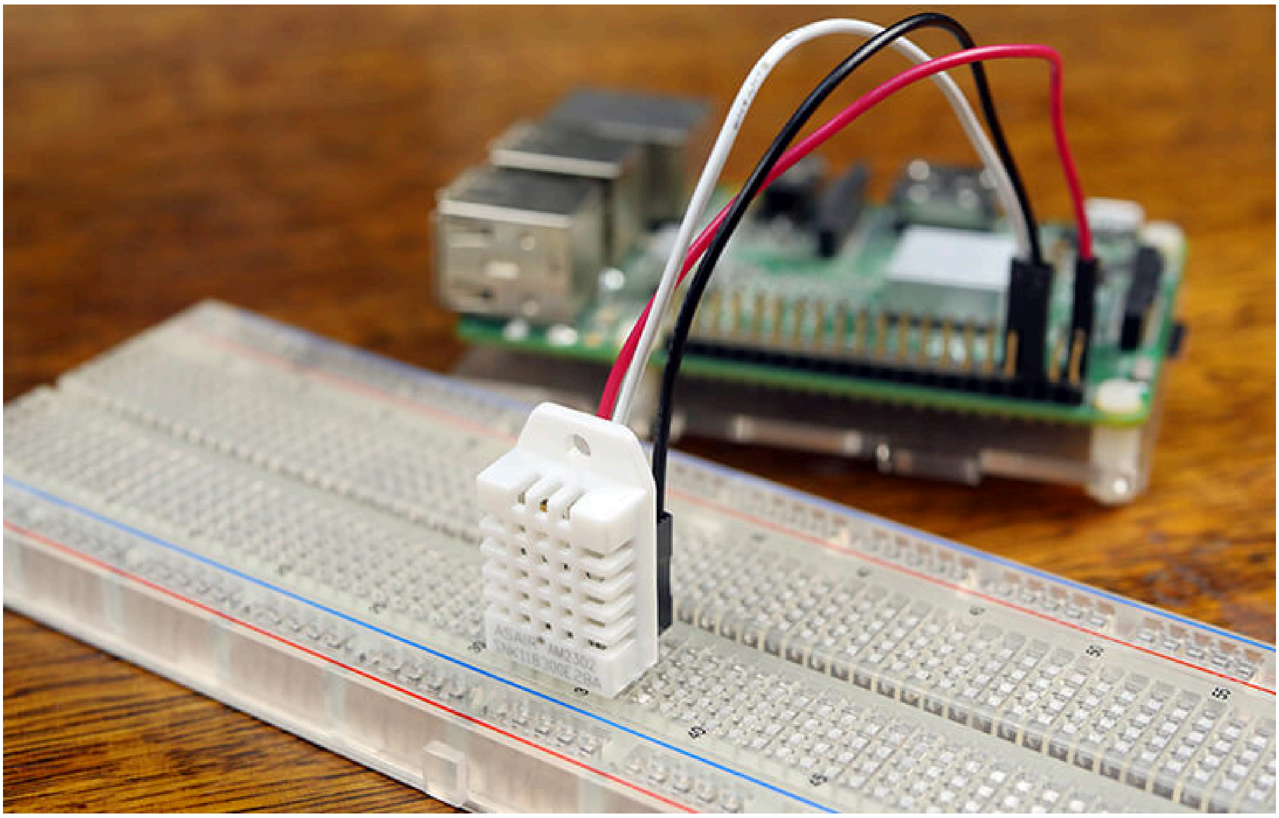
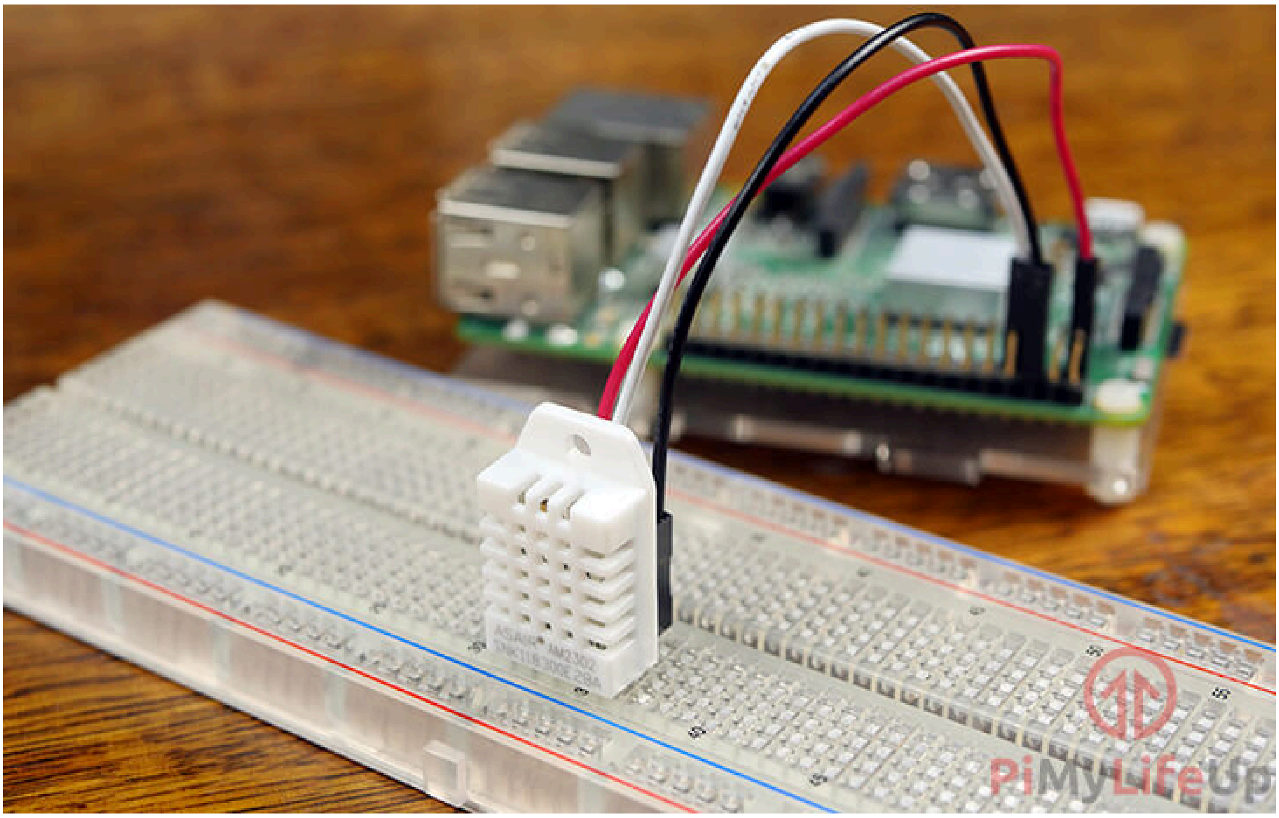
Raspberry Pi Humidity Sensor using the DHT22



In this tutorial, we will show you how to connect the DHT22 humidity sensor to the Raspberry Pi and how you can use Python to read the data.



The DHT22 is a versatile and low-cost humidity sensor that can also calculate the temperature of an area.

This sensor has a relatively long transmission distance, allowing the sensor to transmit data through wires up to 20m away from the Raspberry Pi.

As a bonus, the DHT22 is a digital sensor with an inbuilt analog to digital converter. The converter makes it a lot easier to connect the sensor to the Raspberry Pi as you do not need to deal with any additional chips.

The biggest downside to the DHT11 and DHT22 sensors is that they are quite slow sensors. They have a sampling rate of once every second for the DHT11 and once every 2 seconds for the DHT22.

You can also use the DHT22 with the Arduino, so be sure to check that tutorial if you would rather use an Arduino board.

While this tutorial covers connecting the DHT22 to the Raspberry Pi, it will also work with the DHT11 and AM2302 humidity sensors as they all use the same pinouts.

Equipment

Below is all the equipment that you will need to connect the DHT22 Humidity Sensor to your Raspberry Pi.

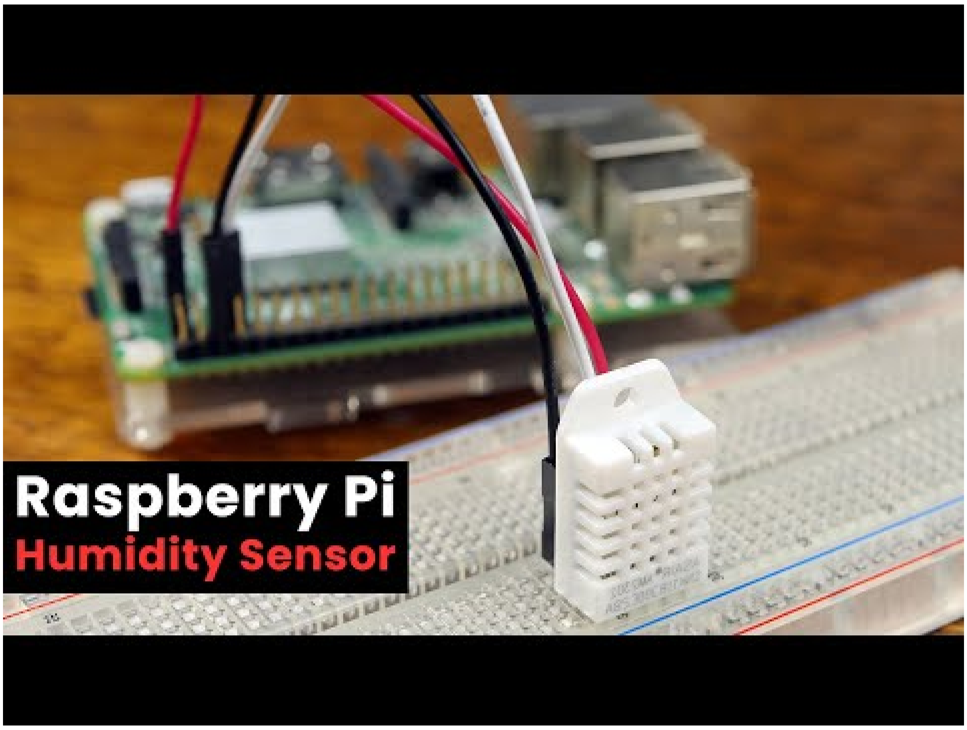
Recommended

Raspberry Pi Amazon
8GB Micro SD Card Amazon
Breadboard wire Amazon
DHT22 Humidity Sensor Amazon
10k ohm resistor Amazon (Brown, Black, Orange, Gold)

Video

The video below will take you through the steps to assemble the humidity circuit and how to connect it to your Raspberry Pi. It also covers the steps on how to write a simple Python script to talk with the DHT22 sensor.

If you prefer a written tutorial, you can find it right underneath the video.



Watch Video At: https://youtu.be/QjNyCeqcq4g

Raspberry Pi Humidity Sensor Hardware Setup

In this section of the tutorial, we will show you the process on how to connect your DHT22 humidity sensor to the Raspberry Pi.

Thanks to the DHT22 being a digital sensor, it is incredibly straightforward to connect to the Raspberry Pi. The single data pin is able to connect directly to the Raspberry Pi's GPIO pins.

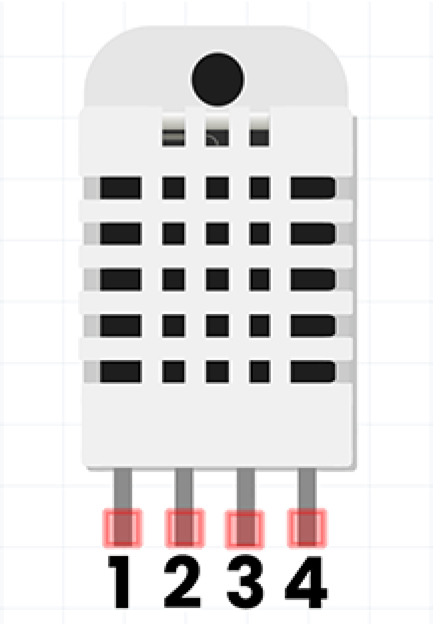
You can follow our guide below to see how to connect the DHT22 to your Raspberry Pi.

DHT22 Pinout

To make things easier when assembling the humidity sensor circuit we have included the pinout of the DHT22 sensor.

This diagram should help you work out where each pin needs to go on the Raspberry Pi.

- **Pin 1** is **VCC** (Power Supply)
- **Pin 2** is **DATA** (The data signal)
- **Pin 3** is **NULL** (Do not connect)
- **Pin 4** is **GND** (Ground)

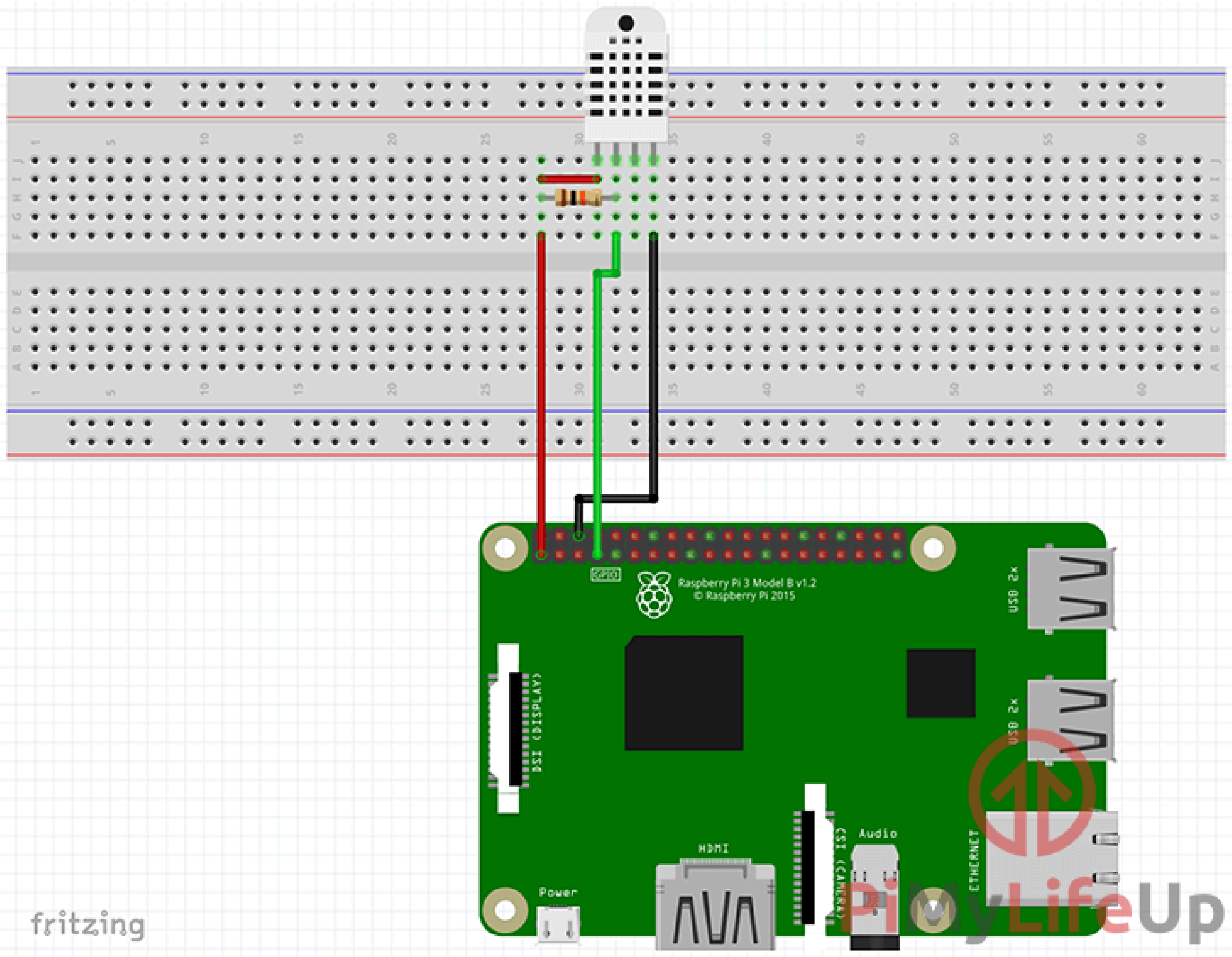


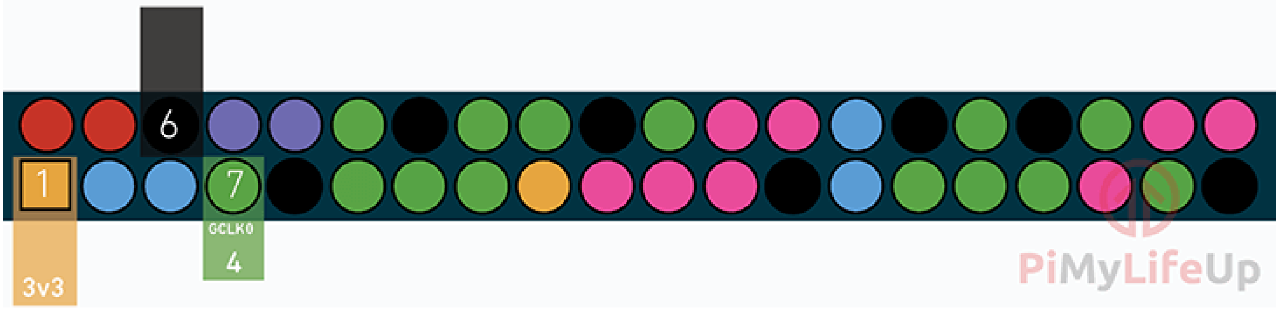
Raspberry Pi DHT22 Circuit

Here, we have included a couple of ways to assemble the Raspberry Pi Humidity sensor circuit.

You can refer to our two diagrams below to see which pins need to be connected to which, or follow the written steps below.

- Place a **10k resistor** between **Pin 1** and **Pin 2** of the DHT22
- Wire **Pin 1** of the DHT22 to **Physical Pin 1** (**3v3**) on the Pi
- Wire **Pin 2** of the DHT22 to **Physical Pin 7** (**GPIO4**) on the Pi
- Wire **Pin 4** of the DHT22 to **Physical Pin 6** (**GND**) on the Pi





Preparing the Raspberry Pi to talk with the Humidity Sensor

In this section, we will prepare your Raspberry Pi to communicate with the DHT22 humidity sensor.

Primarily, we need to install Python 3 on the Pi and set up a Python Virtual Environment.

Setting up your Raspberry Pi

1. Before we get started with programming a script for the Raspberry Pi humidity sensor, we must first ensure that we have the latest updates on our Raspberry Pi.

We can do this by running the following two commands to update both the package list and installed packages.

```
sudo apt update
sudo apt upgrade
```

2. With our package list now up to date, we need to go ahead and install both **python 3** and **pip**. We will be using both of these packages to interact with our humidity sensor.

Install both "`python3-dev`" and "`python3-pip`" by running the command below.

```
sudo apt install python3-dev python3-pip
```

Setting up a Python Virtual Environment for the DHT22 Humidity Sensor

3. Our first step is to create a directory where we will store the Python virtual environment for the DHT22 humidity sensor.

You can create a directory called "`dht22`" in your user's home directory by running the following command.

```
mkdir ~/dht22
```

4. After creating the directory, you must now change to it by using the cd command.

```
cd ~/dht22
```

5. We now need to use Python to generate the virtual environment. All of the libraries that we will be using will be installed to this environment.

Generate the Python virtual environment by typing the following command.

```
python3 -m venv env
```

6. Once the virtual environment has been generated, we will need to tell the terminal to utilize it as its source.

You will need to run this command every time you want to interact with your DHT22 humidity sensor script. The reason for this is that the Python library we are using will be installed only in this environment.

```
source env/bin/activate
```

7. Now using pip, we will go ahead and install Adafruit's DHT library to the Raspberry Pi.

We will be using this Python library to interact with our DHT22 Humidity and temperature sensor.

As a bonus, the library also supports the DHT11 and AM2302 humidity/temperature sensors, making it a great library to learn how to utilize.

Run the following command to install the DHT library on your Raspberry Pi.

```
python3 -m pip install adafruit-circuitpython-dht lgpio RPi.GPIO
```

Programming for the Raspberry Pi humidity sensor

1. Now that we have installed the Adafruit DHT library on our Raspberry Pi we can proceed to program with it.

First, we must make a Python script where we will store all our code. To begin writing this file, you can enter the following command into your Raspberry Pi.

```
nano ~/dht22/humidity.py
```

2. Within this file, we need to enter the following lines of code. We will explain each section of the code as we go along.

a. The first library we will be importing in this script allows us to sleep the script between readings. This setup stops the script from constantly reading from the sensor when it doesn't need to.

```
import time
```

b. This line imports the "`Adafruit_DHT`" library that we obtained using `pip` in the previous section.

We will be using this library to talk and interact with the DHT22 sensor. The library enables us to easily retrieve the temperature and humidity data from the sensor with just a few lines of Python code.

```
import adafruit_dht
```

c. The Adafruit DHT22 Library also required us to import the "board" library.

This library is used internally by Adafruit to select the pins to which your humidity sensor is attached.

```
import board
```

d. Our next step is to create our "`dht_device`" variable that points to Adafruit DHT22 library. In this function call, we pass in the pin to which our DHT22 sensor is connected on our Raspberry Pi.

We use this object to get the current temperature and humidity from the sensor.

Since we are using the GPIO4 pin, we need to use the "`D4`" option from the board library.

```
dht_device = adafruit_dht.DHT22(board.D4)
```

e. Since we want our Python script to get readings from the humidity sensor constantly, we will need to start an infinite loop. This loop causes the script to run continually until you terminate it.

All code that is within this loop must be indented.

```
while True:
```

f. One problem with the DHT22 library is that it can commonly throw errors. This issue isn’t necessarily a problem with the DHT22 library or your Raspberry Pi, but more with how the sensor itself works.

To prevent an error from stopping the script, we must run our code within a “`try`” block.

Indent the code by another four spaces after this block.

```
    try:
```

g. Finally, within our try block, we can get our first temperature value from our sensor. Reading a value from the sensor is as simple as grabbing the “temperature” value from the “`dht_device`” object.

Since the DHT22 reports temperature in Celsius, we will store the value in a variable called “`temperature_c`“.

```
        temperature_c = dht_device.temperature
```

h. While the DHT22 humidity sensor might not give us the value in Fahrenheit, luckily, it is very easy to convert the value.

The following line of code converts our Celsius temperature to Fahrenheit and stores it in a variable called “`temperature_f`“.

```
        temperature_f = temperature_c * (9 / 5) + Copy
```

i. Luckily, the humidity reading is super simple and is returned as a percentage that we store within the “`humidity`” variable.

```
        humidity = dht_device.humidity
```

j. Finally, once we have gotten the temperature and humidity values from our DHT22 sensor, we can print them to the terminal by making use of the “`print()`” function.

```
        print("Temp:{:.1f} C / {:.1f} C    Humidity: {}%".format(temperature_c,
temperature_f, humidity)
```

k. Now that we are finished with our try block, we must end it with the following block of code.

This code catches any errors that might be caused by the DHT22 library on our Raspberry Pi and prints the error to the terminal. By catching the error, the script will continue to run.

```
    except RuntimeError as error:
        print(err.args[0])
```

l. Finally, we end every loop by running a short 2-second sleep of the script. This sleep allows us time between recordings and reduces the likelihood of encountering errors.

```
    time.sleep(2.0)
```

3. Once you have finished entering the code, it should look like what we have displayed below.

```
import time
import adafruit_dht
import board

dht_device = adafruit_dht.DHT22(board.D4)

while True:
    try:
        temperature_c = dht_device.temperature
        temperature_f = temperature_c * (9 / 5) + 32

        humidity = dht_device.humidity

        print("Temp:{:.1f} C / {:.1f} F    Humidity: {}%".format(temperature_c,
temperature_f, humidity))
    except RuntimeError as err:
        print(err.args[0])

    time.sleep(2.0)
```

4. When you are happy that all the code you entered is correct, you can then save the file by pressing CTRL + X, then Y followed by ENTER.

5. With the script now saved, let's go ahead and run it so that we can start to see the data from the humidity sensor.

You can run this script by running the following command.

```
python3 ~/dht22/humidity.py
```

6. From this command, you should start seeing results like what we have below. The temperature and the humidity should be displayed through the command line.

```
Temp:24.0 C / 75.2 F    Humidity: 47%
Temp:24.0 C / 75.2 F    Humidity: 48%
Temp:24.0 C / 75.2 F    Humidity: 49%
Temp:24.0 C / 75.2 F    Humidity: 52%
```

7. In the next section of the tutorial, we will show you how you can modify this script so that it logs the data to a file. The file will be able to be read by a program such as Microsoft Excel or Google Spreadsheets.

Logging the Data from the Raspberry Pi Humidity Sensor

1. Let's start by creating a new script. This script will be similar to our previous script, but with a few changes made to allow us to write to a file.

Start by running the following command to begin writing our new script.

```
nano ~/dht22/humidity_logger.py
```

2. Within this file, enter the following lines. We will only be explaining the new additions to the script in this section.

a. Here we add the import for both the "`os`" and "`time`" libraries. We utilize the "`os`" library to check if our CSV file exists before attempting to write to it.

We use the "`time`" library to timestamp each new row with the current date and time.

```
import os
import time
import adafruit_dht
import board
```

b. There is no difference with this line, keep it as you had in the previous script.

```
dht_device = adafruit_dht.DHT22(board.D4)
```

c. Here we wrap everything within a try statement to handle any potential errors.

We open up a handle to our "`/home/pi/humidity.csv`" file with the "`a+`" tag applied. The **a+ tag** means that any data written to the file will be appended to the end of it.

Next, we use the "`os`" library to see if we have ever written to this file before. If the size returns as 0 we then write an initial line to the file. This line will contain our column headers, so you can understand the data easier.

```
try:
    f = open('/home/pi/humidity.csv', 'a+')
    if os.stat('/home/pi/humidity.csv').st_size == 0:
            f.write('Date,Time,Temperature C, Temperature F,Humidity\r\n')
except:
    pass
```

d. Here we have our while loop again. We utilize the DHT Library to read data from our DHT22 humidity sensor again.

This function stores the data it reads from the sensors into our “`humidity`” and “`temperature`” variables.

```
while True:
        temperature_c = dht_device.temperature
        temperature_f = temperature_c * (9 / 5) + 32

        humidity = dht_device.humidity
```

e. Our big change to this section of code is that instead of printing the temperature and humidity to the console, we write it to our “`humidity.csv`” file. We do this by using the file handle we opened earlier.

We format the text written to the file to include both the **current date**, **current time**, our formatted **temperature**, and **humidity**.

At the end of the loop, we sleep the script for 30 seconds. If you want to make it sleep longer or poll more often, then modify this number.

```
        f.write('{0},{1},{2:0.1f}*C,{2:0.1f}*F,
{3:0.1f}%\r\n'.format(time.strftime('%m/%d/%y'), time.strftime('%H:%M'),
temperature_c, temperature_f, humidity))
    except RuntimeError as err:
        print(err.args[0])

    time.sleep(30)
```

3. Once you have finished entering the code, it should look like what we have displayed below.

Ensure that you replace “`pi`” with your own username.

```
import os
import time
import adafruit_dht
import board

dht_device = adafruit_dht.DHT22(board.D4)

try:
    f = open('/home/pi/dht22/humidity.csv', 'a+')
    if os.stat('/home/pi/dht22/humidity.csv').st_size == 0:
            f.write('Date,Time,Temperature C, Temperature F,Humidity\r\n')
except:
    pass

while True:
    try:
        temperature_c = dht_device.temperature
        temperature_f = temperature_c * (9 / 5) + 32

        humidity = dht_device.humidity

        f.write('{0},{1},{2:0.1f}*C,{2:0.1f}*F,
{3:0.1f}%\r\n'.format(time.strftime('%m/%d/%y'), time.strftime('%H:%M'),
temperature_c, temperature_f, humidity))
    except RuntimeError as err:
        print(err.args[0])

    time.sleep(30)
```

4. Once done, save the file by pressing `CTRL` + `X`, then `Y` followed by `ENTER`.

5. Now, like our last script, let's go ahead and run it by entering the following command.

```
python3 ~/dht22/humidity_logger.py
```

6. Once you exit the script, you will now be able to check out the "`humidity.csv`" file to see all the results that you have logged over time.

If you run the following command, you should see the contents of the file.

```
nano ~/dht22/humidity.csv
```

7. Below is an example of the contents that you should see within this file.

```
Date,Time,Temperature,Humidity
05/04/19,05:47,22.3*C,50.6%
05/04/19,05:48,22.2*C,50.4%
05/04/19,05:48,22.2*C,50.6%
05/04/19,05:49,22.2*C,50.4%
05/04/19,05:49,22.2*C,50.4%
05/04/19,05:50,22.2*C,50.3%
05/04/19,05:50,22.2*C,50.3%
05/04/19,05:51,22.2*C,50.2%
```

Once you have verified that the file is being written successfully, you are finally done programming your Raspberry Pi humidity sensor.