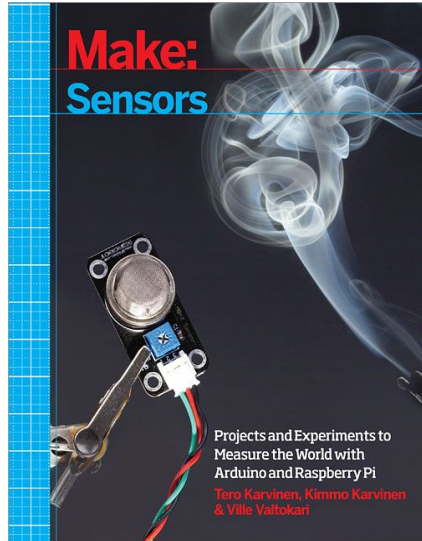


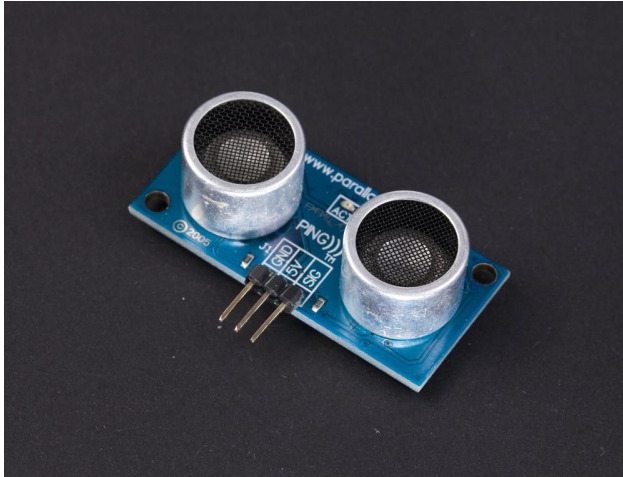
Sensors



Distance

*. Ultrasonic distance : Ping(29.9\$) vs HC-SR04(0.85\$)

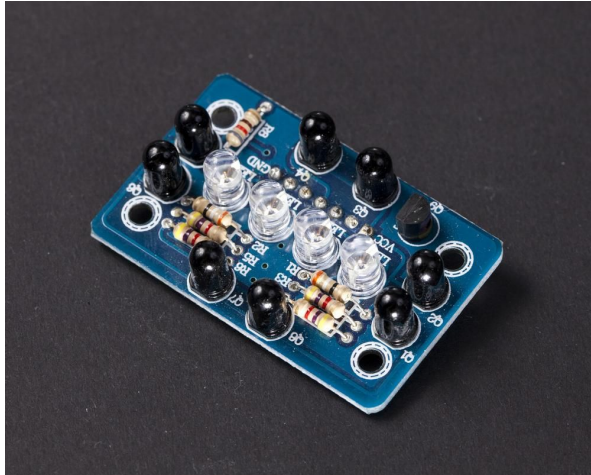
cons : soft pillow, inclined plane



Distance

*. Using Infrared : Compound Eye

- More reliable than ultrasonic but less versatile.
- <https://www.youtube.com/watch?v=kmTzTchwa1k>



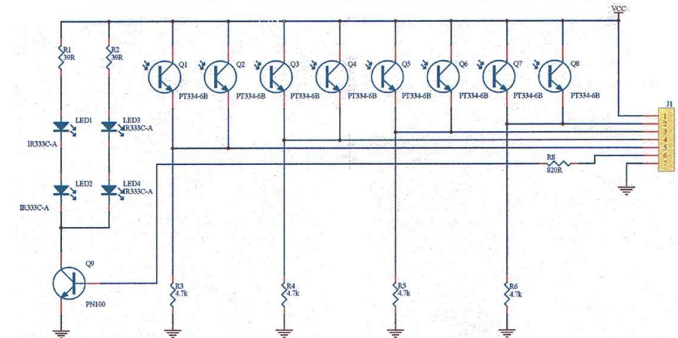
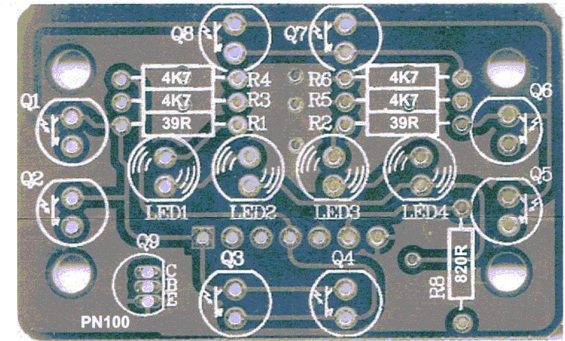
IR compound eye

Assembly Instructions:

1. Install the resistors and 7 pin header first.
2. Install the 4 IR LEDs (clear colour) in the center. Be careful of their polarity.
3. Install the PN100 transistor.
4. Install the 8 IR phototransistors (black colour).

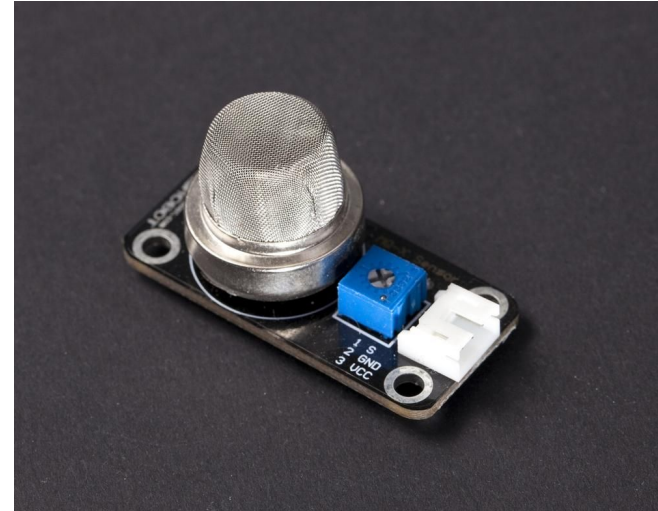
Calibration: (should be done at night to reduce ambient IR from sunlight).

1. Connect to 1 digital output and 4 analog inputs of your micro controller.
2. Write code to make digital output high and display analog inputs.
3. Place small pieces of heatshrink (about 3mm wide) on IR LEDs.
4. With sensor facing away from all objects, adjust position of heatshrink so all readings are similar.
5. Place a white object 100mm away from all sensors. Adjust heatshrink if required.
6. When calibrated gently heat the heatshrink so it maintains position on LEDs.



Gas and Smoke

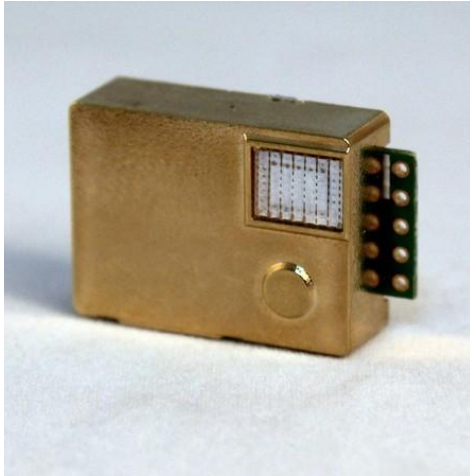
| Q Sensor | Gases detected |
|---------------|---|
| MQ-2 | Flammable gas and smoke |
| MQ-3, MQ-303A | Alcohol (ethanol) |
| MQ-4 | Methane (CH ₄) |
| MQ-7 | Carbon monoxide |
| MQ-8 | Hydrogen |
| MQ-9 | Carbon monoxide, methane, LPG (propane or butane) |



Gas and Smoke

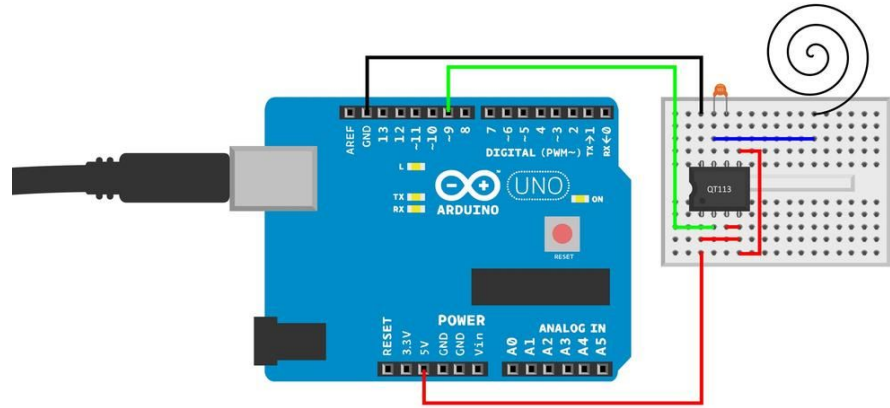
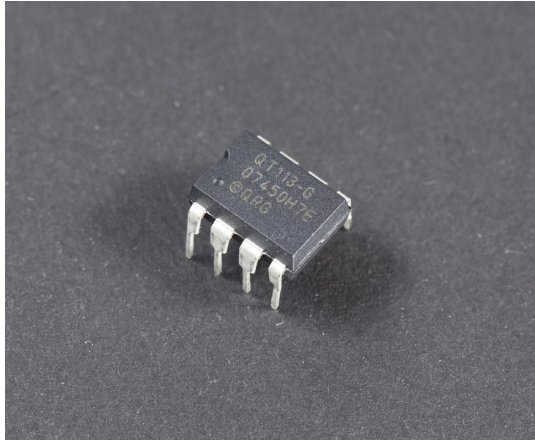
*. CO2 sensor : MH-Z19 detects CO2 (0~5000ppm). cf) 400ppm in the air

- **Nondispersive Infrared (NDIR)** : The key components are an [infrared](#) source, a [light](#) tube, an interference (wavelength) filter, and an infrared detector. The gas is pumped or diffuses into the light tube, and the electronics measures the absorption of the characteristic [wavelength](#) of light



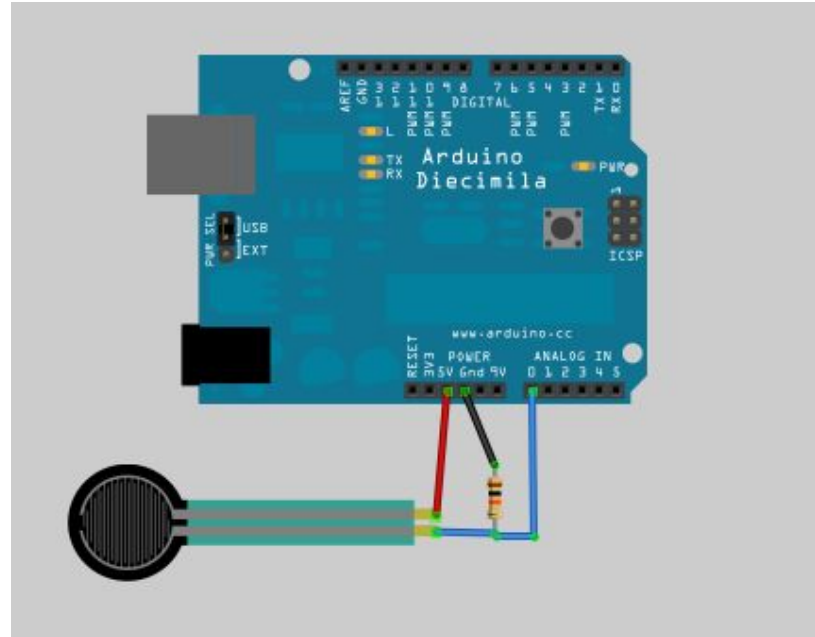
Touch

*. QT113 touch sensor : detect touch then output pin become to low



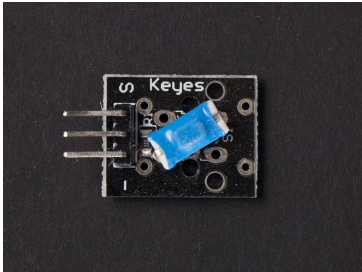
Touch

*. FlexiForce(37\$), FSR402(13\$) : The more you squeeze, the lower the resistance.

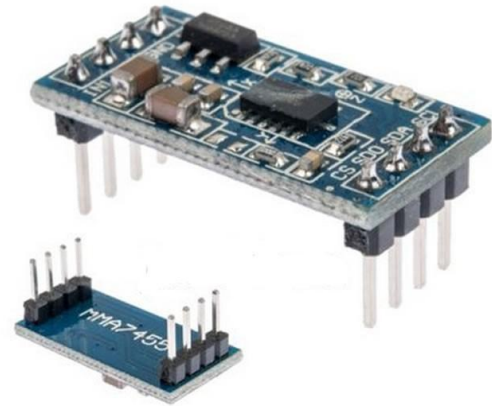


Movement Detect

*. Tilt sensor : 1 axis(< 1\$)



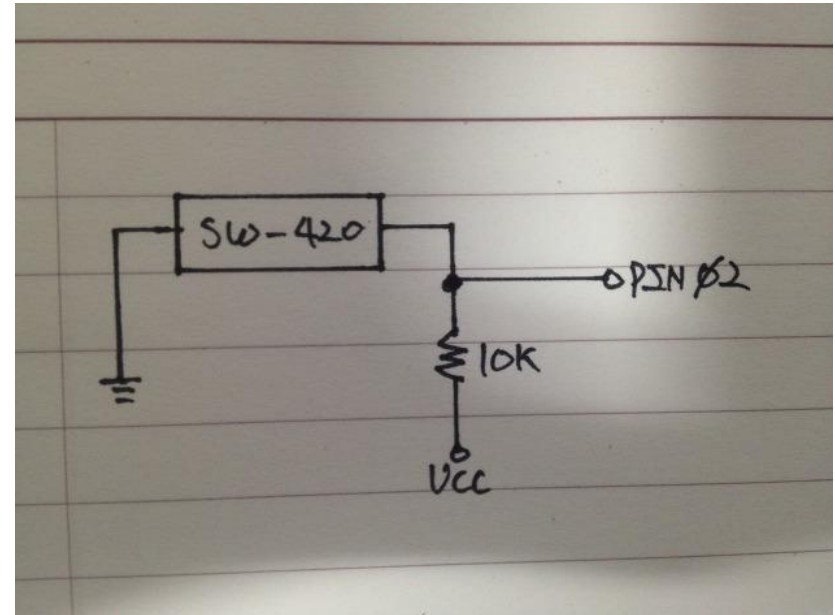
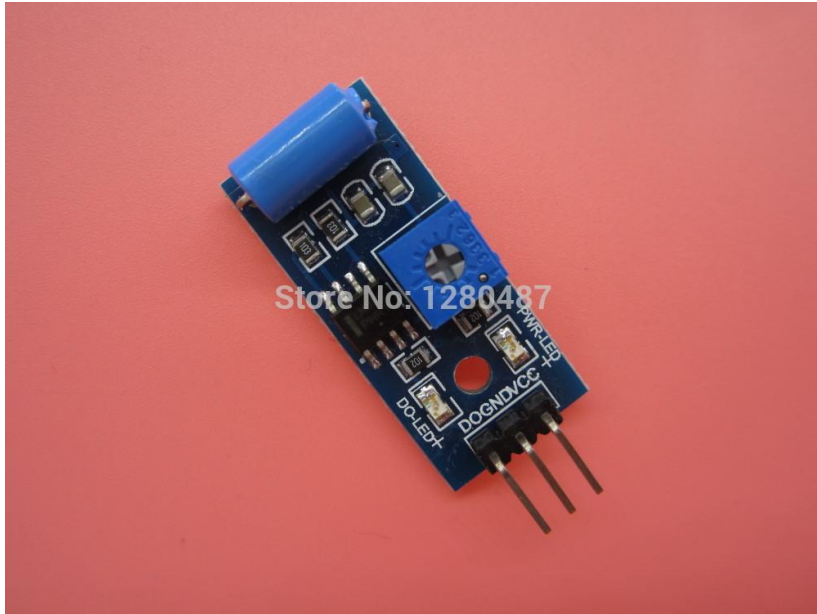
PIR sensor (0.75\$) : Passive Infrared



3 axis accelerator using
MMA7455 (1.68\$)

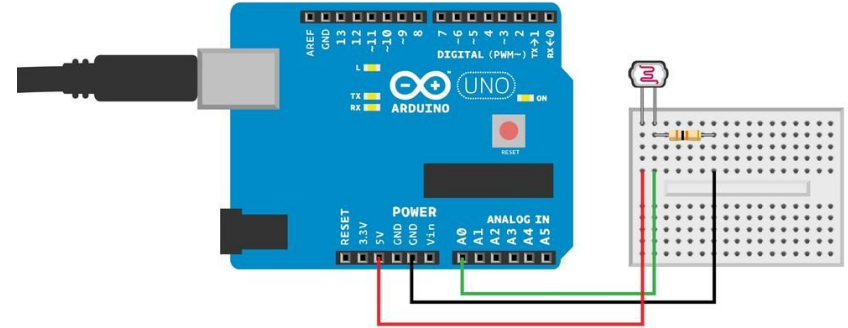
Vibration Detect

*. SW-420 (0.75\$) : Using LM393 voltage comparator



Light

*. Flame detector (0.81\$) : detect IR emitted by the flame



*. LDR : Light Dependent Resistor (~0.2 \$)

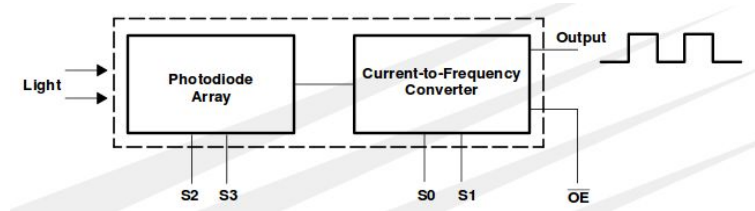
Light

*. TCRT5000 line detector (0.9\$) :

Line detectors light the surface below with light, usually infrared. The surface is considered “white” if enough light is reflected back; anything else is considered a line.



*. TCS230 color recognition (2.25\$)



| PARAMETER | TEST CONDITIONS | CLEAR PHOTODIODE S2 = H, S3 = L | | | BLUE PHOTODIODE S2 = L, S3 = H | | | GREEN PHOTODIODE S2 = H, S3 = H | | | RED PHOTODIODE S2 = L, S3 = L | | | UNIT |
|---------------------------------|---|------------------------------------|-----|-----|-----------------------------------|------|------|------------------------------------|------|------|----------------------------------|-----|-----|------|
| | | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | |
| f _o Output frequency | E _D = 45.6 μW/cm ² , λ _D = 470 nm | 16 | 20 | 24 | 11.2 | 16.4 | 21.6 | | | | | | | kHz |
| | E _D = 39.2 μW/cm ² , λ _D = 524 nm | 16 | 20 | 24 | | | | 8 | 13.6 | 19.2 | | | | kHz |
| | E _D = 32.8 μW/cm ² , λ _D = 635 nm | 16 | 20 | 24 | | | | | | | 14 | 19 | 24 | kHz |
| | E _D = 0 | | 2 | 12 | | 2 | 12 | | 2 | 12 | | 2 | 12 | Hz |

Acceleration

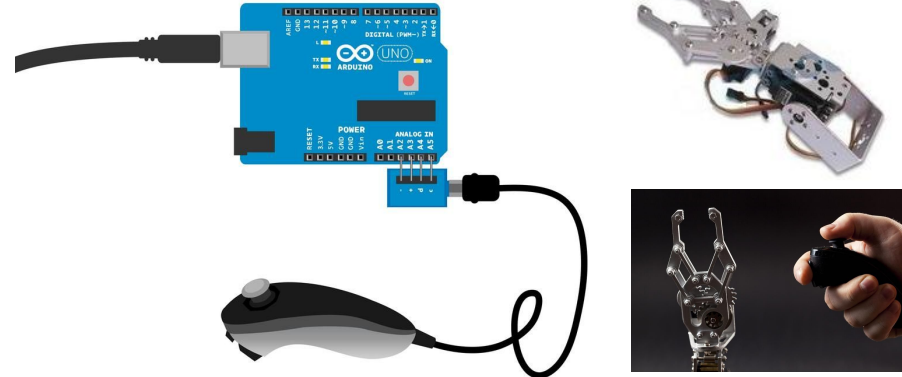
| Sensor | Measures | Meaning | Unit | Gravity |
|---------------|------------------|--|--------------------------------|-----------------|
| Accelerometer | Acceleration | Change of velocity, speeding up or braking | m/s / s = m/s ² | Yes, 1 g down |
| Gyroscope | Angular velocity | Change of angle, spinning | rad/s (SI), often deg/s or RPM | Ignores gravity |

*. MPU-6050 (1.75\$) : 3-Axis Accelerometer + gyroscope module

*. MPU-9150 (16.86\$) : MPU-6050 + Magnetometer(compass)

*. Wii Nunchuk with I2C (3.43\$)

web : <http://playground.arduino.cc/Main/MPU-6050>



Identifying

*. Fingerprint scanner module (25.7\$)

<https://github.com/adafruit/Adafruit-Fingerprint-Sensor-Library>

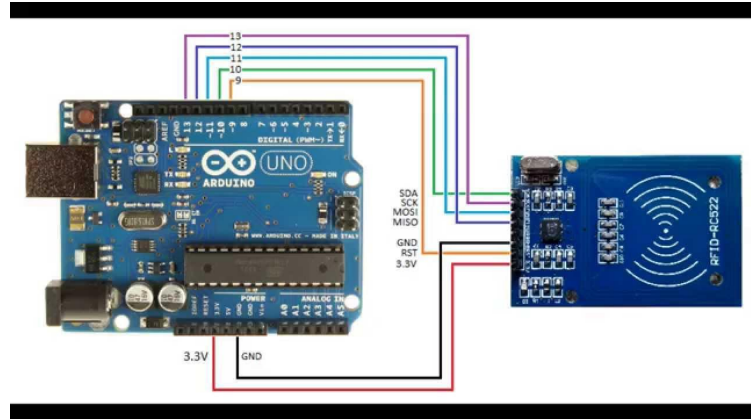


GT-511C3 (43\$)

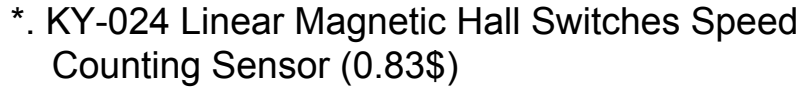
Identifying

*. RFID : MFRC-522 (1.85\$)

<http://playground.arduino.cc/Learning/MFRC522>



*. AttoPilot voltage current sensor (3.82\$)

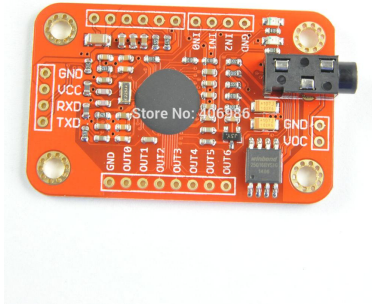


Sound

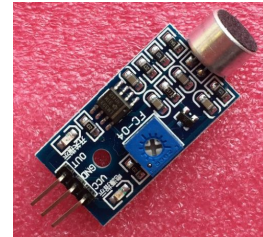
*. FZ0475 : Voice recognition module (20\$)

http://www.elechouse.com/elechouse/images/product/VR3/VR3_manual.pdf

- Support maximum 80 voice commands, with each voice 1500ms (one or two words speaking)
- Maximum 7 voice commands effective at same time
- Arduino library is supplied



*. FC-04 : Voice Sound Detection Sensor Module (0.53\$)

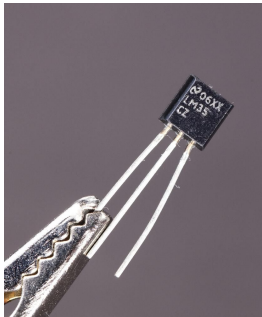


Climate and Temperature

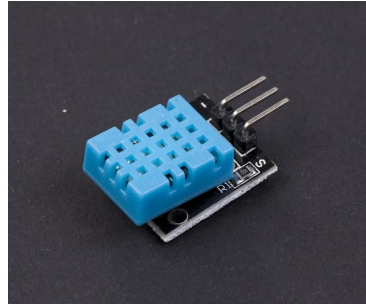
*. LM35 Temp Sensor (0.5\$)

Table 12-1. LM35 reports temperature with voltage

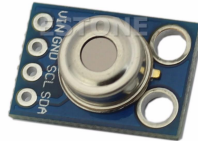
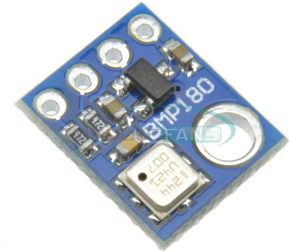
| Temperature C | Voltage V | Comment |
|---------------|-----------|------------------------------|
| 2 C | 0.02 V | Minimum measured temperature |
| 20 C | 0.2 V | Room temperature |
| 100 C | 1.0 V | Boiling water |
| 150 C | 1.5 V | Maximum measured temperature |



*. DTH11 Humidity (0.9\$)



*. BMP180 : Digital Pressure sensor (2.25\$)



*. MLX90614 : Contactless Temp sensor (5.4\$)