Collecting Data with BME680

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What is Temperature?

\[ T = \frac{\partial U}{\partial S} \]
What is Humidity?

\[ AH = \frac{m_{H_2O}}{V_{net}} \]

- \( AH \) = absolute humidity
- \( m_{H_2O} \) = mass of the water vapor
- \( V_{net} \) = volume of the air and water vapor mixture
Dew Point

- Requires Software
- Humidity “Feel”
What is Barometric Pressure?

\[ P_h = P_0 e^{-\frac{mgh}{kT}} \]

- \( P_h \) = pressure at height \( h \)
- \( P_0 \) = sea level pressure
- \( g \) = acceleration due to gravity
- \( k \) = Boltzmann's constant (ideal gas constant divided by Avogadro's number)
- \( T \) = absolute temperature
- \( m \) = mass of one air molecule
VOC Gas Sensor

- High vapor pressure, low water solubility
- Many VOCS cause short and long term health issues
  - Paint, ink, wood stain, etc.

Used in EPA TEAM studies (Environmental Protection Agency’s research team)

How?

- Metal oxide heats up in contact with VOCs
- Changes its resistance
- Tolerance of 0.5-15 ppm
How the BME680 Works
Specs

- Sensor is the silver square in the center of the chip
- Specifications
  - Temp: -40°C to 85°C with ±1.0°C accuracy
  - Humidity: 0 to 100% with ±3% accuracy
  - Pressure: 300Pa to 1100 hPa with ±1 hPa absolute accuracy
  - Altitude: 0 to 30,000 ft (9.2 km) with ±1 m accuracy
  - Cannot tell difference between gasses
- Uses 3.3V voltage regulator; can use 3.3V or 5V microcontrollers
- Have sensor run for 48 hours initially, then 30 minutes before each use
Working With the Arduino

- I2C and SPI compatible
- Adafruit libraries
  - BME680 specific
  - Adafruit Sensor Master
- Get and Set functions for each sensor,
- unit conversion built into functions

https://learn.adafruit.com/assets/93614
Applications of the Sensors

- Measuring Altitude
- Weather Prediction
- Fitness tracking
  - Vertical speed
  - Sweat
- HVAC systems
  - Temperature control
  - Monitor air quality

Willful Fitness tracker


