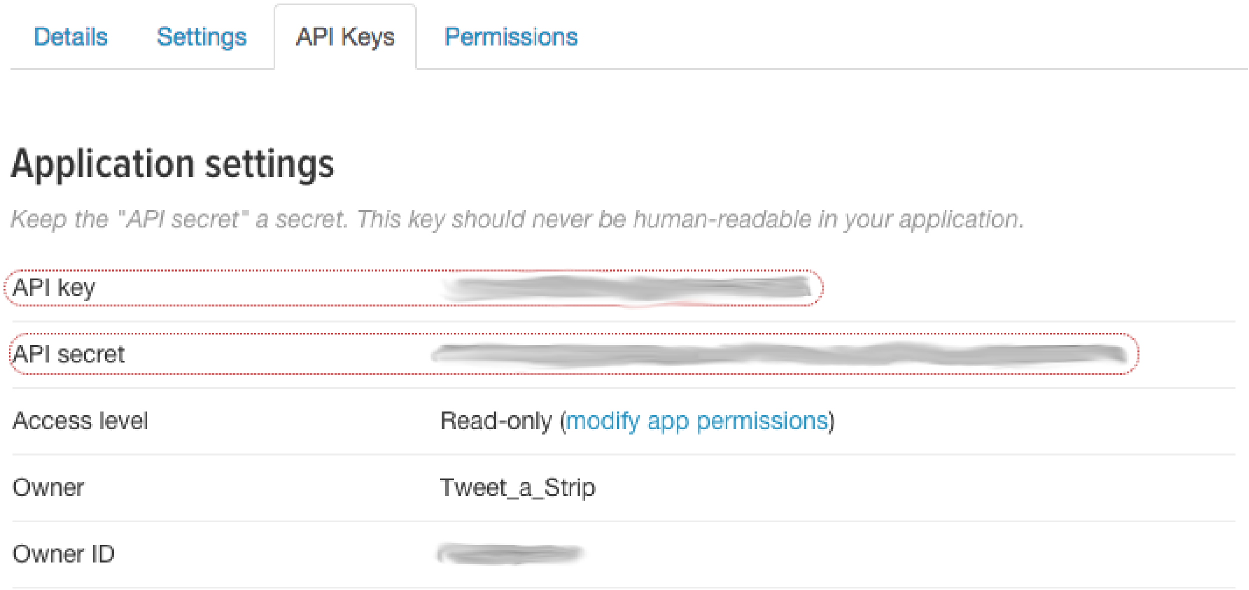
What type of access does your application need?

Read more about our Application Permission Model.

○ Read only

● Read and Write

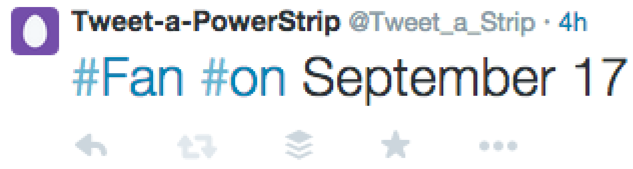
○ Read, Write and Access direct messages



Application settings

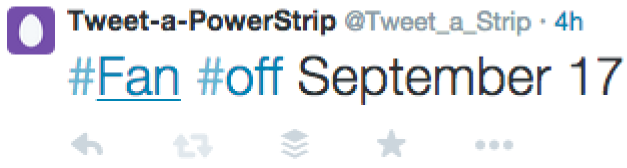
Keep the "API secret" a secret. This key should never be human-readable in your application.

API key	[redacted]
API secret	[redacted]
Access level	Read-only (modify app permissions)
Owner	Tweet_a_Strip
Owner ID	[redacted]



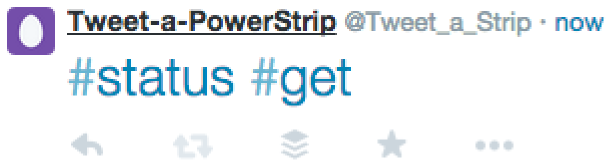
Tweet-a-PowerStrip @Tweet_a_Strip · 4h

#Fan #on September 17



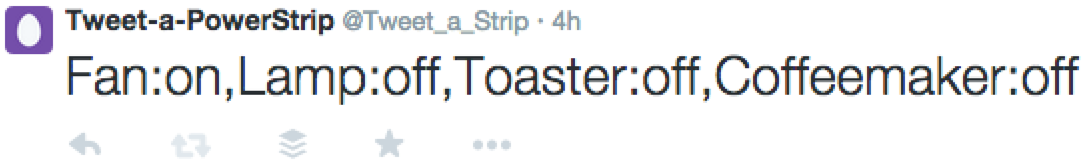
Tweet-a-PowerStrip @Tweet_a_Strip · 4h

#Fan #off September 17



Tweet-a-PowerStrip @Tweet_a_Strip · now

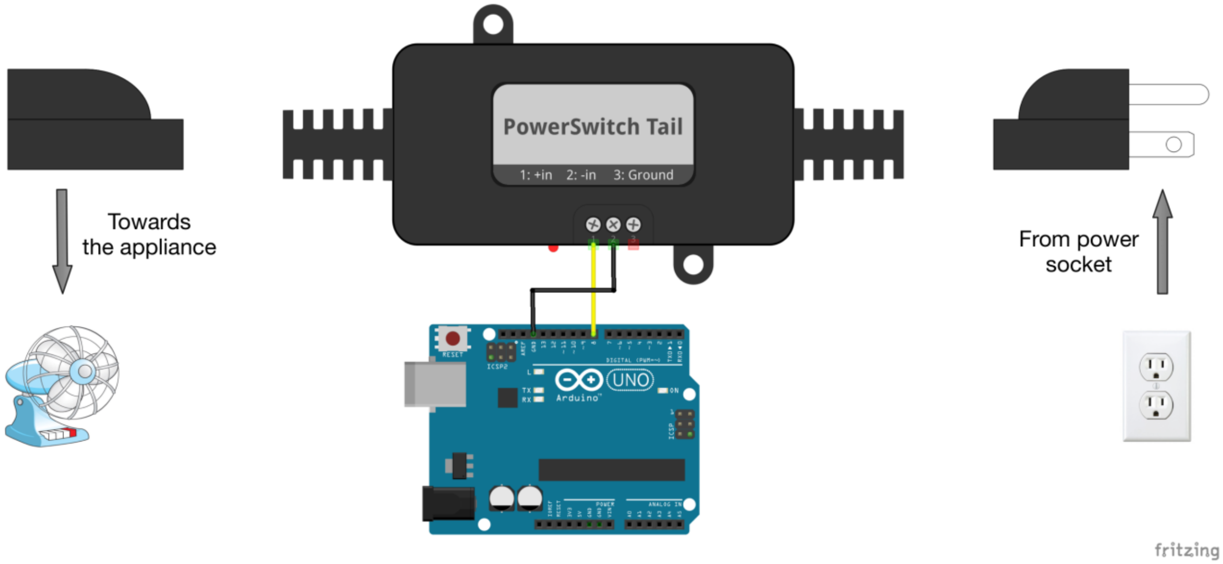
#status #get

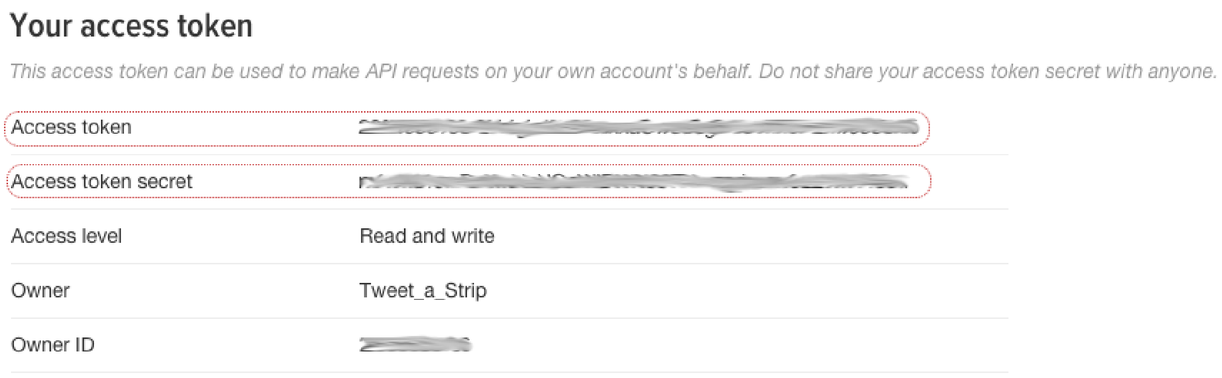


Tweet-a-PowerStrip @Tweet_a_Strip · 4h

Fan:on,Lamp:off,Toaster:off,Coffeemaker:off

PowerSwitch Tail II
Isolated DC Actuated AC Power Switch
www.PowerSwitchTail.com
1: +in 2: -in 3: Ground


PowerSwitch Tail
1: +in 2: -in 3: Ground
Towards the appliance
From power socket
UNO
Arduino
fritzing



Your access token

This access token can be used to make API requests on your own account's behalf. Do not share your access token secret with anyone.

Access token	[redacted]
Access token secret	[redacted]
Access level	Read and write
Owner	Tweet_a_Strip
Owner ID	[redacted]