A couple of months ago, I noticed that I would periodically feel plugged up in the nasal cavity. I talked to our Heating, Ventilation and Air Conditioning (HVAC) guy about it. He stated that our HVAC system was the top of line and that the Minimum Efficiency Reporting Value (MERV) of our furnace filter was as high as it could go without restricting air flow, and possibly damage the constant variable fan motor.

I checked around and a good air quality monitor starts at about $200 and has restricted uses.

Therefore I decided to build one. There is a company in the UK, near where the Raspberry PI (RPI) computers come from, that I have used before. Pimoroni stands for Pirate, Monkey, Robot, Ninja (Pi-Mo-Ro-Ni). They design, manufacture, and sell friendly products for Makers, Educators, Crafters and Creatives.

I purchased an enviro+ Hardware Attached on Top (HAT) and a Particulate Matter Sensor (PMS) from them. They connect to one of our three Raspberry PI Zeros. You saw a picture of one last month on Allie.

The HAT measures temperature, humidity, pressure and noise pollution. It also detects the following gases:

Carbon monoxide CO 1 – 1000ppm
Nitrogen dioxide NO_2 0.05 – 10ppm
Ethanol C_2H_5OH 10 – 500ppm
Hydrogen H_2 1 – 1000ppm
Ammonia NH_3 1 – 500ppm
Methane CH_4 >1000ppm
Propane C_3H_8 >1000ppm
Iso-butane C_4H_{10} >1000ppm.

The Particular Matter Sensor (PMS) measures particles in the air and reports:

PM1.0 ug/m3 (ultrafine particles):
PM2.5 ug/m3 (combustion particles, organic compounds, metals):
PM10 ug/m3 (dust, pollen, mould spores):
PM1.0 ug/m3 (atmos env):
PM2.5 ug/m3 (atmos env):
PM10 ug/m3 (atmos env):
>0.3um in 0.1L air:
>0.5um in 0.1L air:
>1.0um in 0.1L air:
>2.5um in 0.1L air:
>5.0um in 0.1L air:
>10um in 0.1L air:

As with most products from Pimoroni, you can download basic software, which can be used to verify that the hardware works. It takes samples from the HAT and PMS every one second and displays them on the stamp sized LCD screen on the HAT. That is a lot of data to view flashing by. Next step was to write the data out to the SD card for later analysis.

Over to Github, the repository of user created software, and picked up a program called EnviroPlusWeb. This is a basic utility that will display the HAT and PMS data on a web page as a graph. A few e-mail exchanges with the author, and I have the rough plan on how to create software for my requirements.

Yeh, Dr Roboto, blah, blah, blah… enuf of the techno babble. Where are the pictures and what are the results?
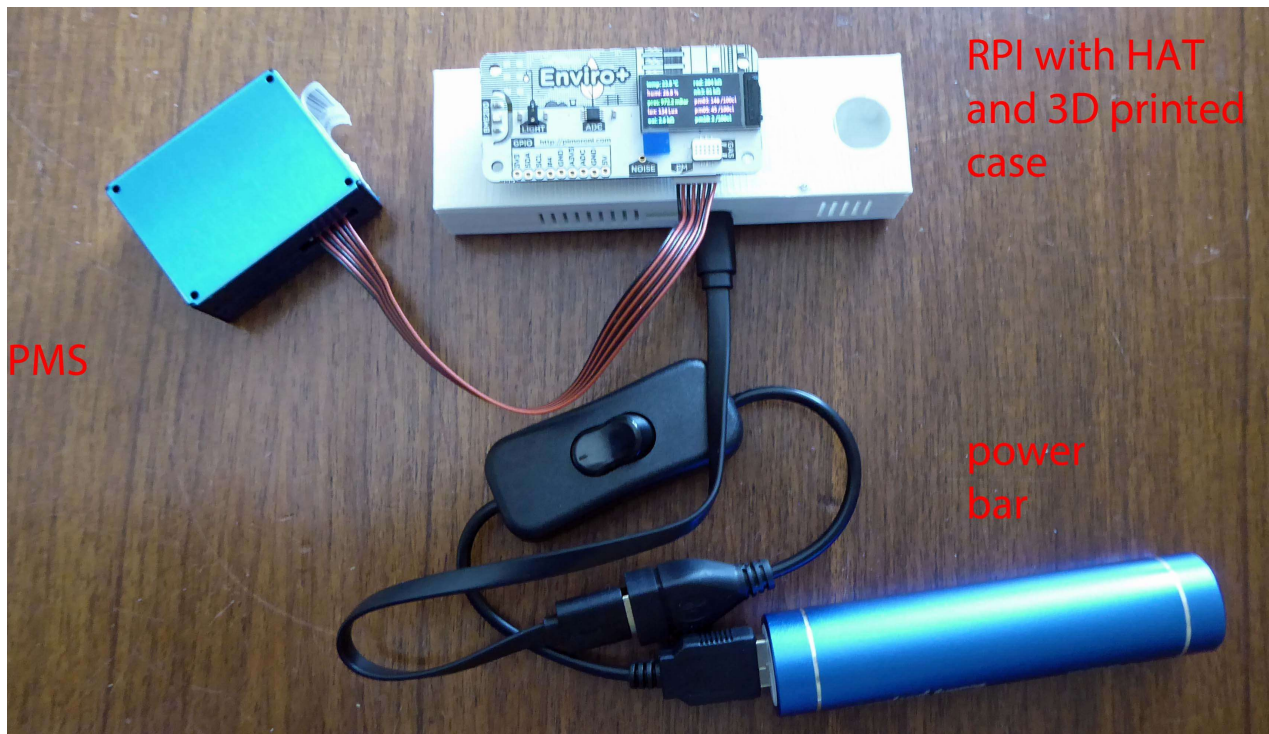
The power bar also doubles as a flashlight so that I can see the light at the end of the programming tunnel. The whole package would fit in a 4 in (10cm) square enclosure.
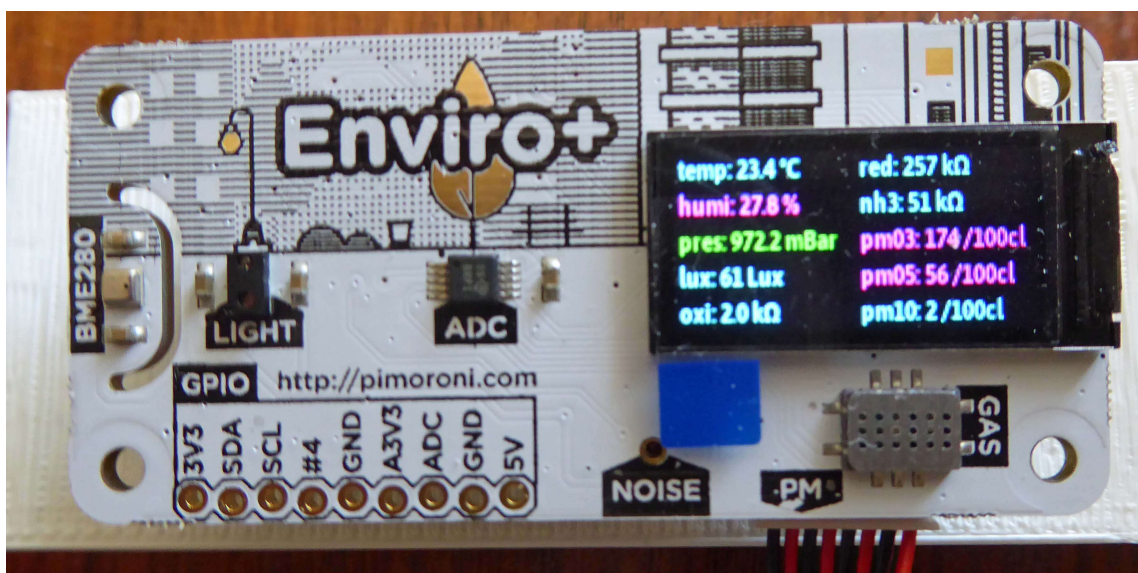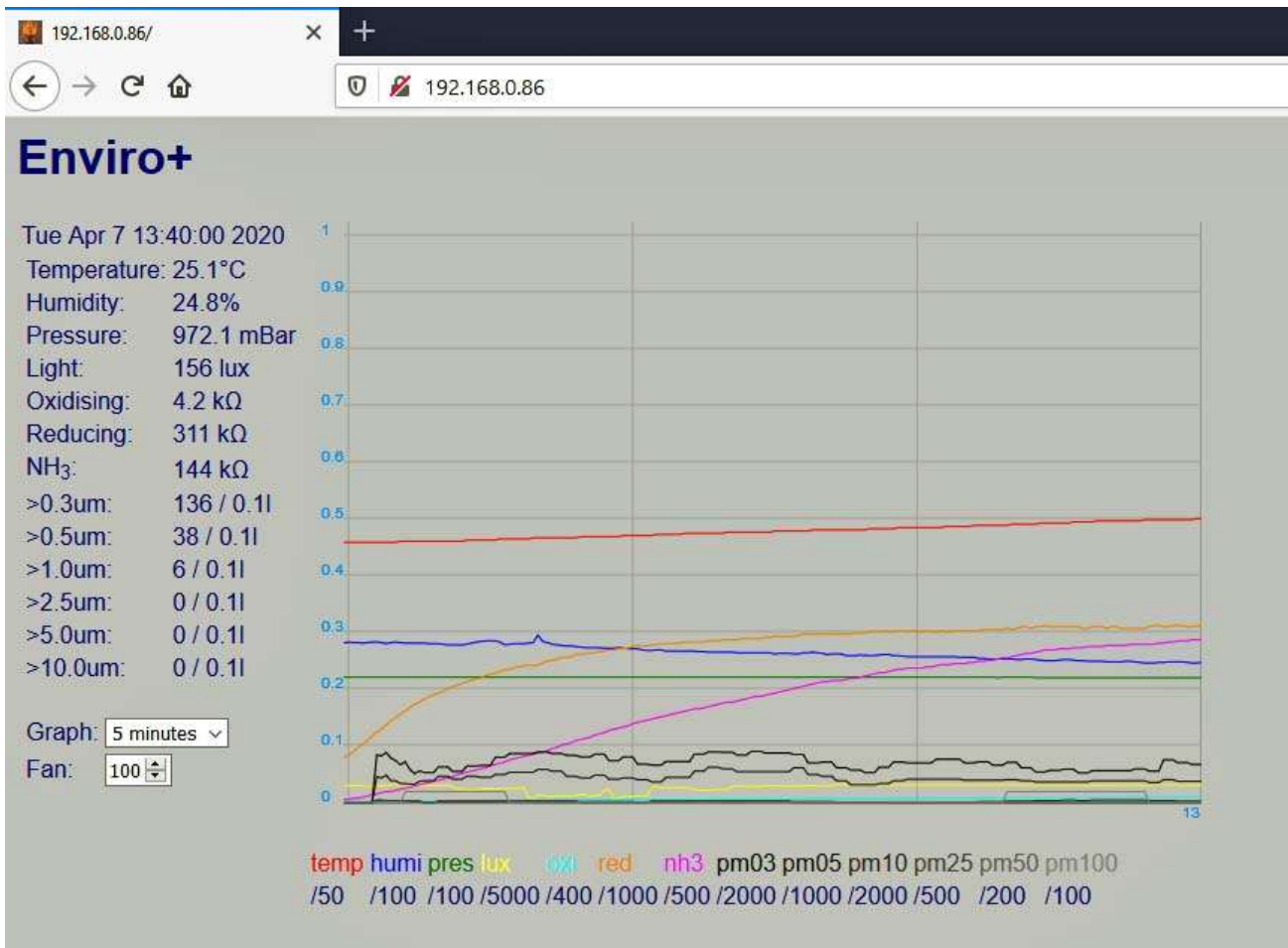
With an enclosure, the unit could be placed outside and the graph accessible from the web site, anywhere in the world. Just like the camera in the last report.

The HVAC guy suggested that we install a UV light and change the MERV furnace filter twice a year versus once, even though it does not get that dirty in non-smoke years.. We did both. Fortunately, I had completed enough coding the capture a couple of days data before he made the change. I then compared the data with the past few days. The result is that the particulate count decreased by 50%. This could be coincidence, or because of the filter change or the UV, or a combination of either. More tweaking and testing to follow.