Getting started with CircuitPython

Flash talk @ PyData 4-12-2018

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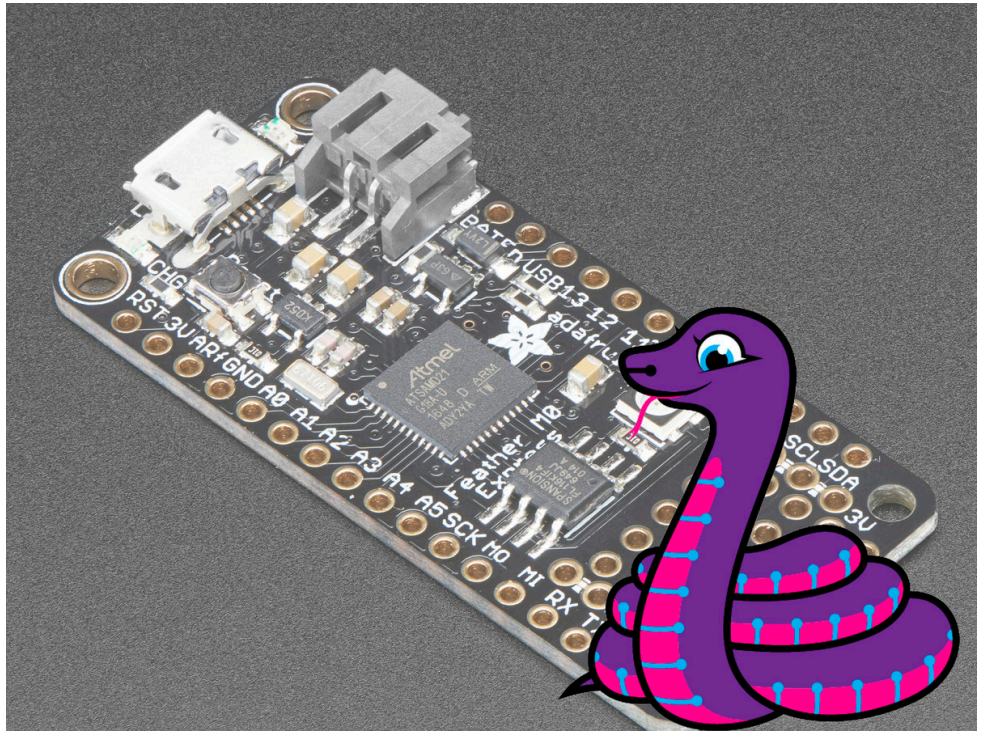
https://github.com/robmarkcole

CircuitPython

- CircuitPython -> Python 3 on single board computer
- Beginner friendly -> boards show as USB drive
- Connect sensors and gather data

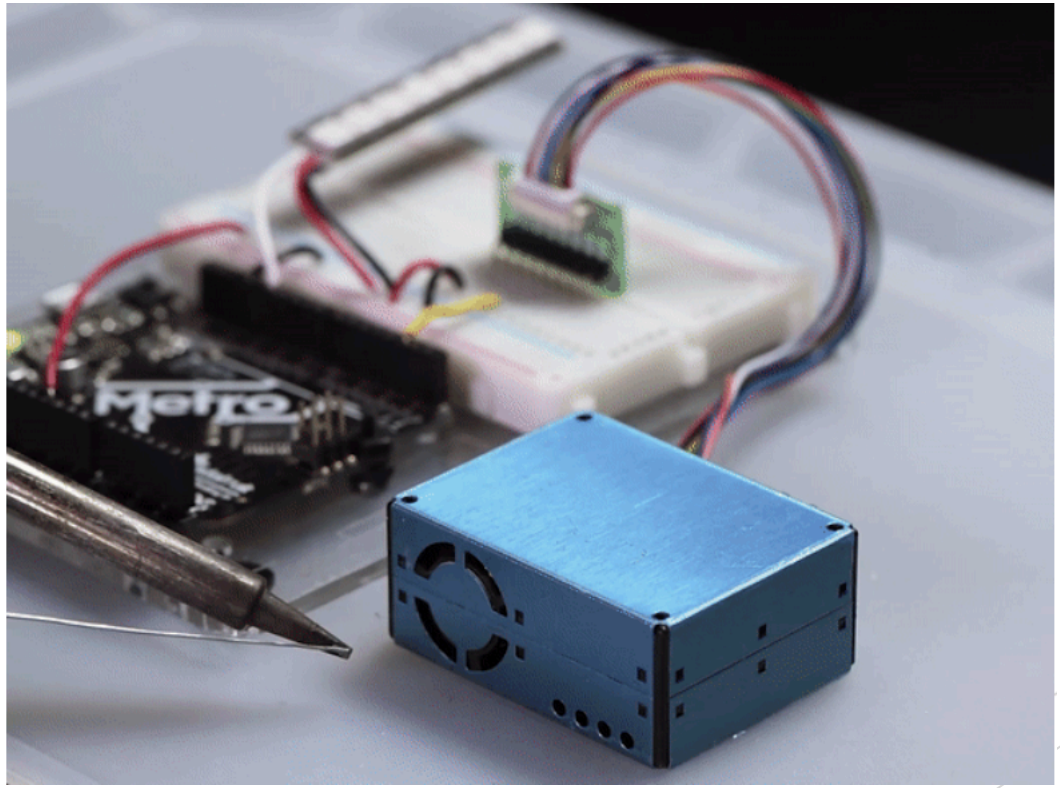


Mu editor

- Beginner friendly editor -> https://codewith.mu/
- Easy to plot streaming data

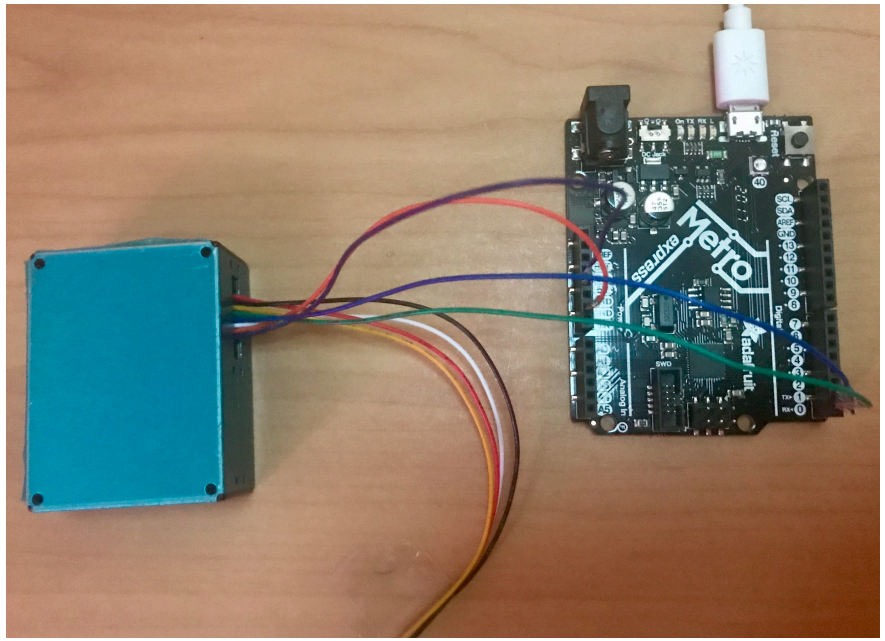
Air quality data logger project

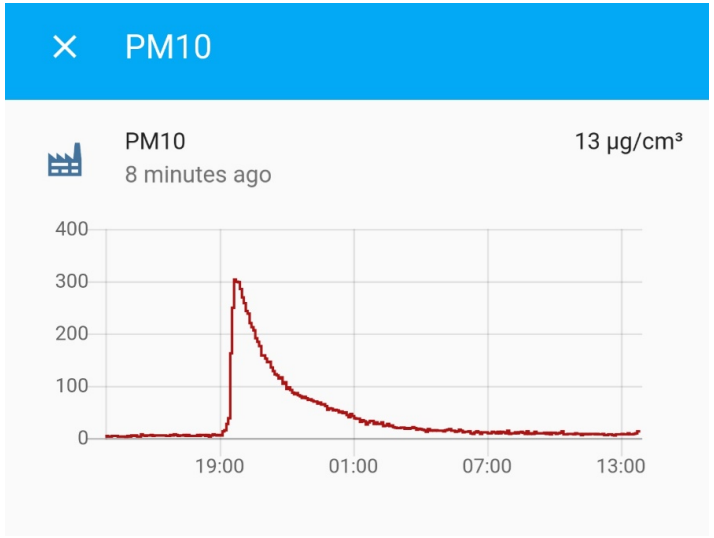
- Poor air quality is major contributor to ill health
- Project: develop simple, portable & personalised air quality data logger



CircuitPython air quality data logger

- PM1, PM2.5 & PM10 particulates
- Fully python stack
- https://github.com/robmarkcole/HASS-circuitpython-air-quality-sensor-node





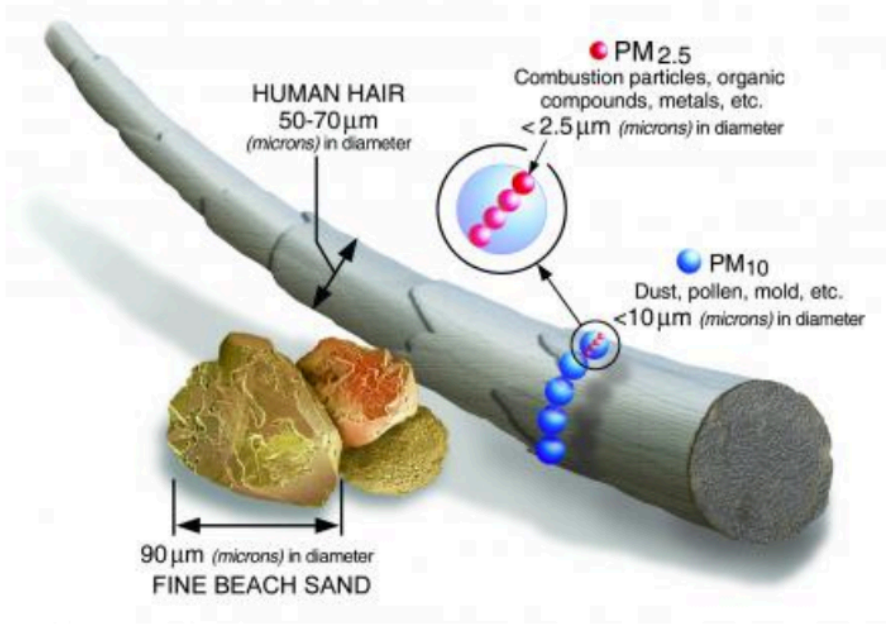
Sausage

Future Work

- Get people involved!
- Go wireless & low power
- Demo

What is PM, and how does it get into the air?

PM stands for particulate matter (also called particle pollution): the term for a mixture of solid particles and liquid droplets found in the air. Some particles, such as dust, dirt, soot, or smoke, are large or dark enough to be seen with the naked eye. Others are so small they can only be detected using an electron microscope.



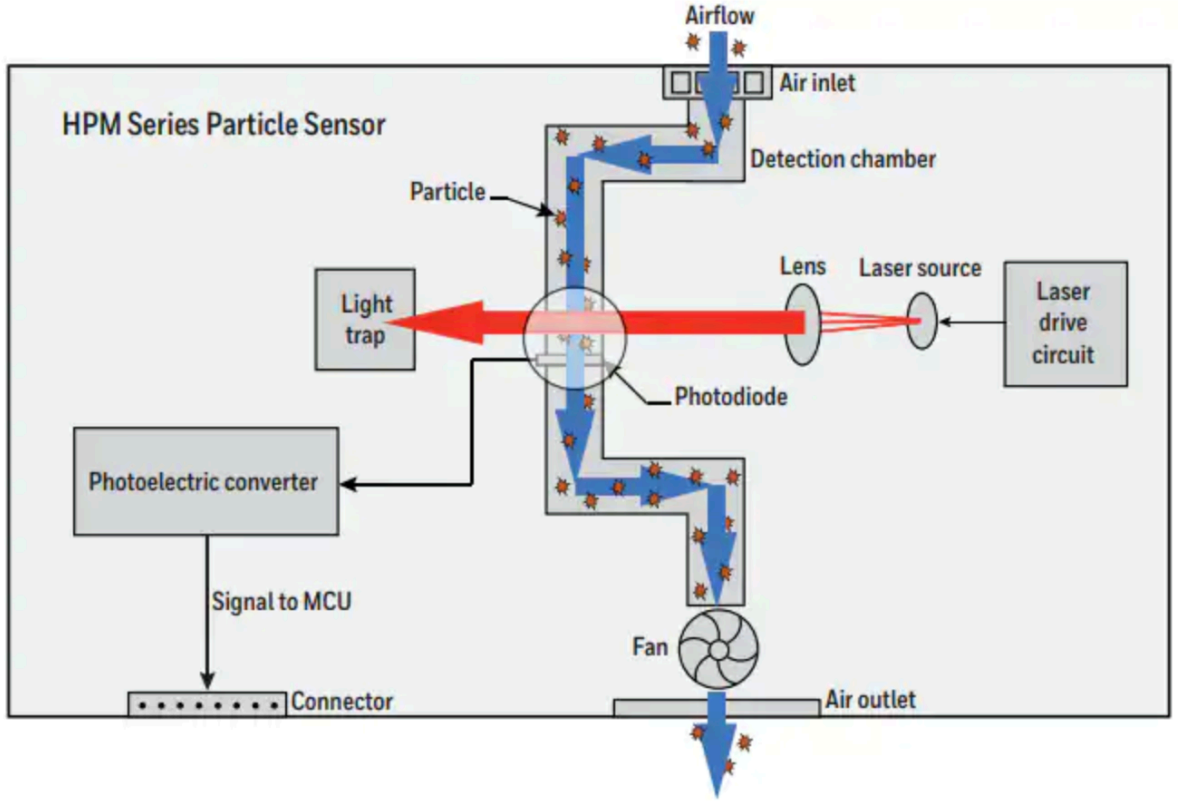
Size comparisons for PM particles

Particle pollution includes:

- **PM_{10}** : inhalable particles, with diameters that are generally 10 micrometers and smaller; and
- **$PM_{2.5}$** : fine inhalable particles, with diameters that are generally 2.5 micrometers and smaller.
  - How small is 2.5 micrometers? Think about a single hair from your head. The average human hair is about 70 micrometers in diameter – making it 30 times larger than the largest fine particle.

https://www.epa.gov/pm-pollution/particulate-matter-pm-basics

Operation principle



A laser and photodiode are arranged orthogonally such that the focal point of the laser is located directly above the photodiode. A small fan draws air through the system and across the photodiode. Particles in the air stream that intersect the path of the laser scatter light onto the photodiode; the resulting voltage signal from the photodiode is amplified by an operational amplifier circuit and sampled by a micro-controller. Peaks in the resulting waveform correspond to particles crossing the photodiode, and can be counted. The amplitude of the peaks can be used to roughly approximate the size of particles (higher peaks correspond to larger particles).

Air quality index

AQI	Air Pollution Level	Health Implications
0 - 50	Good	Air quality is considered satisfactory, and air pollution poses little or no risk
51 -100	Moderate	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
101-150	Unhealthy for Sensitive Groups	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
151-200	Unhealthy	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects
201-300	Very Unhealthy	Health warnings of emergency conditions. The entire population is more likely to be affected.
300+	Hazardous	Health alert: everyone may experience more serious health effects