Weather Station Pi Instructions

Your kit should contain:

- 1 raspberry pi zero W
- 1 power pack
- 1 USB to micro USB adapter (for power)
- 1 temperature sensor
- 1 rain gauge
- 1 weather vane
- 1 anemometer
- Poles for mounting the wind sensors
- 1 wiring connector box
- 1 4.7K Ohm resistor
- 7 GPIO connectors
- 1 4Gb micro SD card
- 1 weatherproof box (to weatherproof the pi)
- 1 tupperware box (to weatherproof the battery pack)

The aim of this project is to build an automated weather station that you can deploy in the area around Nettlecombe, and that will automatically record temperature, wind speed and rainfall, ready for analysis.

The project has two parts; assembling and wiring up the three sensors, and customising the Python script that will monitor them. These can be done largely in parallel, so it might be sensible to split up into two smaller groups.

Part 1: Hardware

Your final weather station will have three operational sensors, a thermometer, an anemometer (wind speed sensor) and a rain gauge (the weather vane will not be used but is required to connect the anemometer).

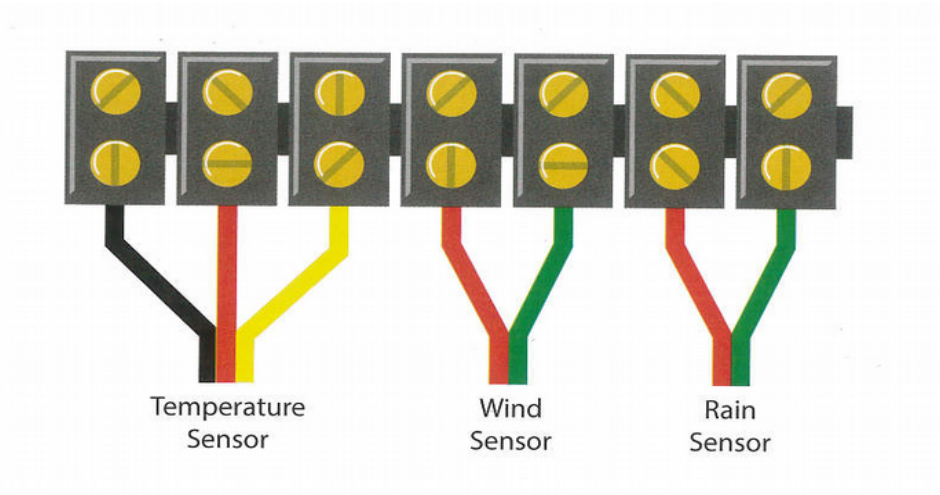
Step 1: Prepare the sensor cables.

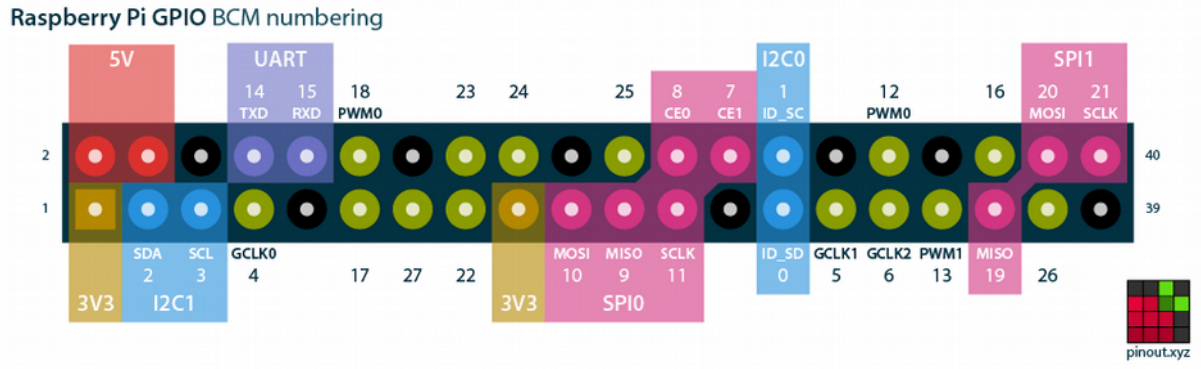
- The thermometer: strip about 1cm of insulation from each of the three wires and braid the copper together. The red wire will be connected to power, the black wire to ground, and the yellow wire will output the temperature data.
- The wind sensor: Plug the ethernet connector on the wind speed sensor into the port on the underside of the weather vane. The cable coming out of the weather vane has 4 wires, we shall only be using the red and yellow ones. Strip 1cm of insulation from each, and braid.
- The rain sensor: strip and braid both cables. Red is data, green is ground

Step 2: loop cables through the weatherproof box. Pop out one of the rubber seals on the weatherproof box and install the gland in its place. Pull all the cables from the sensors through the gland now, as you won't be able to do this once they are wired into the connector box.

Step 3: Wire into the connector box.

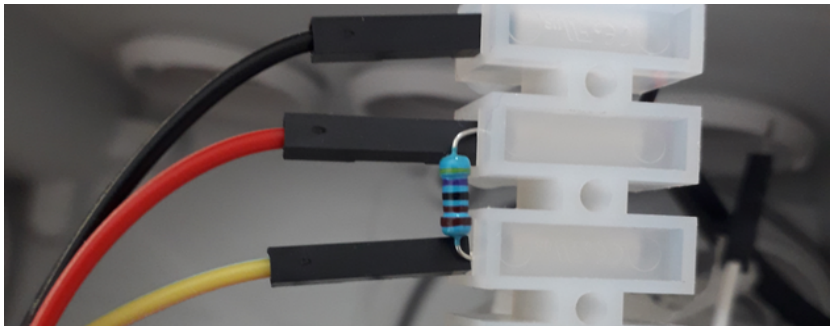
- The connector box allows you to connect the messy wiring of the sensors to neat GPIO connectors for use with the pi.
- Arrange the cables as shown:





- For each cable, insert the exposed copper wiring into the connector box and tighten the screw so the cable is secure. This will be easier if the wire is well braided. If the connection is poor, or two neighbouring wires are in electrical contact your weather station will not work, so take the time to get this right!

- Next we want to connect the GPIO pins to the box. Each pin will be in electrical contact with the wire directly across from it on the box. For the thermometer, the power and data cables must be bridged by the resistor. This serves to transfer a small amount of power to the yellow data wire. To do this, bend the resistor so it looks a bit like a staple and trim the ends to ~1cm in length. It should then be possible to insert the resistor along with GPIO pins as shown:



- Attach the GPIO connectors to the correct type of pins on the raspberry pi as follows:

Wire from sensor	Pin on raspberry pi
Anemometer - red	A ground pin
Anemometer - yellow	Data pin (17)
Rain gauge - red	Data pin (27)
Rain gauge - green	A ground pin
Thermometer - black	A ground pin
Thermometer - red	A 3V power pin
Thermometer - yellow	Data pin (4)

Each data pin has a numeric label, and you can use any of them as long as you also change the python script so that the pi knows where to look for data input. The default configuration is shown in brackets in the table.

Part 2: Software

To interface with the pi you will log into it remotely via ssh (**s**ecure **sh**ell). If you are using a mac or linux computer all you will need is an open terminal. If you are using Windows you will instead need to install the ssh client PuTTy. Your pi will have a unique name stuck on the bottom which identifies them as blackberry, blueberry, mulberry, gooseberry or elderberry.

Step 1: Getting into the pi.

- Power on the pi by connecting to the power pack, and wait for the green light to stop flickering
- Connect to the local network “mmkv” with the password “ALLUPPERCASE”
- The pi will have automatically connected to the local network, so once you are also on that network you can access the pi using the command:
  “ssh pi@Xberrypi.local”

  and entering the password “Xberry” where X is one of (black, blue, mul, goose, elder).

- If no errors were thrown you will now be logged into your pi 😊

Step 2: change the python script.

- To change directories in linux we use the command ‘cd’. Move to the directory where the script is located by typing “cd ~/pi_weather_station/”
- To open the file so we can read and edit it, we will use a tool called vim. Type “vim weatherstation.py” to open the file in your terminal.
- Since the vim interface can be a little awkward, if you just want to read the code and get a sense for how it works, try looking at it on your laptop on github at https://github.com/tommylees112/pi_weather_station/blob/master/weatherstation.py
- You will not need to fiddle too much with the code (unless you want to!), but you will want to think about the values of some of the constants. CSVOUTPUT controls whether the pi prints results to terminal or saves them in a .csv file, and OUTPUT_DT sets the time between measurements. You also want to set ‘codename’ to the name of your pi.
- If you have connected any of the data cables to different pins than the default suggestion, then you will have to change the value of the DATA_PIN constants accordingly

Step 3: change the initialisation script.

Once you are happy with the configuration of the python script you must tell the pi when the script should be run. To do this, you need to open the bashrc file which contains all commands that the pi executes at boot up.

- Type ‘vim ~/.bashrc’ to open the file
- At the bottom of the file you will see a line

  ““#python3 ~/pi_weather_station/weatherstation.py”

- Any text preceded by a # in bash will not be executed, so remove the # now. This will cause the pi to run weatherstation.py on startup

Part 3: Assembly and weatherproofing

You should now have a fully programmed pi, and a fully wired sensor network. All that remains now is to make sure that your weatherstation can withstand the weather!

The power pack will need to be connected to the raspberry pi via the USB to micro USB connector for it to function. Due to an entirely intentional design

choice, the power packs we have will not fit into the weatherproof boxes, and so they will need to be deployed in a separate Tupperware box.

- Cut a hole in the box just large enough for the connector to pass through using scissors or a craft knife.
- Make sure that the position of the cut allows you to thread the power cable through the gland and easily connect it to the pi.
- Once the power cable is in place, put a ring of blutac around it to create a watertight seal
- Assemble the poles on which the wind meter will be deployed
- Go out into the world and place your station

Make sure that you power on your power pack before leaving!