

# Set up Raspberry Pi

## Equipment Needed:

- Raspberry Pi with display output, USB ports, and WiFi capabilities
  - Recommend: Raspberry Pi Model 3B+



- MicroSD card with 8GB or more



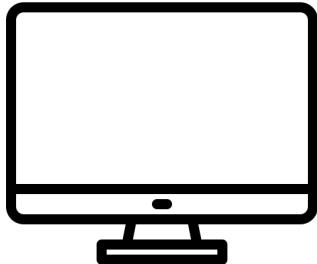
- Raspberry Pi official Power supply



- A computer with a MicroSD card reader



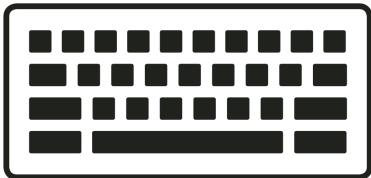
- A display with an HDMI port (most likely a computer monitor, could also be a projector or a TV screen)



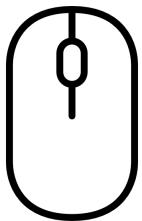
- An HDMI to HDMI cable



- A keyboard



- A mouse



## Installing the Raspberry Pi OS

1. Insert the MicroSD card into your computer's microSD card reader slot
2. Install the Raspberry Pi Imager from [the official Raspberry Pi website](#) on your computer and run it
  - a. To select the correct operating system, choose the first option "Raspberry Pi OS (32-bit)"
  - b. To select the correct storage option, choose the MicroSD card that you previously plugged in

- c. Verify both are selected correctly and then click the “Write” button. Wait for the program to finish.
- 3. You have successfully installed the OS onto the SD card. Eject the SD card from your computer, and plug it into the Raspberry Pi in the SD card slot.

## Connecting the Raspberry Pi to a display and WiFi

1. Power the Raspberry Pi by plugging the official power supply cord into a wall outlet and the other end into the micro USB port on the Raspberry Pi.
2. Connect the Pi to the display by plugging one end of the HDMI cable into your monitor and the other into the HDMI port on the Raspberry Pi. The desktop of the Raspberry Pi should now be visible.
3. Connect your mouse and keyboard.
  - a. If your mouse and/or keyboard have a USB connection, plug them into the USB ports on the Raspberry Pi.
4. Follow the on-screen instruction to set up Raspberry Pi OS.
5. Once got to the desktop, connect to WiFi by clicking on the WiFi symbol in the top right of the screen.
  - a. If your network is greyed-out, it may suggest that your network is a WPA2-Enterprise network. The following step will be useful.
    - i. Connect to a mobile hotspot to get a temporary WiFi connection.
    - ii. Open the terminal on your Raspberry Pi by clicking on the terminal icon in the top left menu.
    - iii. Input the command `sudo apt install network-manager` `network-manager-gnome` and hit enter to install the standard Linux network manager.
    - iv. Input the command `sudo systemctl disable --now dhcpcd` to disable the network service that automatically configures the IP settings of Ethernet devices connected to a network (the DHCP).
    - v. Input the command `sudo systemctl enable --now` `network-manager` to enable the network service.
    - vi. Finally, input the command `sudo reboot` to restart the Pi.
    - vii. After the device reboots, you will see a new network symbol, click on it, and now your network is ready to connect.

## Downloading the Code

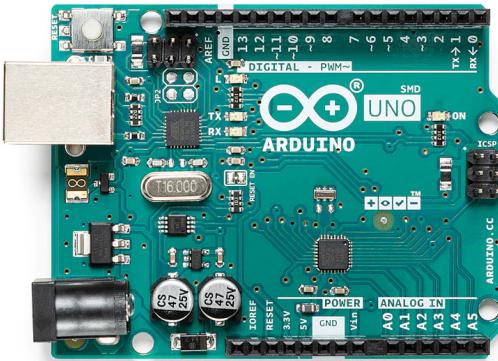
1. On the Raspberry Pi, open up the web browser and navigate to [https://github.com/AirPollutionLondon/sensor\\_arduino](https://github.com/AirPollutionLondon/sensor_arduino). This is the repository for all the code needed to setup the sensors.

2. Click on the code button, and then click on “Download ZIP”. This should download a zip file of the repository.
3. Open the zip file and unzip it.

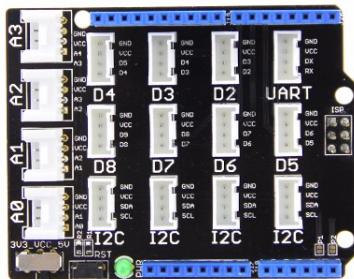
# Set up Arduino and the sensors

## Things Needed

- Arduino Uno



- Grove Base Shield V2



- 2x RGB LED sticks (10-WS2813 Mini)



- Laser PM2.5 Sensor (HM3301)



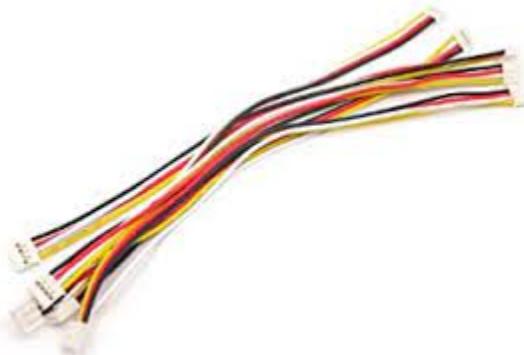
- VOC and eCO<sub>2</sub> Gas Sensor(SGP30)



- Grove LCD RGB Backlight Screen



- 5x Grove 4 Pin Universal Cable



- USB Type B to USB Type A cable



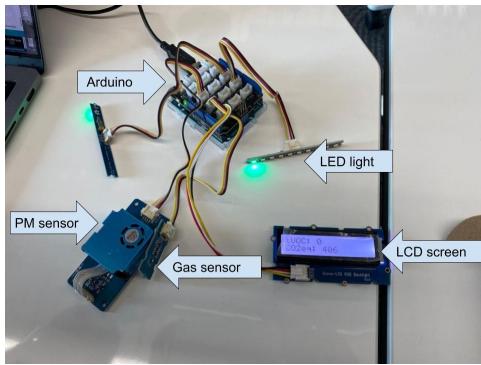
- Raspberry Pi

## Assembling the Arduino

1. Get the Grove Base shield, line up the pins with sockets on the Arduino board, and plug it into the Arduino

2. Get a 4 Pin Universal Cable and connect one end to Port D2 on the Base Shield and the other end to an RGB LED stick.
3. Get another 4 Pin Universal cable and connect one end to Port D3 on the Base Shield and the other end to an RGB LED stick.
4. Get a 4 Pin Universal cable, connect it to any free I2C port on the Base Shield, and connect the other end to the Gas Sensor.
5. Get a 4 Pin Universal cable, connect it to any free I2C port on the Base Shield, and connect the other end to the PM2.5 sensor
6. Get a 4 Pin Universal cable, connect it to any free I2C port on the Base Shield, and connect the other end to the LCD RGB backlight screen.
7. Connect the Arduino to the Raspberry Pi using the USB A to B cable.

Finished setup



## Programming the Arduino

1. On your Raspberry Pi, navigate to [the official Arduino website](#) to download the latest version of Arduino IDE. Download the Linux ARM 32-bit version for the Pi.
2. Open the folder previously unzipped, and navigate to the jdf folder and into jdf\_lcd\_pm folder.
3. Double click on the “jdf\_lcd\_pm.ino” file and it should open the file inside Arduino IDE.
  - a. If double click does not open the file within Arduino IDE, make sure Arduino IDE is properly installed on the Pi. If the IDE is already installed then:
    - i. Open and run Arduino IDE.
    - ii. Go to File, and click on Open.
    - iii. Find the folder and locate “jdf\_lcd\_pm.ino” file and open it.
4. Under Tools, click on “Manage Libraries...”
5. In the search bar type in “hm3301” and find “Grove - Laser PM2.5 Sensor HM3301” by Seeed Studio. Choose Version 1.0.0 in the drop down and then click on install.
6. In the search bar type “sgp30” and find “Adafruit SGP30 Sensor” by Adafruit. Choose Version 1.0.5 and then click on install.

7. In the search bar type “neopixel” and find “Adafruit NeoPixel” by Adafruit. Choose Version 1.3.2 and then click on install.
8. Confirm that the Arduino board is connected to the Raspberry Pi via USB. Click on Tools on the top menu.
9. Make sure that “Board:” is selected for “Arduino Uno” and Port is selected to a serial COM port.
  - a. There should be only one option to select if you only have one Arduino connected
10. Click on the “Verify” button on the top right to make sure the code can run errorfree. The code should compile fine.
11. Click on the “Upload” button to send the code to the Arduino. Wait until the code is finished uploading. The LCD screen and LED lights should light up after finishing.
12. The LCD screen will display a 16-digit number, which is the serial number of your device. Go to <https://airpollutionlondon.github.io/breatheUK/> and enter it in the sensor registration form along with your latitude and longitude to register your sensor.

## Final Steps

### Running the Program

1. Open the file folder previously downloaded from Github, navigate to the jdf folder.
2. Locate the “run.sh” file and double click to run
3. It may prompt to choose where to execute the file, in that case choose to “Execute in Terminal”.
4. It will open a terminal window and show the output of the program.
5. The program will take about 30 seconds to setup and then will log the sensor data.