DS18B20 TEMPERATURE SENSOR WITH PYTHON

Things Required

1 We will need to following hardware for this project (you will have all of this at the Jam but you can easily get this from the Internet if you are trying this at home).

* A Raspberry Pi
* A DS18B20 Temperature Sensor (we will be using waterproof ones)
* A 4.7K Ohm Resistor
* A Breadboard
* 3 x female to male jumpers
* A 3 pin terminal block
* Internet connectivity for your Pi

We will also need the two following bits of software installing (again these will be pre-installed at the Jam):

* Python 3 w1thermsensor library
* Python 3 MatPlotLib library

Software Install

2 Open a terminal and type the following two commands, pressing enter after each command. ***Remember you don't need to do this at the Jam!***

```
sudo pip3 install w1thermsensor

sudo apt-get install python3-matplotlib -y
```

Configure the Pi

3 The temperature sensor we are using uses a 1 wire serial interface. We need to tell our Raspberry Pi to enable this interface. We do this by using the "**Raspberry Pi Configuration**" tool found in the main menu, under the "**Preferences**" sub-menu.
Open this tool and select the "**Interfaces**" tab. Click to enable the "**1-wire**" interface and then select "**OK**".
You will then be asked to reboot. Select "**No**" and shut your Pi down through the menu.

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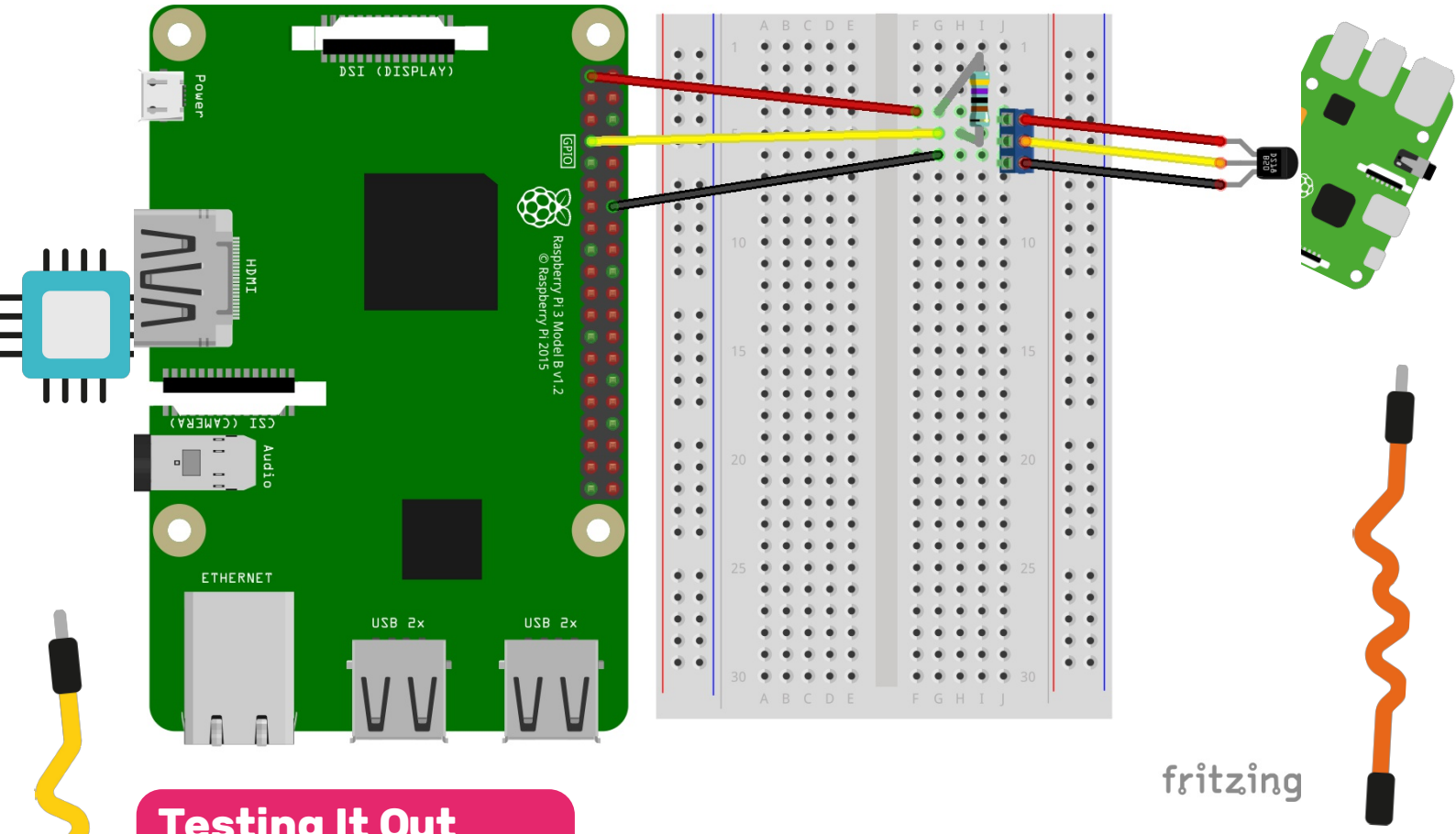
The Electronics

4 Construct your electronic circuit as shown. Take care that you are connecting to the correct pins on the Pi and that you have the resistor joining the red and the yellow wires from the sensor!



Testing It Out

5 Once you are happy everything is connected as shown, start your Pi up again and open "**Python 3 (IDLE)**" from the "**Programming**" menu and then open a new window by pressing "**Ctrl + N**".

Type the following program into your new file, save it as "**tempTest.py**" and press "**F5**" to run it...

```
from time import sleep
from w1thermsensor import W1ThermSensor

sensor = W1ThermSensor()

while True:
    temp = sensor.get_temperature()
    print("The temperature is %s celsius" % temp)
    sleep(1)
```

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Test Output

6 All being well, you should see something like this scrolling up your Python shell every second... If you don't go back and check your program and your electronics!

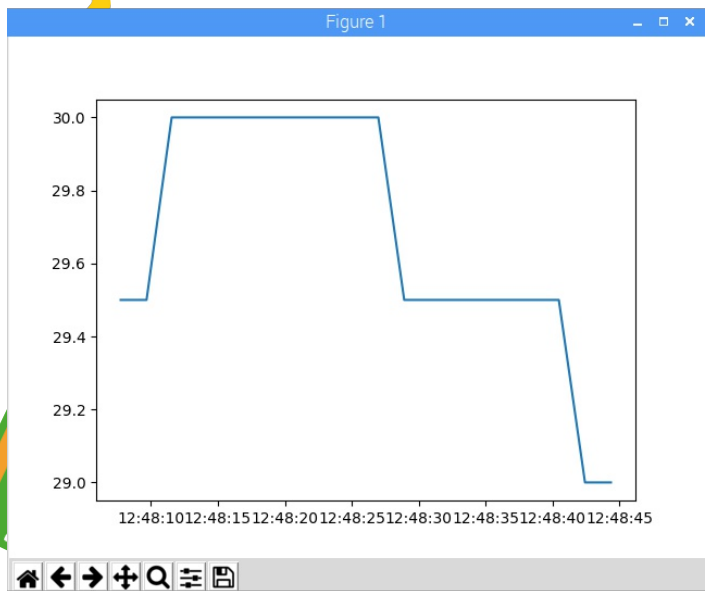
Once your test program works we can move onto the next step; graphing our data...

```
File  Edit  Shell  Debug  Options  Window  Help
Python 3.5.3 (default, Jan 19 2017, 14:11:04)
[GCC 6.3.0 20170124] on linux
Type "copyright", "credits" or "license()" for
>>>
================ RESTART: /home/jwitts/Deskto
The temperature is 23.5 celsius
The temperature is 23.5 celsius
The temperature is 23.5 celsius
The temperature is 23.5 celsius
The temperature is 24.0 celsius
The temperature is 24.0 celsius
The temperature is 24.0 celsius
The temperature is 24.0 celsius
```

MatPlotLib - List

7 We will use the MatPlotLib Python library to create a graph of our temperature change over time. For our first graph we will first record 20 readings to a list and then graph them. Type the following program into a new Python file and save it as "**TempList.py**"

You should see a graph like the one below:




```
import datetime as dt
import matplotlib.pyplot as plt
from time import sleep
from w1thermsensor import W1ThermSensor

fig = plt.figure()
ax = fig.add_subplot(1, 1, 1)
xs = []
ys = []

sensor = W1ThermSensor()

for i in range(20):
    temp = sensor.get_temperature()
    print(str(temp))
    xs.append(dt.datetime.now())
    ys.append(temp)
    sleep(1)

ax.plot(xs, ys)
plt.show()
```

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MatPlotLib - Realtime

8 Now we will use the MatPlotLib Python library to create a live graph of our temperature change over time. We can then use hot water and ice cubes to see the speed of temperature change over time...

```
import datetime as dt
import matplotlib.pyplot as plt
import matplotlib.animation as animation
from w1thermsensor import W1ThermSensor

# Setup our graph
fig = plt.figure()
ax = fig.add_subplot(1, 1, 1)
xs = [ ]
ys = [ ]

sensor = W1ThermSensor()

# This function is called periodically from FuncAnimation
def animate(i, xs, ys):
    # Read temperature from sensor
    temp = sensor.get_temperature()

    # Add x and y to lists
    xs.append(dt.datetime.now())
    ys.append(temp)

    # Limit x and y lists to 40 items
    xs = xs[-40:]
    ys = ys[-40:]

    # Draw x and y lists
    ax.clear()
    ax.plot(xs, ys)
    # Format plot
    plt.xticks(rotation=45, ha='right')
    plt.subplots_adjust(bottom=0.30)
    plt.title('DS18B20 Temp over Time')
    plt.ylabel('Temp (deg C)')

# Set up plot to call animate() function periodically
ani = animation.FuncAnimation(fig, animate, fargs=(xs, ys), interval=1000)
plt.show()
```

Ideas from:
https://bigl.es/ds18b20-temperature-sensor-with-python-raspberry-pi/
https://learn.sparkfun.com/tutorials/graph-sensor-data-with-python-and-matplotlib/all

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