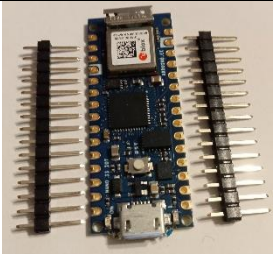
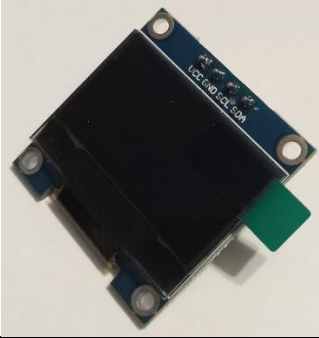
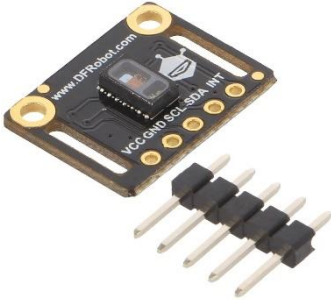
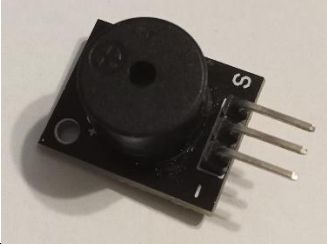

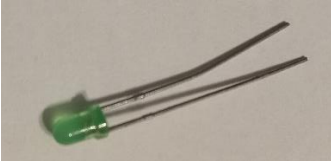





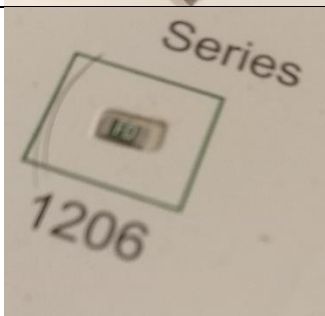

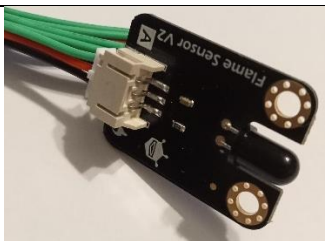
## Project 2 – Elderly Wearables Project – Technical Documentation – Alex Cojocariu


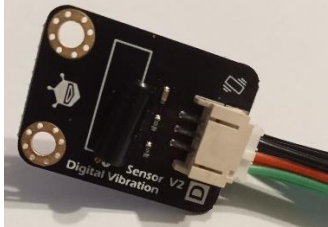
### Hardware Details:

Components:	Image:	Qty:	Description:	Specs:
Arduino Nano 33 IOT		1	Development Board	<ul style="list-style-type: none"><li>• Microcontroller: SAMD21 Cortex®-M0+ 32bit low power ARM MCU</li><li>• Radio module: u-blox NINA-W102</li><li>• Secure Element: ATECC608A</li><li>• Operating Voltage: 3.3V</li><li>• Input Voltage (limit): 21V</li><li>• DC Current per I/O Pin: 7 mA</li><li>• Clock Speed: 48MHz</li><li>• CPU Flash Memory: 256KB</li><li>• SRAM: 32KB</li><li>• EEPROM: none</li><li>• Digital Input / Output Pins: 14</li><li>• PWM Pins: 1 (2, 3, 5, 6, 9, 10, 11, 12, 16 / A2, 17 / A3, 19 / A5)</li><li>• UART: 1</li><li>• SPI: 1</li><li>• I2C: 1</li><li>• Analog Input Pins: 8 (ADC 8/10/12 bit)</li><li>• Analog Output Pins: 1 (DAC 10 bit)</li><li>• External Interrupts: All digital pins (all analog pins can also be used as interrupt pins, but will have duplicated interrupt numbers)</li><li>• LED_BUILTIN: 13</li><li>• USB: Native in the SAMD21 Processor</li><li>• IMU: LSM6DS3</li><li>• Length: 45mm</li><li>• Width: 18 mm</li><li>• Weight: 5 gr (with headers)</li></ul>



				<ul style="list-style-type: none"> <li>No. of Pins: 3</li> <li>Accuracy: <math>\pm 0.4^{\circ}\text{C}</math></li> </ul>
White I2C OLED display		1	Led display to see the data from the sensors	<ul style="list-style-type: none"> <li>0.96-inch screen, 64x128 pixels</li> <li>Protocol: I2C, (SCK = Clock, SDA = Data)</li> <li>Supply Voltage (Vcc): 3.3V</li> <li>IO voltage: 3.3 V</li> </ul>
MAX30102		1	Heart rate sensor	<ul style="list-style-type: none"> <li>Power Supply: 3.3V~5V</li> <li>Working Current: &lt;5mA</li> <li>RED/IR LED Driving Current: 0-50mA</li> <li>Communication: I2C</li> <li>I2C Address: 0x57</li> <li>Operating Temperature: -40°C~85°C</li> <li>Dimension: 18x14mm/0.71x0.55"</li> </ul>
Piezo Buzzer		1	Make noise if issue arises	<ul style="list-style-type: none"> <li>Wide voltage range from 3.3V to 5V.</li> <li>Digital</li> </ul>
Gas Sensor V2		1	Check the air quality, Carbon Monoxide Detection. It can detect CO-gas concentrations anywhere from 20 to 2000ppm. The sensitivity can be adjusted by the potentiometer.	<ul style="list-style-type: none"> <li>Power supply needs: 5V</li> <li>Interface type: Analog</li> <li>Pin Definition: 1- Output 2-VCC 3-GND</li> <li>High sensitivity to carbon monoxide</li> <li>Fast response</li> <li>Stable and long life</li> <li>Size: 40x20mm</li> </ul>
Green LED		1	On / Off Status	<ul style="list-style-type: none"> <li>3mm Green LED</li> <li>Drop Voltage 1.8V</li> </ul>

470 ohms resistor		1	Resistor for Status LED	<ul style="list-style-type: none"> <li>470 Ohm resistor, 0.25 Watts</li> </ul>
SPDT Micro Slide Switch		1	On / Off Power Switch	<ul style="list-style-type: none"> <li>2.5mm by 10mm by 11.5mm</li> <li>Switch Type: slide</li> <li>Pole throw Type: SPDT</li> <li>Poles: 3</li> <li>Switch Function: Locking on/off</li> <li>Switch Connection: PCB Pins</li> <li>Mounting Method: PCB</li> <li>DC Voltage: 24V</li> <li>DC Current 0.5A</li> </ul>
4x AAA battery mount		1	To hold the batteries	<ul style="list-style-type: none"> <li>4x AAA battery holder</li> <li>Length: 54mm</li> <li>Width: 50mm</li> <li>Height: 13mm</li> </ul>
Resettable fuse		1	A resettable fuse so no need to reset the circuit	<ul style="list-style-type: none"> <li>SMD Type fuse, 1206 Series</li> <li>Hold current: 500mA</li> <li>VMAX: 6V ~ 60V</li> <li>IMAX: 10A ~ 40V</li> <li>nanoSMD</li> </ul>
Touch Sensor V2		1	Scroll through OLED display	<ul style="list-style-type: none"> <li>Supply Voltage: 3.3V to 5V</li> <li>Interface: Digital</li> <li>Size: 22x30mm</li> </ul>
Flame Sensor V2		1	Mobile Fire Alarm	<ul style="list-style-type: none"> <li>Supply Voltage: 3.3V to 5V</li> <li>Detection range: 20cm (4.8V) ~ 100cm (1V)</li> <li>Range of Spectral Bandwidth : 760nm to 1100nm</li> <li>Responsive time : 15us</li> <li>Interface: Analog</li> </ul>

				<ul style="list-style-type: none"> <li>• Size:22x30mm</li> <li>• Operating Temp: -25 to 85 degrees C</li> </ul>
Analog Ambient Light Sensor V2.1		1	For OLED display brightness	<ul style="list-style-type: none"> <li>• Supply Voltage: 3.3V to 5V</li> <li>• Illumination range : 1 Lux to 6000 Lux</li> <li>• Responsive time : 15us</li> <li>• Interface: Analog</li> <li>• Size:22x30mm</li> </ul>
Digital Vibration Sensor V2		1	Check for seizures	<ul style="list-style-type: none"> <li>• Wide voltage range from 3.3V to 5V</li> <li>• Standard assembling structure (two 3mm diameter holes with multiple of 5mm as distance from center)</li> <li>• Easily recognitive interfaces of sensors ("A" for analog and "D" for digital)</li> <li>• Icons to simply illustrate sensor function</li> <li>• High quality connector</li> <li>• Immersion gold surface</li> <li>• IO Type: Digital</li> <li>• Switch life: up to 10 million seconds</li> <li>• Open circuit resistance: 10Mohm</li> <li>• Supply Voltage: 3.3V to 5V</li> <li>• Interface: Digital</li> <li>• Size:22x30mm</li> </ul>

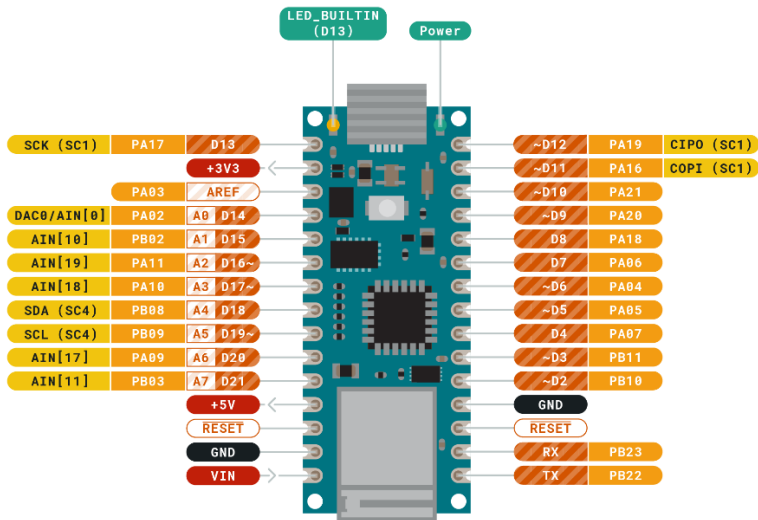
#### Hardware Pinouts:

<b>Components:</b>	<b>Components Pinout:</b>
--------------------	---------------------------

Arduino Nano 33 IOT



ARDUINO  
NANO 33 IoT



Ground Internal Pin Digital Pin Microcontroller's Port  
Power SWD Pin Analog Pin  
LED Other Pin Default

ARDUINO.CC

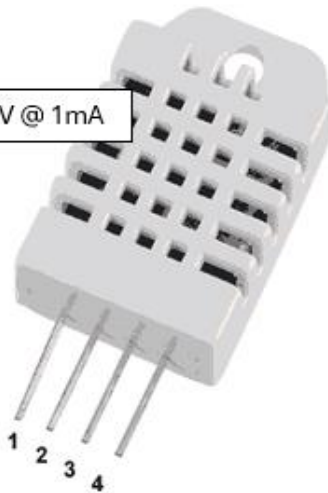


This work is licensed under the Creative Commons Attribution-ShareAlike 4.0 International License. To view a copy of this license, visit <http://creativecommons.org/licenses/by-sa/4.0/> or send a letter to Creative Commons, PO Box 1888, Mountain View, CA 94042, USA.

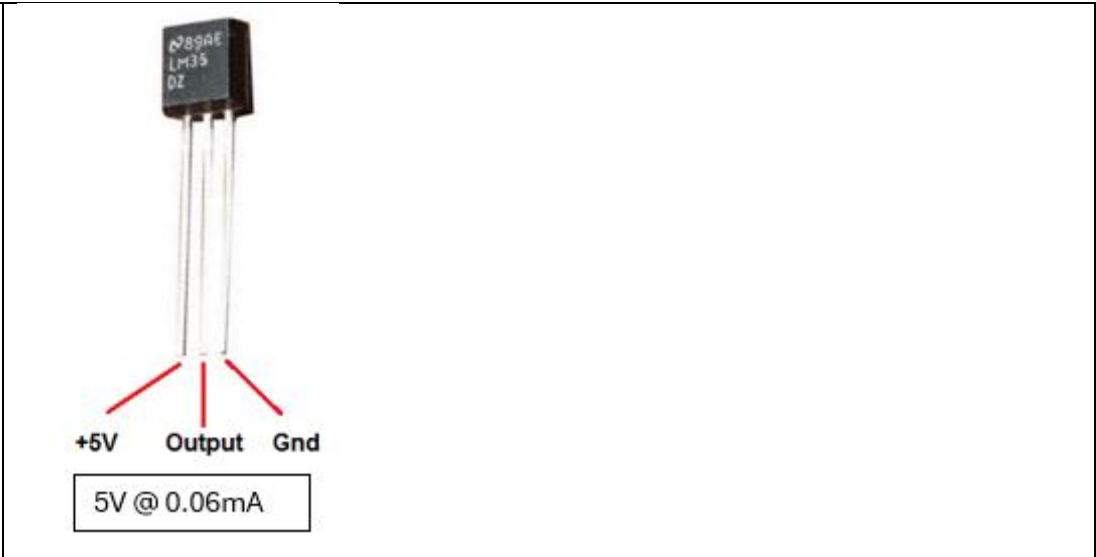
DHT22

DHT22 pins	
1	VCC
2	DATA
3	NC
4	GND

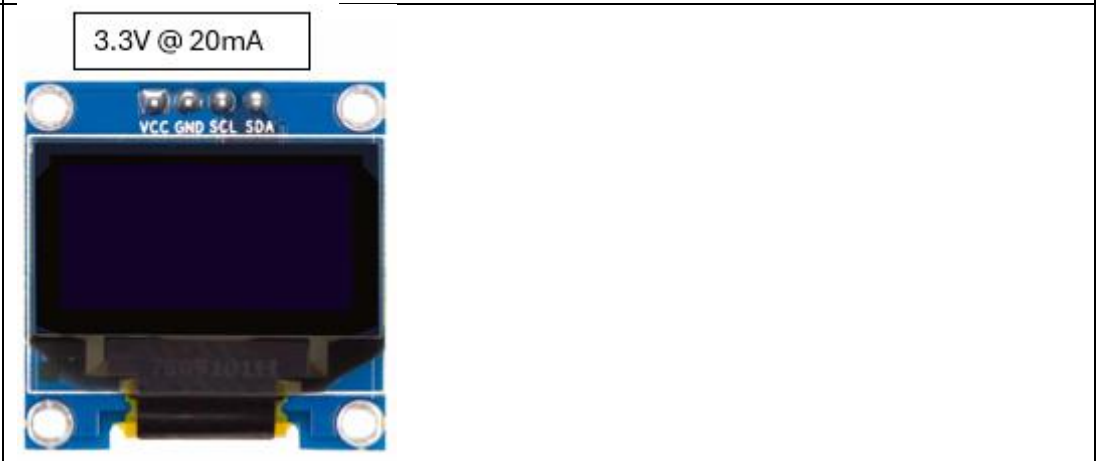
3.3V @ 1mA



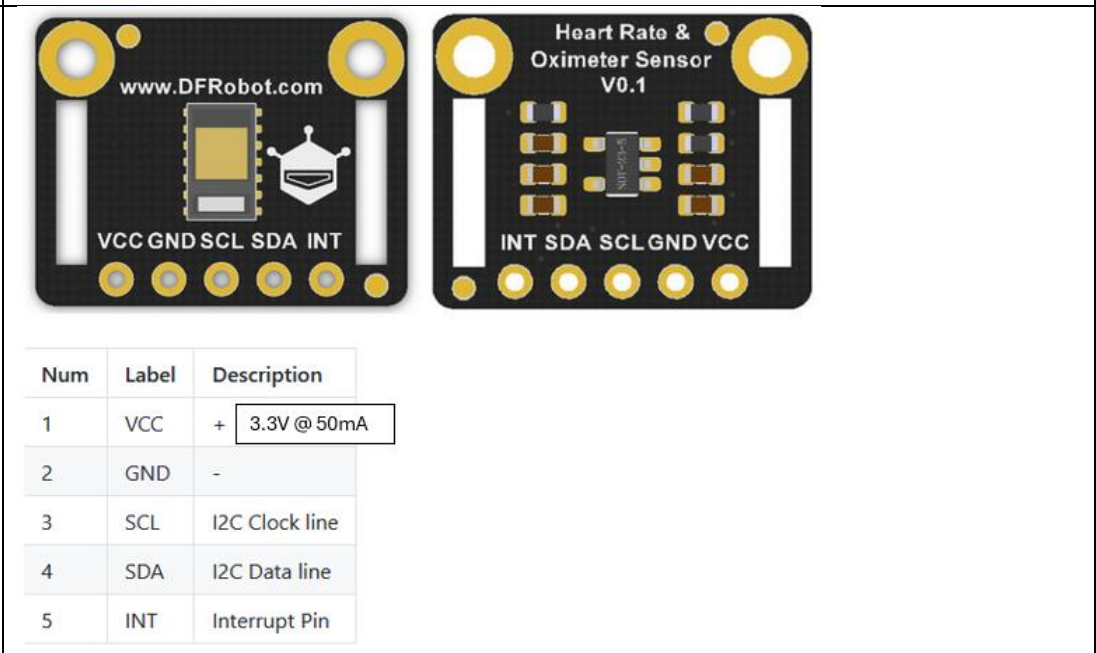
Lm35DZ



White I2C OLED display



MAX30102
----------



Num	Label	Description
1	VCC	+ 3.3V @ 50mA
2	GND	-
3	SCL	I2C Clock line
4	SDA	I2C Data line
5	INT	Interrupt Pin

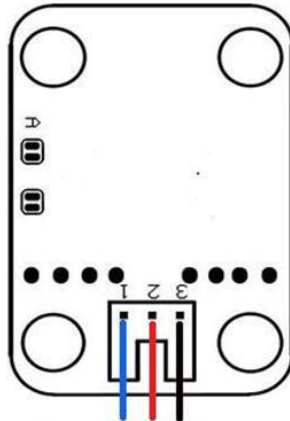


Buzzer



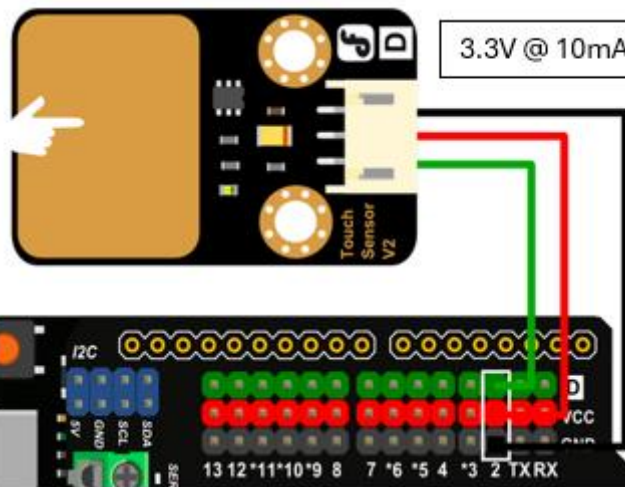
3.3V @ 25mA

Gas Sensor V2



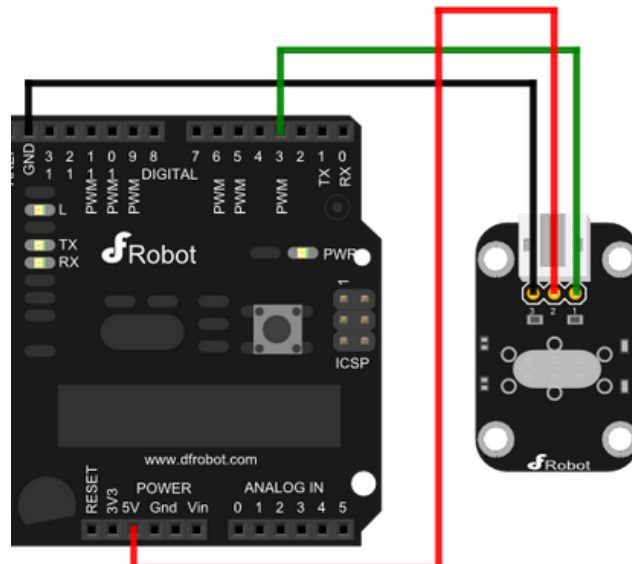
Output 5V GND

Touch Sensor V2



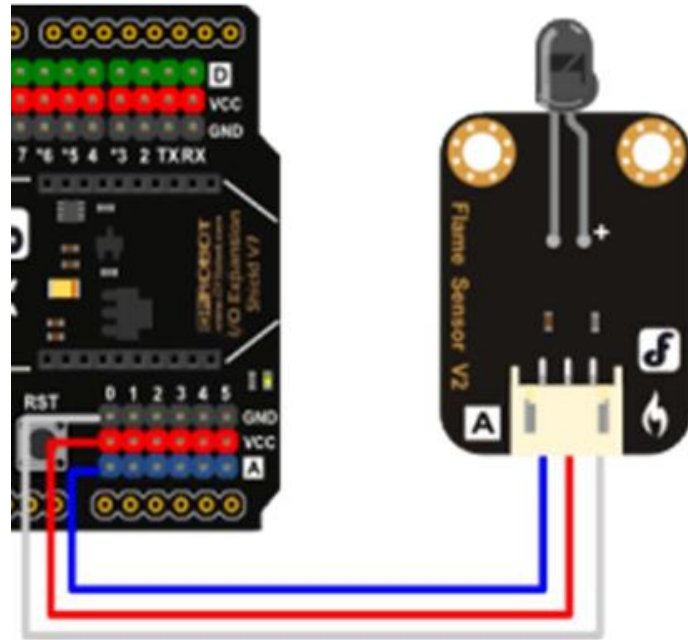
3.3V @ 10mA

Digital Tilt Sensor V2

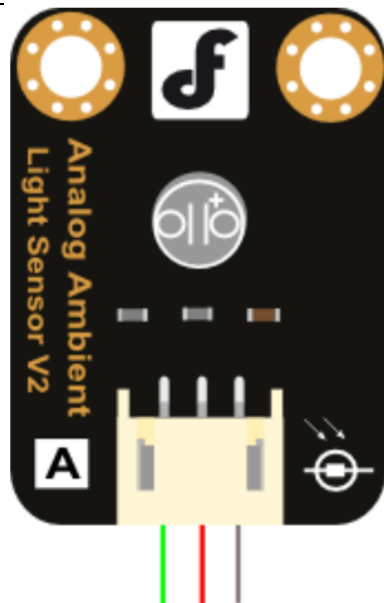




Flame Sensor V2

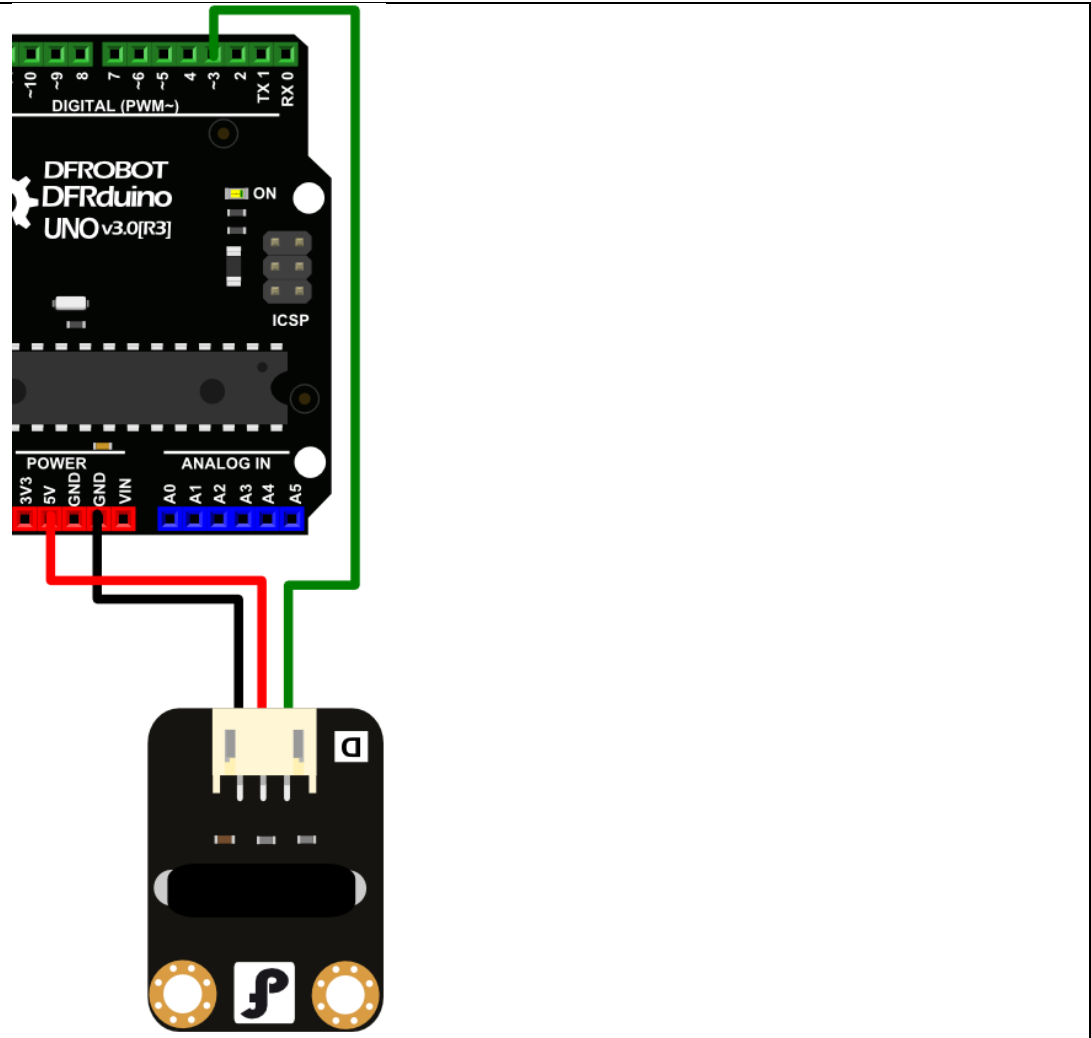


Analog Ambient Light Sensor V2.1



Color	Pin
GREEN	S
RED	VCC
BLACK	GND

Digital Vibration  
Sensor V2



**Components Details:**

Components:	PIN Connections in the System:
Arduino Nano 33 IOT	NA
DHT22	Vcc: 3.3V GND Data: Input D5
TMP36	Vcc: 3.3V GND Data: Input A6
White I2C OLED display	Vcc: 3.3V GND SDA: Input / Output A5 SCL: Output A4
MAX30102	Vcc: 3.3V GND SDA: Input / Output A5 SCL: Output A4
Buzzer	Vcc: 3.3V GND Data: Output D2 PWM
BME680	Vcc: 3.3V GND SDA: Input / Output A5 SCL: Output A4
Touch Sensor V2	Vcc: 3.3V

	GND Data: Input D11
Flame Sensor V2	Vcc: 5V GND Data: Input A1
Analog Ambient Light Sensor V2.1	Vcc: 3.3V GND Data: Input A7
Digital Vibration Sensor V2	Vcc: 3.3V GND Data: Input D3

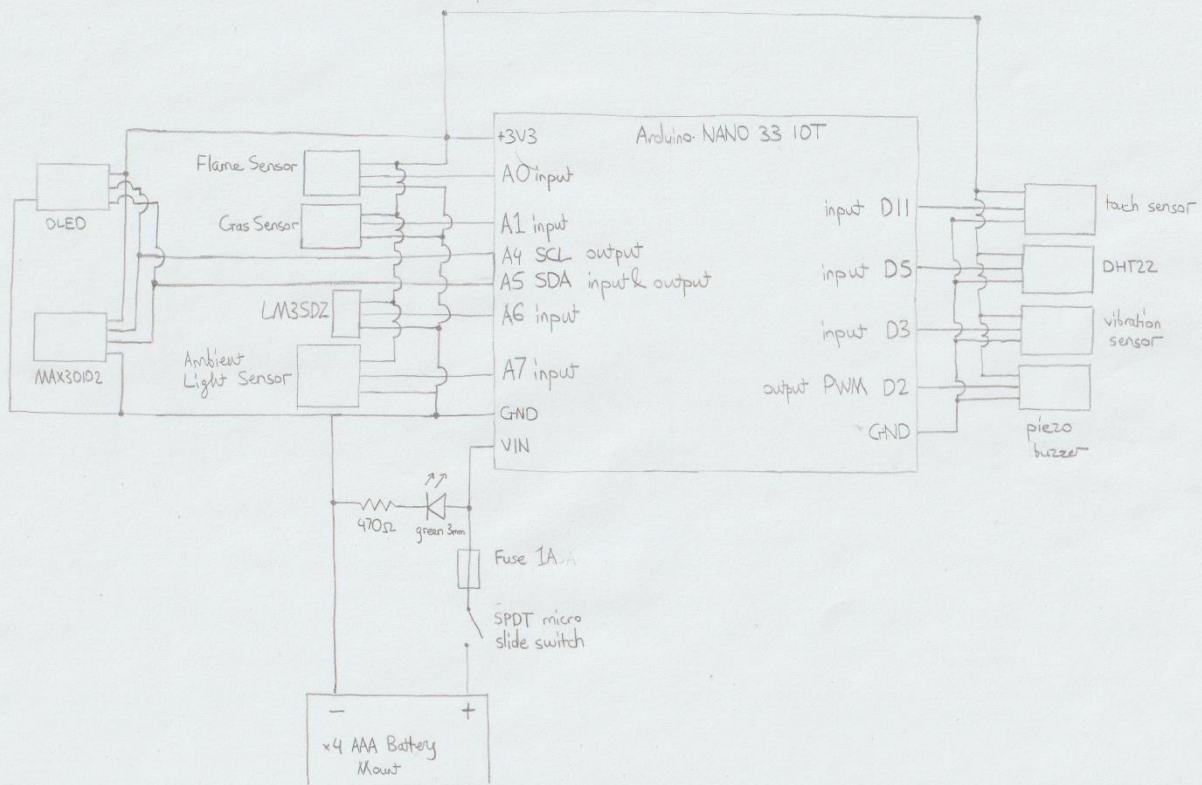
#### Battery Calculations:

Sensor	Voltage ( V )	Current ( mA )
Arduino Nano 33 IOT	3.3	365
DHT22	3.3	1
Lm35DZ	3.3	0.06
White I2C OLED display	3.3	20
MAX30102	3.3	50
Buzzer	3.3	25
BME680	3.3	13
Touch Sensor V2	3.3	10
Flame Sensor V2	3.3	0.01
Analog Ambient Light Sensor V2.1	3.3	0.008
Digital Vibration Sensor V2	3.3	10
		<b>Total Current: 494.078mA</b>
		494.078mA < 500mA (Fuse)

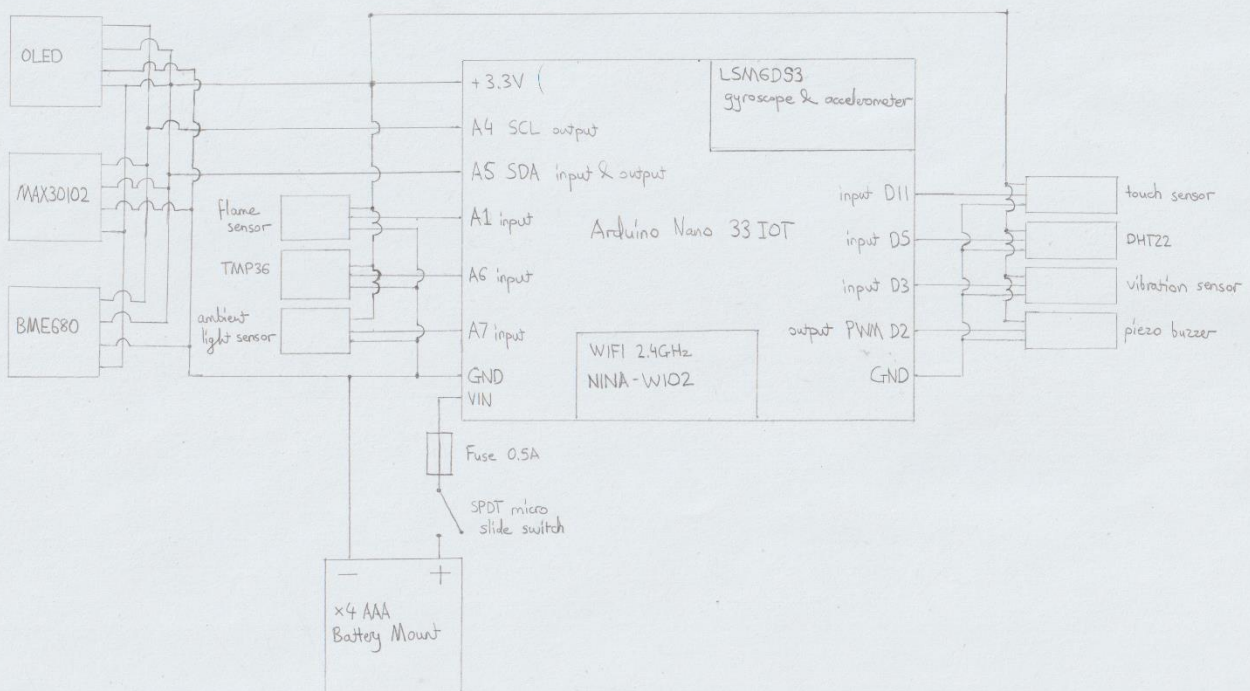
#### Complete PCB Circuit Diagram AND Pinout:

This is the Circuit Design for the PCB ( image of complete PCB further down in this documentation)

## System Schematic : Initial

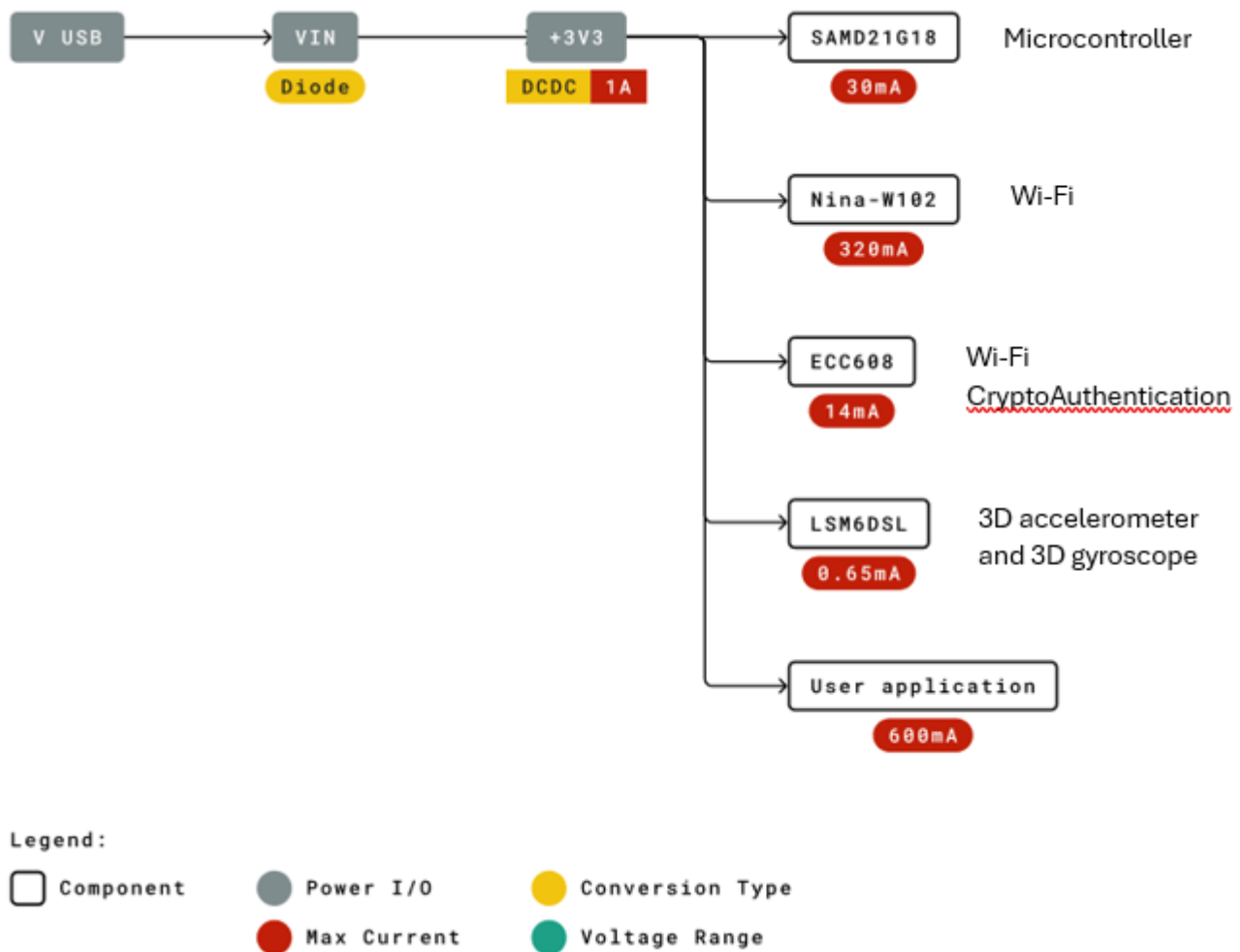


## System Schematic : Revised



Revised Circuit Design Schematic has the LM35DZ replaced by TMP36, gas sensor with BME680 and the green led, and resistor removed, due to issues with power and battery life to power the PCB.

#### Arduino Nano 33 IOT Power Tree:



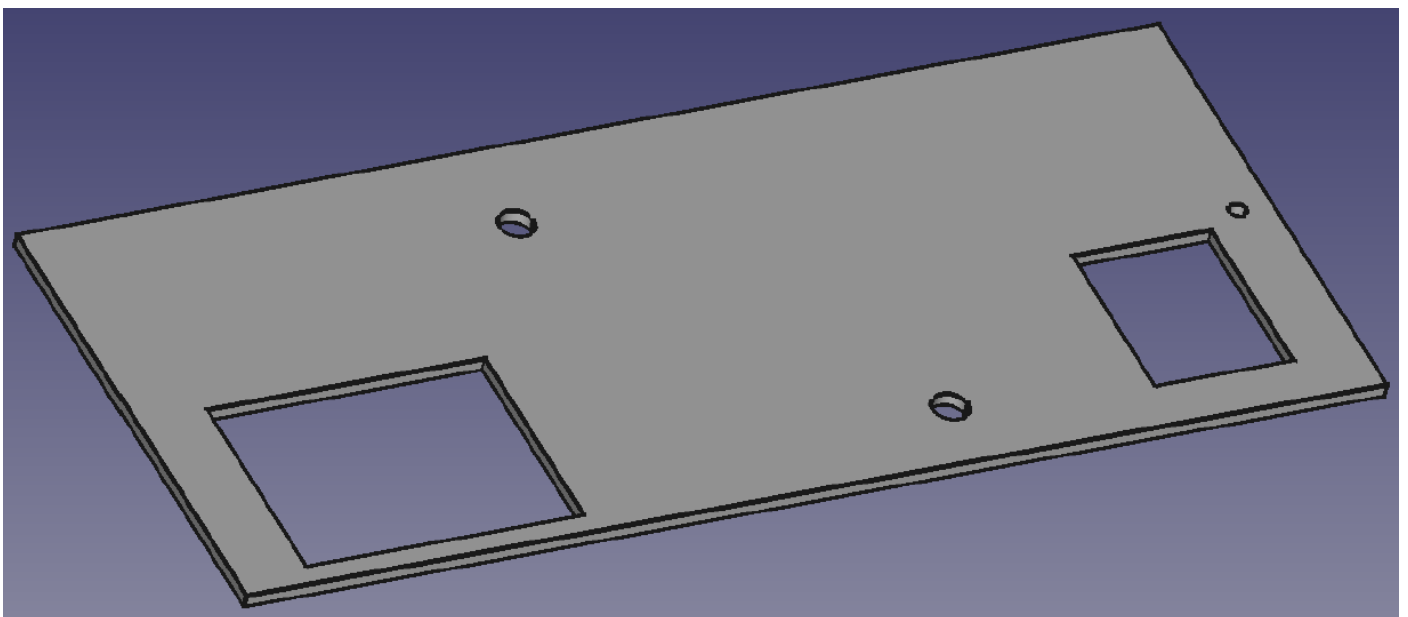
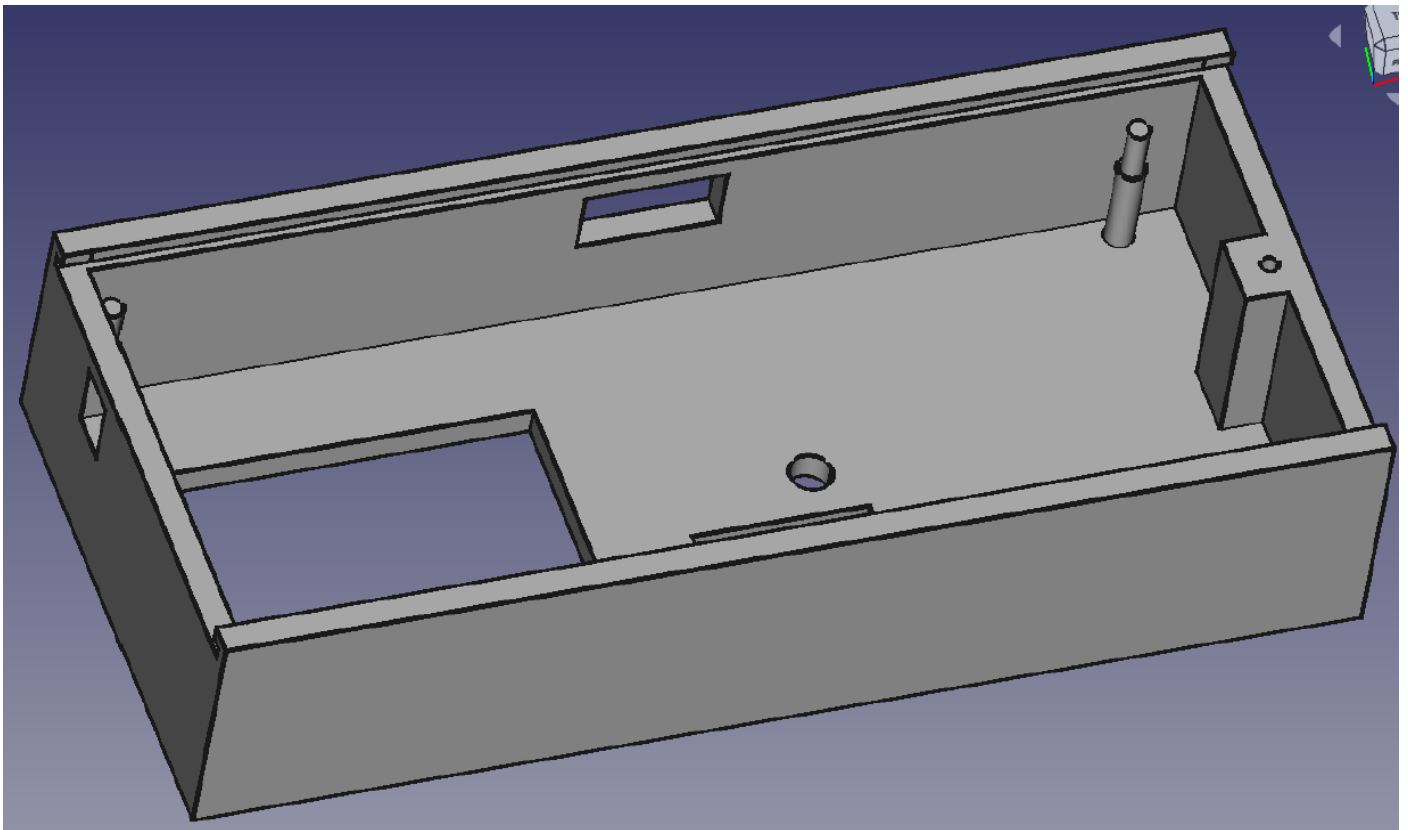
#### Materials/Parts/Sensors List:

Components	Purchase Links: ( Core Electronics )
Arduino Nano 33 IOT	<a href="https://core-electronics.com.au/arduino-nano-33-iot.html">https://core-electronics.com.au/arduino-nano-33-iot.html</a>
DHT22	<a href="https://core-electronics.com.au/dht22-temperature-and-relative-humidity-sensor-module.html">https://core-electronics.com.au/dht22-temperature-and-relative-humidity-sensor-module.html</a>
Lm35DZ	<a href="https://core-electronics.com.au/lm35dz-temperature-sensor.html">https://core-electronics.com.au/lm35dz-temperature-sensor.html</a>
White I2C OLED display	<a href="https://core-electronics.com.au/white-i2c-oled-display-ssd1306.html">https://core-electronics.com.au/white-i2c-oled-display-ssd1306.html</a>
MAX30102	<a href="https://core-electronics.com.au/dfrobot-max30102-heart-rate-and-oximeter-sensor.html">https://core-electronics.com.au/dfrobot-max30102-heart-rate-and-oximeter-sensor.html</a>
Buzzer	<a href="https://core-electronics.com.au/digital-buzzer-module.html">https://core-electronics.com.au/digital-buzzer-module.html</a>
BME680	<a href="https://core-electronics.com.au/bme680-breakout-air-quality-temperature-pressure-humidity-sensor.html">https://core-electronics.com.au/bme680-breakout-air-quality-temperature-pressure-humidity-sensor.html</a>
Touch Sensor V2	<a href="https://core-electronics.com.au/capacitive-touch-sensor.html">https://core-electronics.com.au/capacitive-touch-sensor.html</a>
Flame Sensor V2	<a href="https://core-electronics.com.au/flame-sensor.html">https://core-electronics.com.au/flame-sensor.html</a>

Analog Ambient Light Sensor V2.1	<a href="https://core-electronics.com.au/analog-ambient-light-sensor.html">https://core-electronics.com.au/analog-ambient-light-sensor.html</a>
Digital Vibration Sensor V2	<a href="https://core-electronics.com.au/digital-vibration-sensor.html">https://core-electronics.com.au/digital-vibration-sensor.html</a>
TMP36	<a href="https://core-electronics.com.au/temperature-sensor-tmp36.html">https://core-electronics.com.au/temperature-sensor-tmp36.html</a>

### CAD Drawings:

I initially wanted the colour to be in Light Grey like in my CAD Designs but white was the best available option at the time.



## System Functionality:

All sensors are collecting data and processing through the Arduino Nano 33 IoT to the web, ( google firebase )

Flame sensor, gas sensor, dht22, touch sensor, vibration sensor, ambient light sensor, buzzer, OLED display, heart rate sensor, lm35dz, Arduino Nano 33 IoT with inbuilt 3-axis accelerometer and RTC.

The flame, gas, dht22, vibration, heart rate, lm35dz and ambient light sensor are all working passively, getting data from the environment and person and sends the data to the web with timestamp (RTC).

The flame sensor detects if there is a fire, if there is, the buzzer sounds.

The gas sensor detects if there is bad air quality, if there is, the buzzer sounds.

The vibration sensor senses vibration, if over a threshold, the buzzer sounds.

Ambient light sensor is for detected room brightness.

Touch sensor when touched, will scroll through the data, basically displaying the data of the different sensors.

All the sensor data will be sent to the web to thingspeak.

Visual Studio Code **Live Share Extension** to collaborate for the Arduino code.

## Remarks:

The LM35DZ doesn't work with the Arduino nano 33 IoT, it is not compatible with it, during testing It became very hot, and nothing else was working, luckily, after turning off power and taking it out, the PCB was functioning like normal.

To make this PCB, you will need an entire electronics workshop setup.

In the end thingspeak was used as I was having numerous connection issues with Google Firebase.

When using Google Firebase so that no issues occur, **disable your adblocker**.

## Notable Images:



