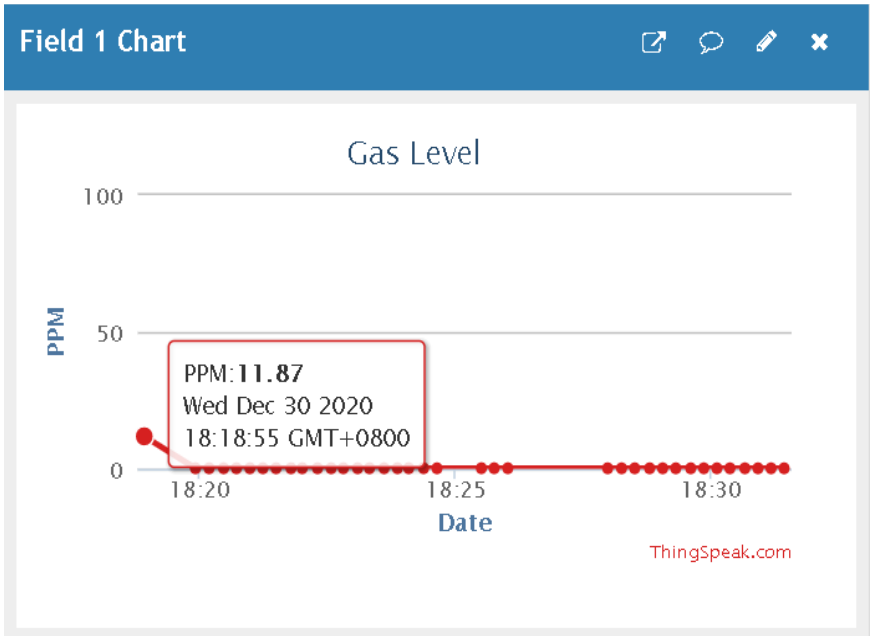
Noise pollution monitoring

System analysis:

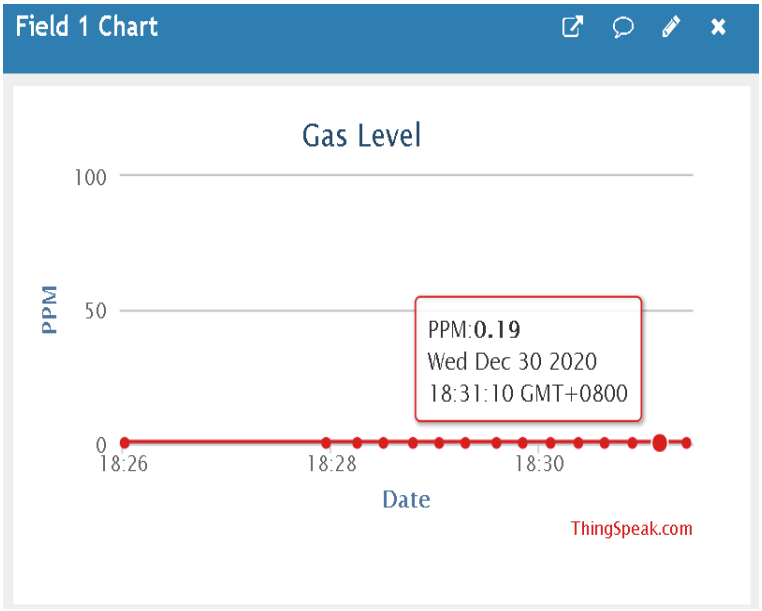
The value obtained by the gas sensor MQ9 and sound sensor LM393 were both analog inputs. Both sensors were connected to the analog pin of ESP8266 Wi-Fi Module NodeMCU. The value obtained from analog input wasconverted to into digital output. The measured ppm value and noise level in decibel (dB) were displayed on the Arduino serial monitor of the selected COM port. The data was sent to the ThingSpeak server and the output displayed in graphical analytic form.

Referring to Figure 5 (a) and (b), it shows the ThingSpeak graphical representation of gas level. Figure 5
(a) shows the highest carbon monoxide concentration, while Figure 5 (b) shows the lowest concentration value obtained from the gas sensor MQ9.



(a)

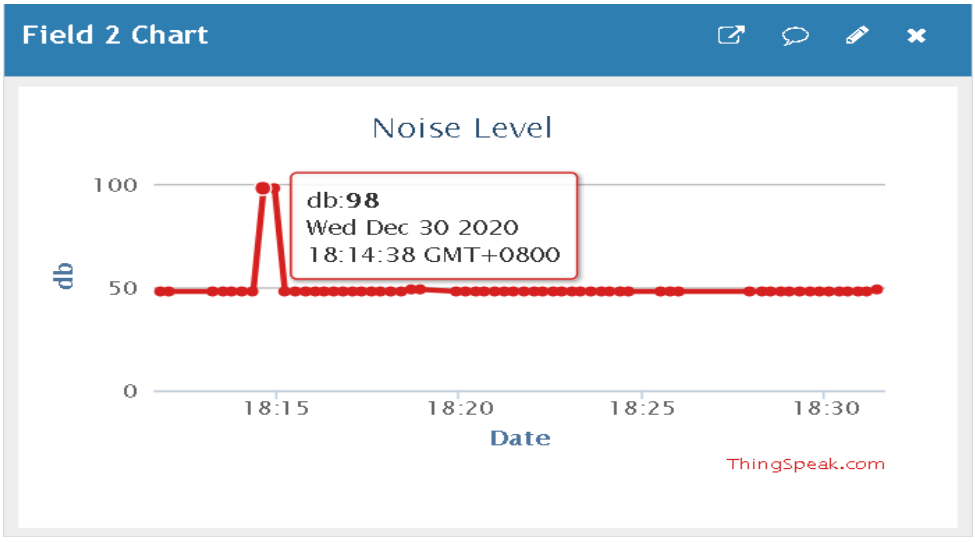
Fig 1: Showing the ThingSpeak graph of the (a) maximum concentration of Carbon monoxide, CO



(b)

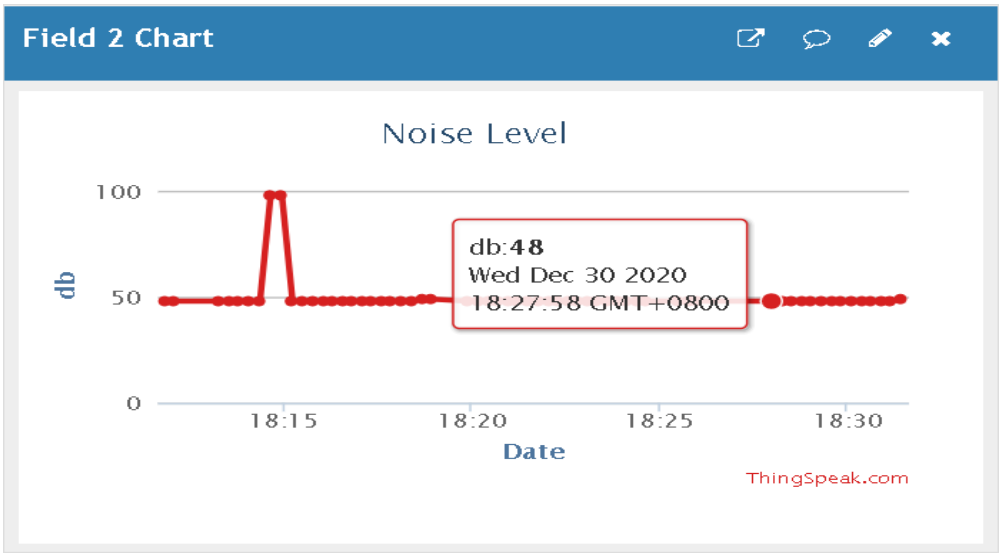
fig2: Showing the ThingSpeak graph of the (b) minimum concentration of Carbon monoxide, CO in ppm (parts per million)

The ThingSpeak graphical representation of noise levelin decibels (dB) is shown in Figures 6 (a) and (b). Figure 6 (a)shows the highest level of noise while Figure 6 (b) shows the lowest level of noise recorded from the sound sensor LM393.To activate the alerting state, a Bluetooth speaker wasturned up to its maximum volume to provide loud sound from a song.



(a)

Fig 3:Showing the Thingspeak graph of the (a) maximum noise level



(b)

Fig 4: Showing the Thingspeak graph of the (b) minimum noise level in decibel (dB)

The validation results are shown in Figures 7 and 8. Running ten trials and averaging the findings completed the validation process for carbon monoxide concentration. Figure 7 shows that the average carbon monoxide concentration for the gas sensor MQ9 and the carbon monoxide meter are identical, though the average valuesvaried at times. This might be due to the tolerance level of the sensor and carbon monoxide meter. The ability of gas sensor MQ9 and carbon monoxide meter to measure the carbon monoxide concentrations was also hampered by variations in the direction of the wind and the condition of the surrounding room

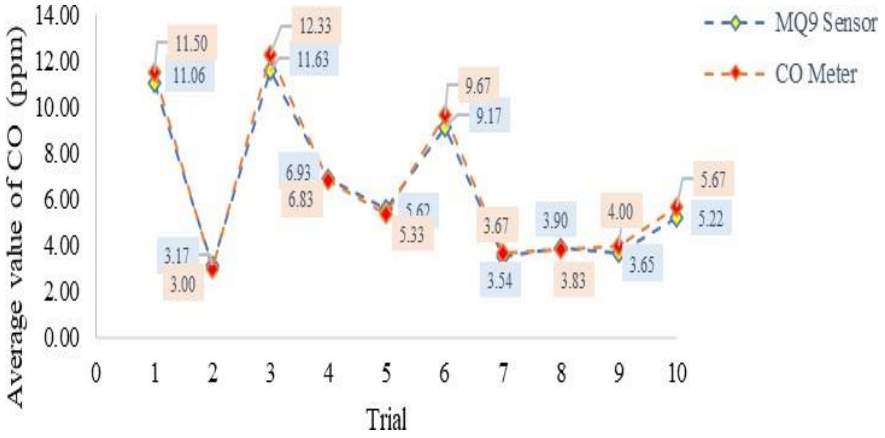


Fig 5: Showing the comparison graph of carbon monoxide concentrations in ppm using gas sensor MQ9 and carbon monoxidemeter

The noise level values obtained from the sound sensor LM393 and the digital sound level meter are shown in Figure8. To confirm the noise values measured by the sound sensor LM393, three experiments were carried out. The same part of the song was played for 60 seconds. The trials were conducted in a controlled environment with a Bluetoothspeaker acting as a noise source. From the results, theoverall noise level from both instruments was comparable. Between the sound sensor LM393 and the digital sound level meter, there were minor variations in value ranging from 0.1 to 0.3 decimal points. This may be due to the sensor's and instrument's tolerance levels.

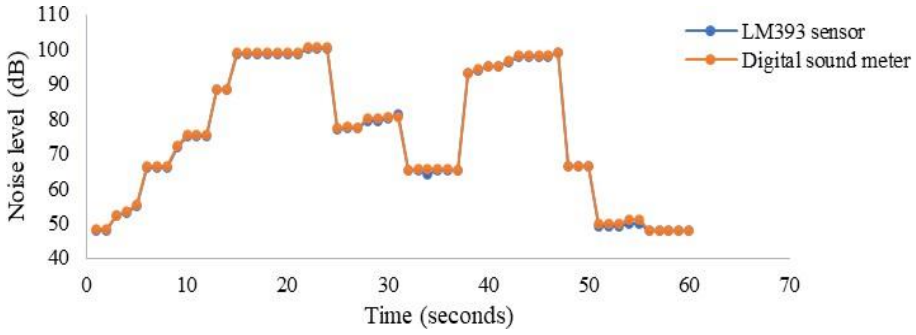


Fig 6: Showing the comparison graph of noise levels in dB using sound sensor LM393 and digital sound level meter