SENSORTECH

About Sensors
- and -
Sensors I have known and loved (or hated)

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https://github.com/romkey/sensortech
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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 (CO_2, CO, formaldehyde, H_2S, …)
- Occupancy
- Motion
- Radar
- Sonar
- LIDAR
- Voltage, Current

CCS811
Air Quality
3Vo SCL INT WAKE
VIN GND SDA RST
AS 7341
Multi Spect. Sensor
GND SDA INT
VIN SCL GPIO
TSL2591
Light Sensor
3Vo SCL INT
VIN GND SDA
SPARK X
Qwiic SCD40
PWR
QWIIC
GND 3.3V SDA SCL
AHT20
Temp & Humidity
GND SDA
VIN SCL
BH1750
Light Sensor
3Vo SCL ADDR
VIN GND SDA
VCC
GND
VO
ALA
NA
ROBOT

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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- Precision
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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
- Repeatability
- Size
- Weight
- Lifespan
- Interface
- Drift
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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

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

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

5.0 8 Reviews | 103 sold

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

Visit the Eujgoov Store

1.0 (1)

-7% $17.54

Typical price: ~~$18.79~~

prime Today

FREE Returns

Coupon price $16.66 Terms

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 ✅
CO2 (SCD40)
563
ppm
574
572
570
568
566
564
562
560
TVOC (CCS811)
TVOC (ENS160)
TVOC (CCS811)
187
ppb
200
180
160
140
120
100
80
60
40
20
0
eCO2 (CCS811)
1524
ppm
1,600
1,400
1,200
1,000
800
600
400

SHPARG

Alcohol on CCS81 - *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!

HSN-1000L / HSN-3000L