

SENSORTECH

Sensors I have known and loved (or hated)

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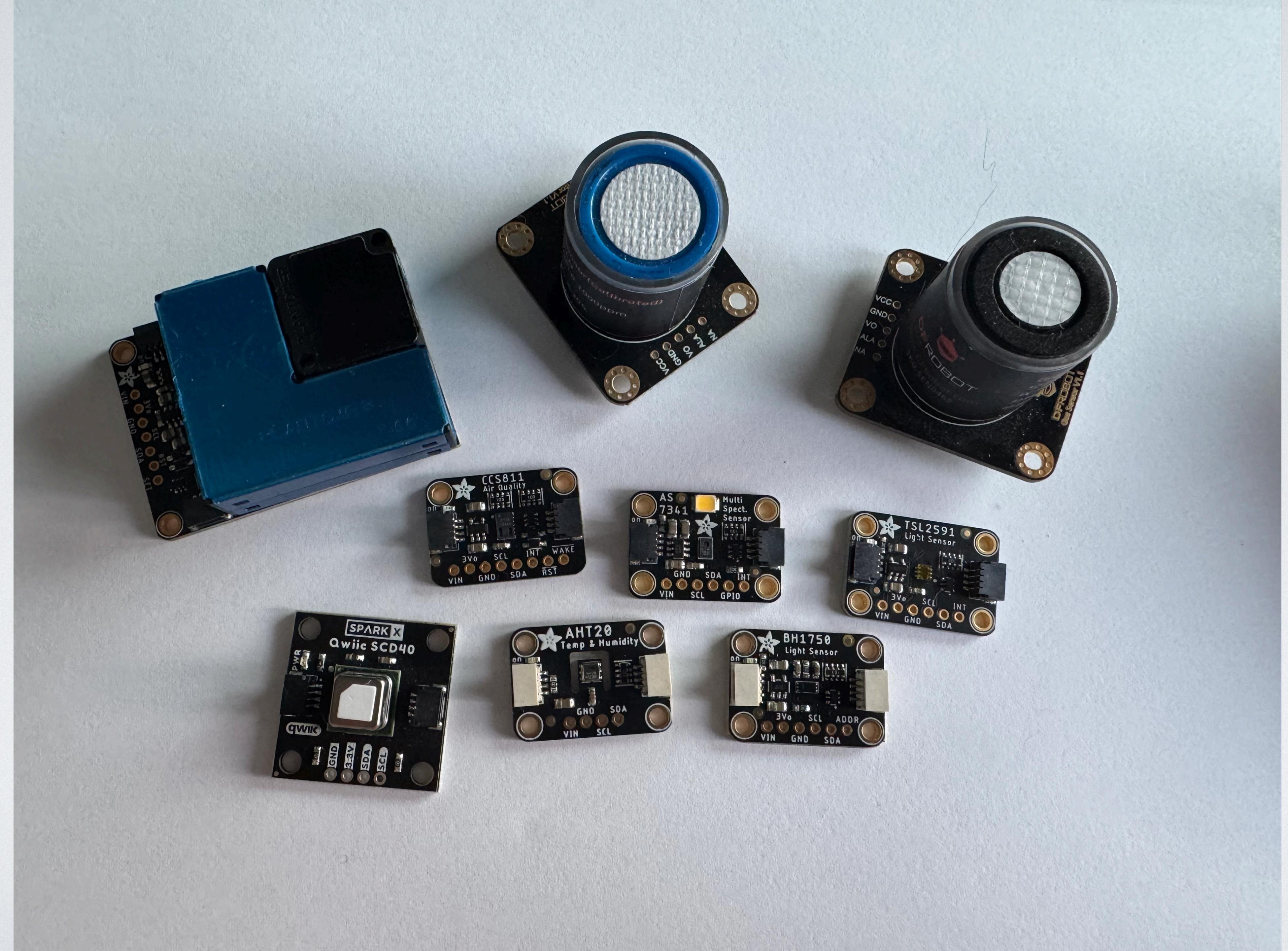
YOU ARE FULL OF SENSORS

- You have at least 15-20 senses (not five)
- You have > 200 million sensors - nerve endings, photo receptors, etc
- Our senses are limited, bounded and imperfect
- Electronic sensors are also limited, bounded and imperfect

- Vision – sight
- Hearing – auditory
- Taste – between 5 and 9 different receptors
- Smell – olfaction
- Touch – somatosensation (already a bundle of multiple senses)
- Proprioception – sense of body position and movement (you can touch your nose with your eyes closed)
- Vestibular sense – balance and spatial orientation, via the inner ear

SO MANY KINDS OF SENSORS

- Temperature
- Humidity
- Air pressure
- Weight/pressure
- Touch
- Light intensity
- Light by frequency (IR, UV, colors)
- Cameras
- Acceleration
- Position
- Magnometer
- Proximity
- Radiation
- Sound (microphone)
- Sound intensity
- Gasses (CO₂, CO, formaldehyde, H₂S, ...)
- Occupancy
- Motion
- Radar
- Sonar
- LIDAR
- Voltage, Current



HUMAN LIMITATIONS

- Vision - roughly 380 nm (violet) to 740 nm (deep red)
- Hearing - roughly 20Hz to 20kHz
- Uneven frequency response for both
- Varies by user
- Works best between -30°C and 30°C
- Needs correct nutrition and hydration to function

SENSORS - HOLD MY BEER

- They're tested and intended to work under certain conditions
- Outside those conditions they may work but be unreliable or inaccurate
- Further outside those conditions they may temporarily or permanently fail

- Cost
- Availability
- Voltage range
- Current requirements
- Accuracy
- Precision
- Burn In
- Run In
- Poisoning
- Cross-tolerance
- Temperature Range
- Humidity Range
- Repeatability
- Size
- Weight
- Lifespan
- Interface
- Drift
- Software Licensing
- Frequency Response (Linearity)
- Frequency Range
- Calibration
- Certifications and compliance
- Enclosure requirements
- Mechanical durability
- Connector type
- EMI susceptibility
- Response Time
- Sample Rate
- MTBF

Too Much!



WHAT DO YOU ACTUALLY NEED?

- What is your use? Art? Education? Toy? Science? Automotive? Medical?
- How accurate and how often do you actually need data?
- What is the **least** your project can manage with?

PRIORITIZE

- Must haves
 - Cost
 - Voltage and current

Spooky Skull

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Smart Watch

- Cost
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Citizen Science - Noise Level Sensor

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Medical

- Cost
- Availability
- Voltage range
- Current requirements
- Accuracy
- Precision
- Burn In
- Run In
- Poisoning
- Cross-tolerance
- Temperature Range
- Humidity Range
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PEOPLE HATE THIS ONE WEIRD TRICK

read the datasheet

(just the fun parts)

SENSOR SOURCES

- Adafruit
- Sparkfun
- SeeedStudio
- DFRobot
- Digikey - authorized distributor - more for components than boards
- Mouser - authorized distributor - more for components than boards
- Amazon/ebay/AliExpress/Temu - you get what you pay for

SENSOR SHAMING - eCO₂

- “Equivalent CO₂” - calculated based on other non-CO₂ measurements like TVOC (Total Organic Volatile Compounds)
- Algorithm based on very specific spaces like a closed office
- Does not detect actual CO₂
- Unexpected VOC sources can give highly inaccurate eCO₂ readings
- Frequently sold as true CO₂, sometimes even as CO!
- CCS811 and successor, ENS160

1~3PCS Gas Sensor Carbon Dioxide Detection Sensor Module CCS811 CO2 eCO2 TVOC Air Quality Detecting I2C Output CJMCU-811 EGBO

★★★★★ 4.9 20 Reviews | 221 sold

Selected item with premium quality

ENS160 CCS811 Carbon Monoxide CO VOCs Air Quality Numerical Gas Sensor Module for arduino

★★★★★ 5.0 8 Reviews | 103 sold

HiLetgo CCS811 CO2 eCO2 TVOC Gas Sensor Carbon Dioxide Detection Sensor Air Quality Detect Module Air Quality Monitoring Sensor I2C Output CJMCU-811



CO2 Detector Carbon Dioxide Detector Air Quality Monitor Temperature Humidity Air Analyzer

[Visit the Eujgoov Store](#)

1.0 ★★★★☆ (1)

-7% \$17⁵⁴

Typical price: \$18.79 ⓘ

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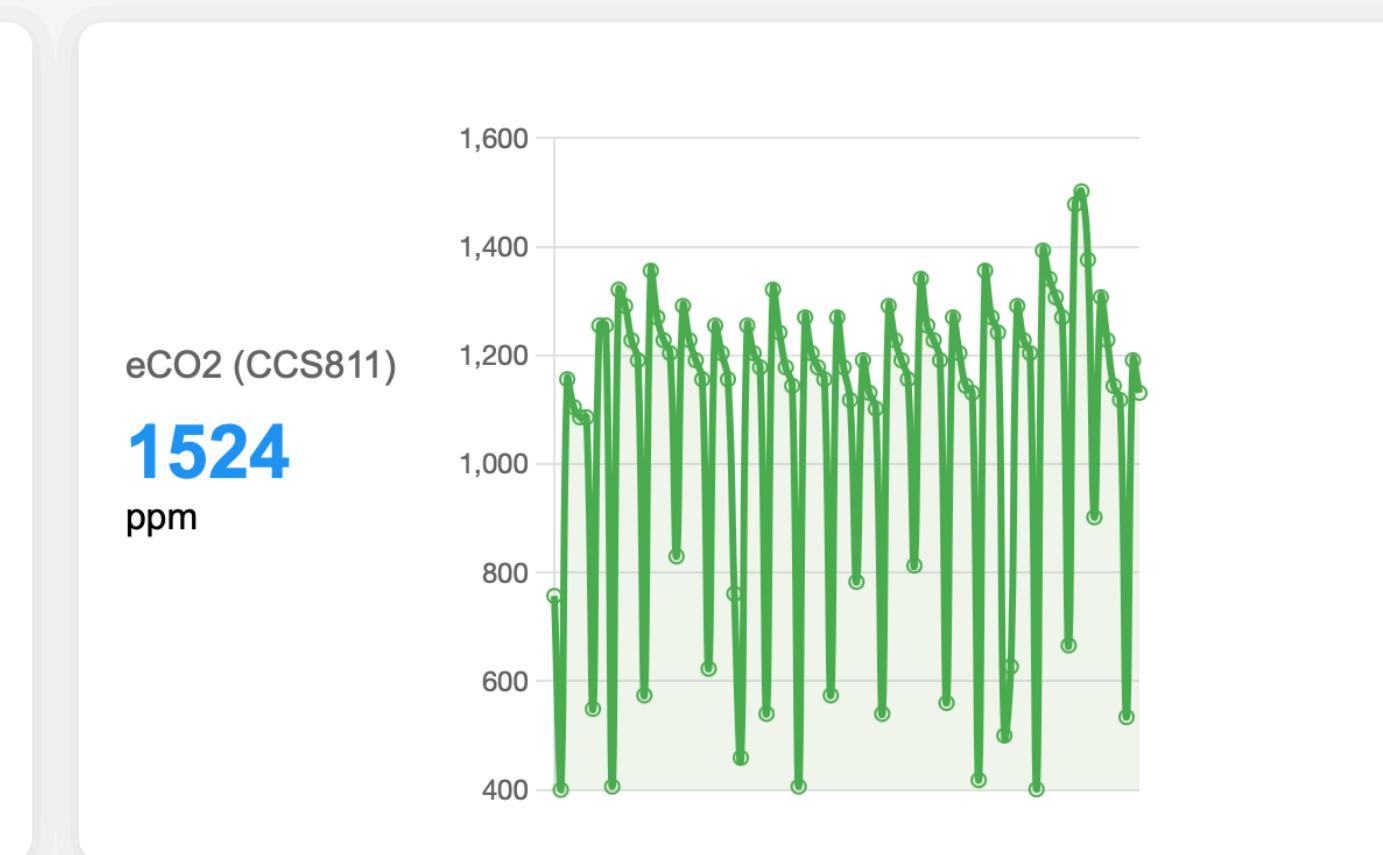
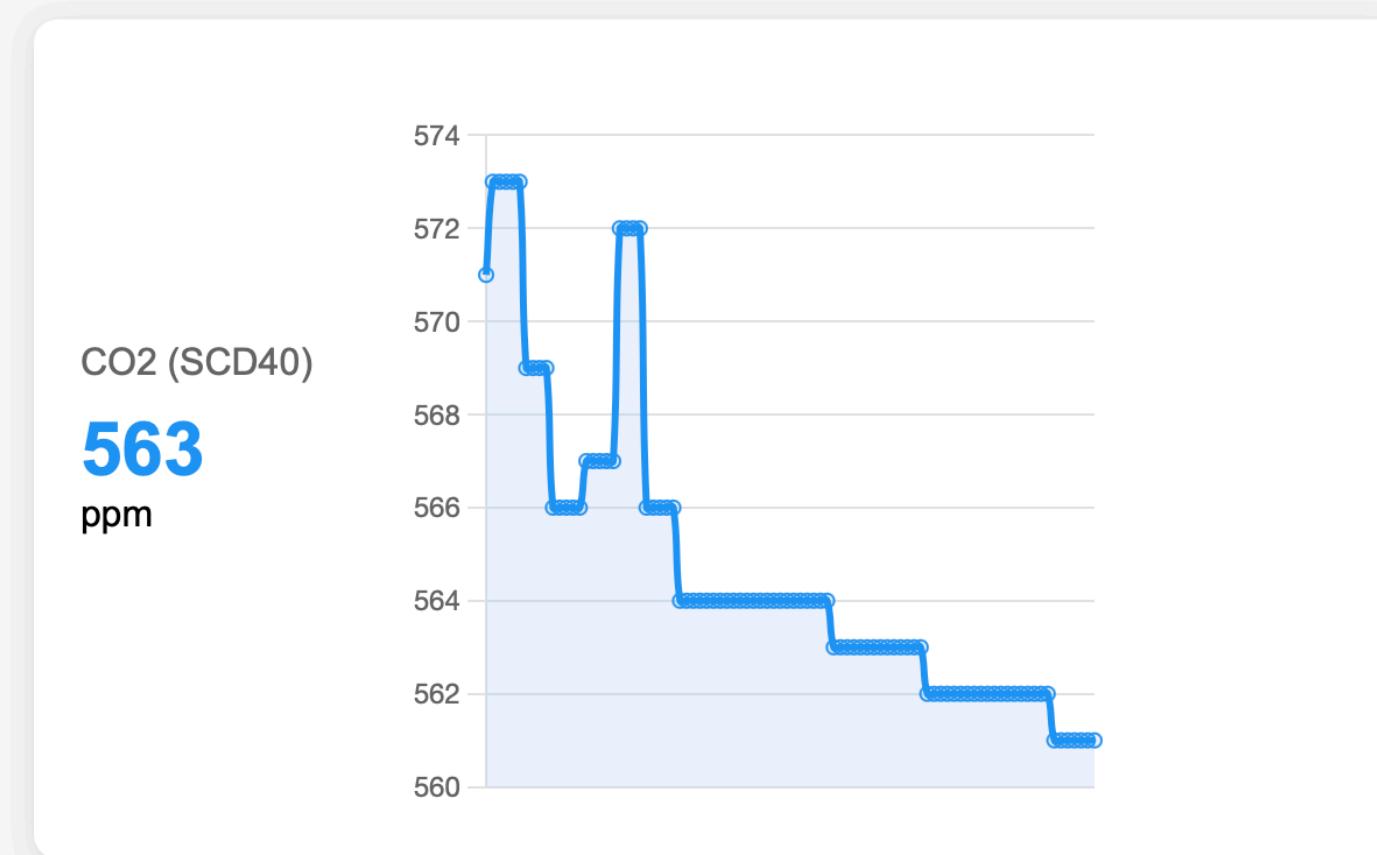
1PCS CCS811 HDC1080 Carbon Dioxide CO2 Temperature And Humidity Sensor Brand New

VOC SOURCES

- Cleaning products
- Furniture polish
- Aerosol sprays
- Floor wax
- Printers and copiers
- Laminators
- New furniture
- Paint
- Microwave popcorn
- Coffee grinding
- Perfumes and colognes
- Strongly scented food
- Nail polish
- Construction
- Toaster ovens
- Dry cleaned clothing

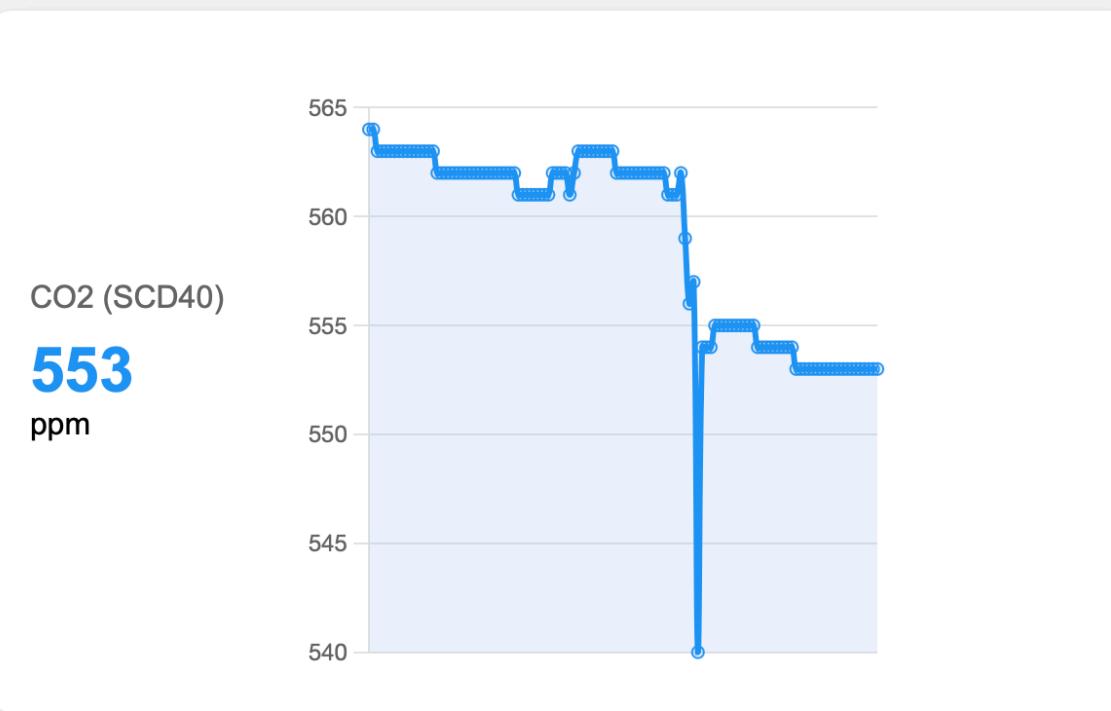
GRAPHS

Sensor Dashboard

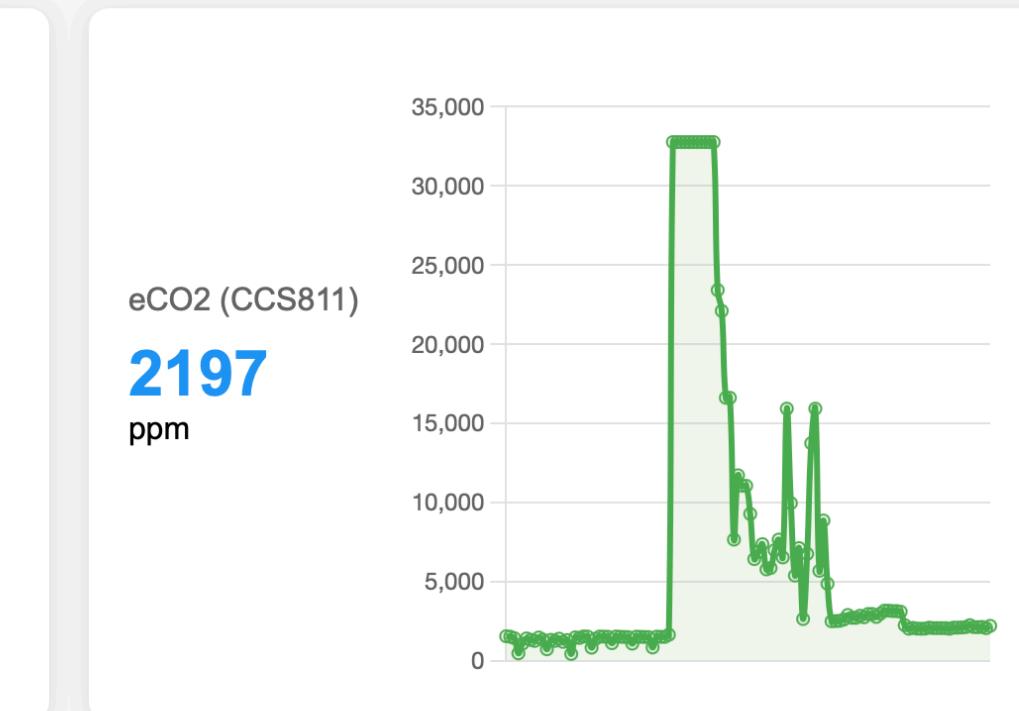
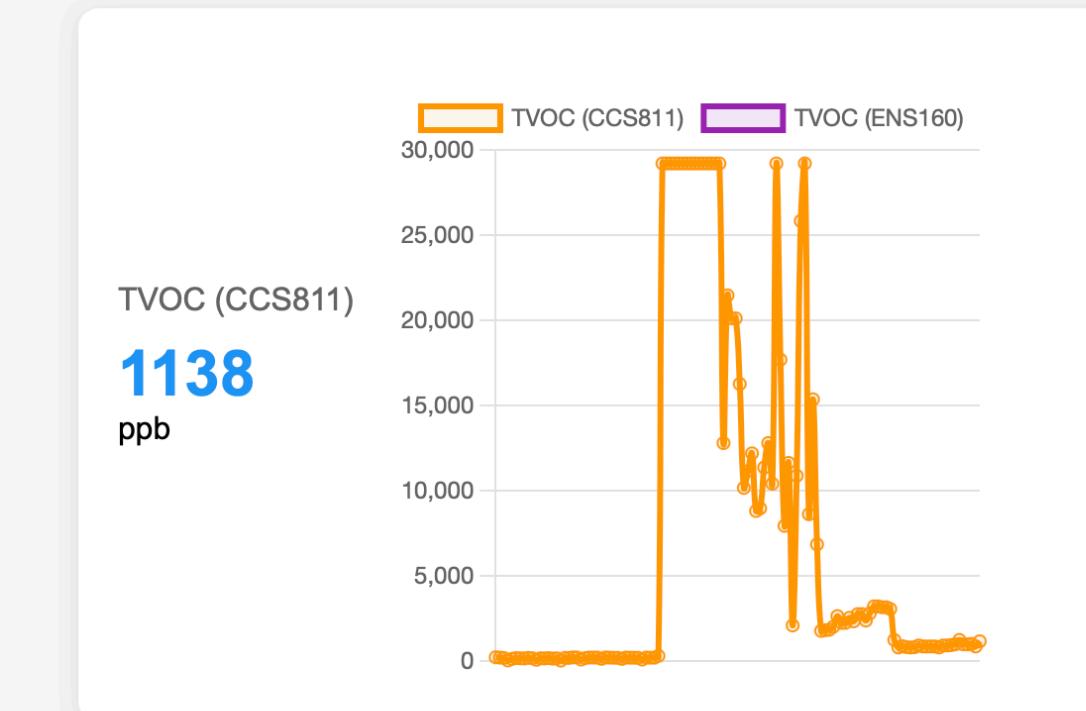
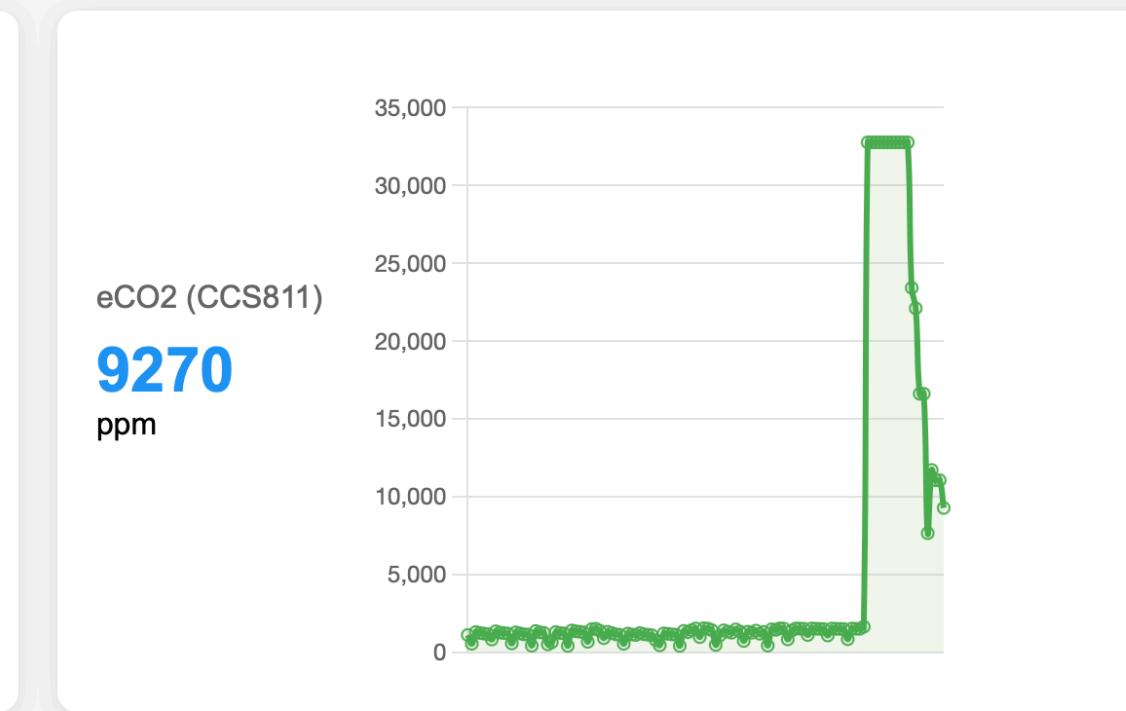
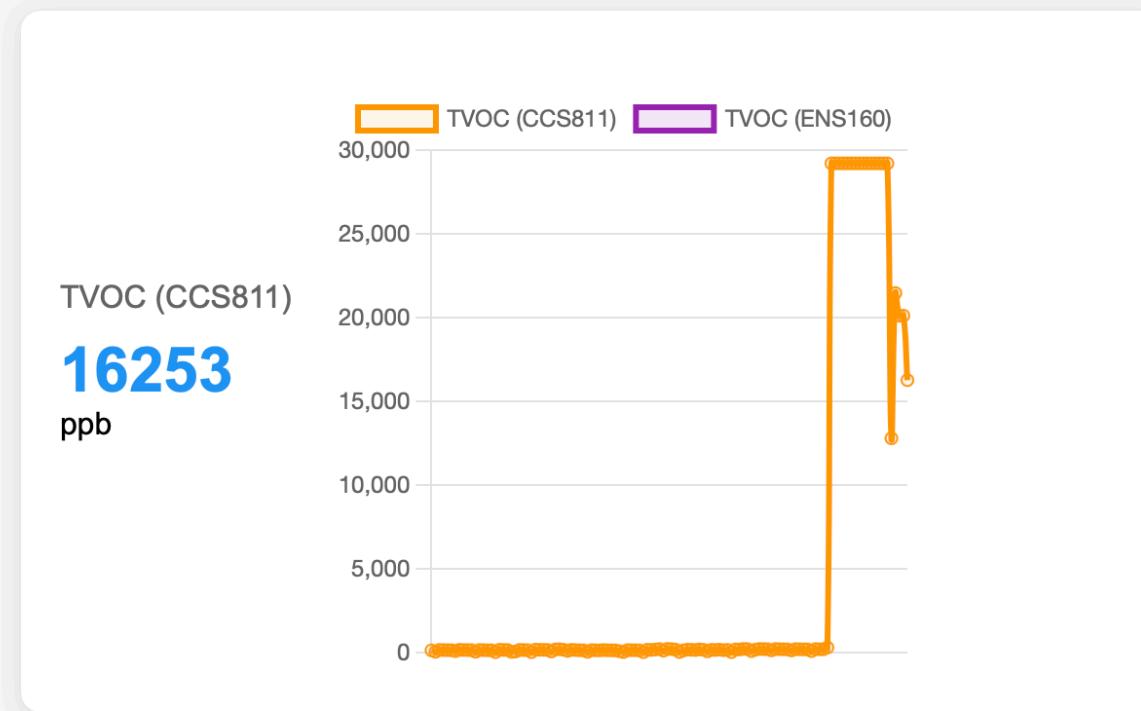
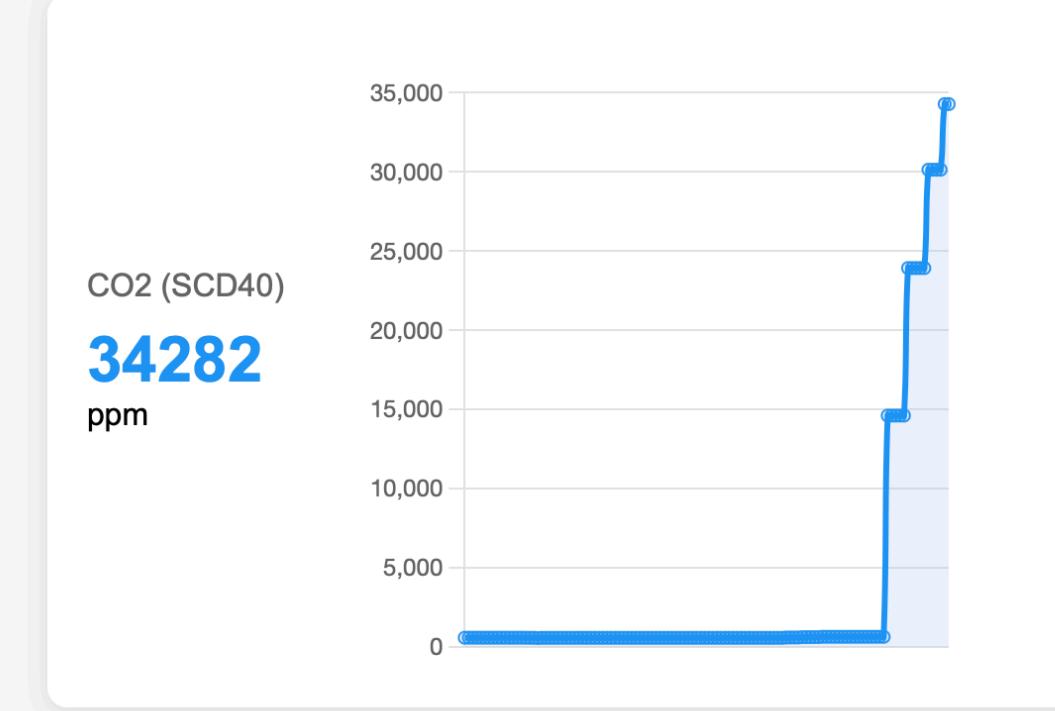


SHPARG

Sensor Dashboard



Sensor Dashboard



Alcohol on CCS811 - oopsie

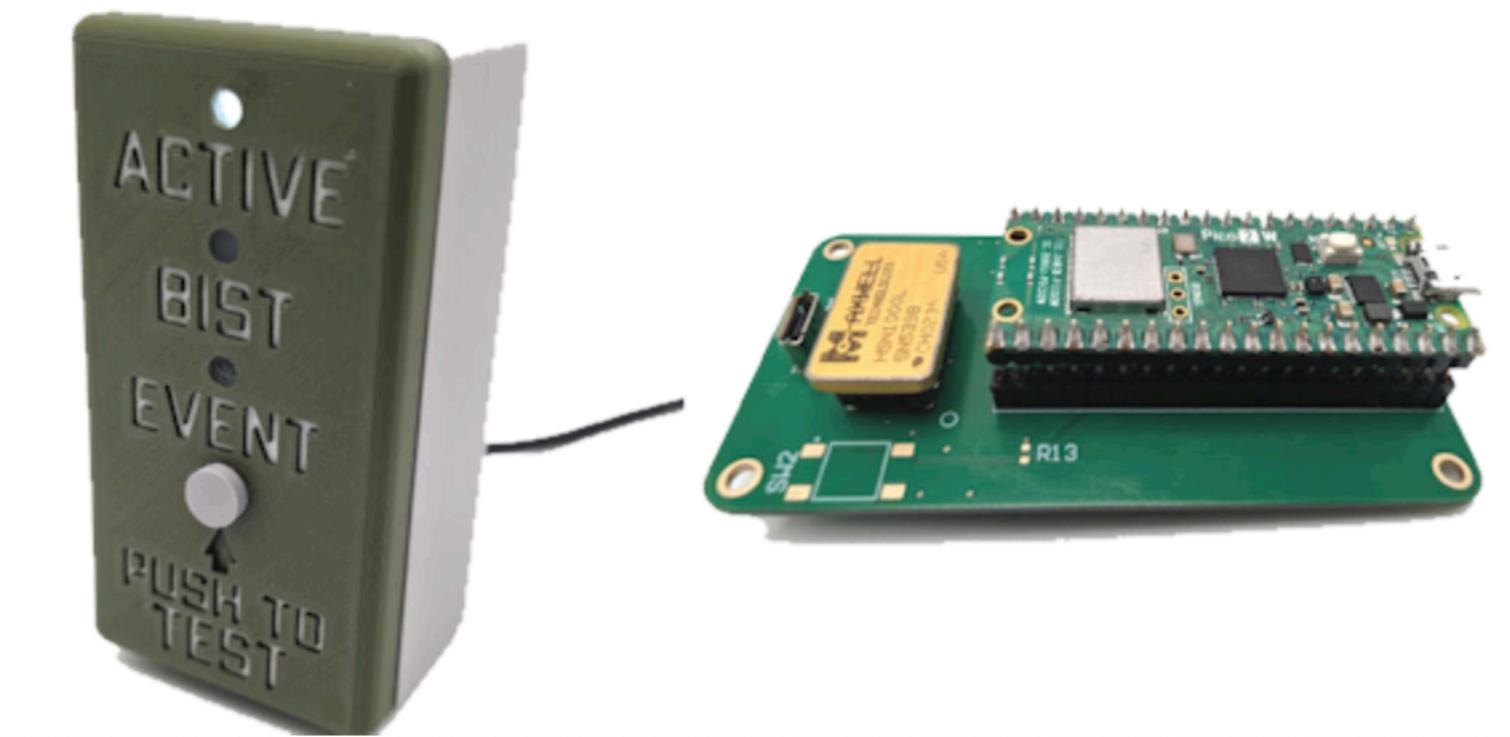
CO2 on CCS811 - d'oh

“NUCLEAR EVENT DETECTOR”

- Woke up on June 24 to find “Has a nuke gone off?” in my news feed...
- The “oh shit” sensor
- Detects gamma bursts associated with nuclear explosions
- I don’t know how to test this sensor!

JUNE 24, 2025 AT 9:25 AM

Has a nuke gone off?



The Bhangmeter V2 is a [Raspberry Pi Pico 2W](#) + MicroPython powered device which can detect a nuclear explosion and uploads the details into a JSON file.

HSN-1000L / HSN-3000L

