***Noise Pollution Monitoring***

# ABSTRACT

In infrastructure of todays societies and industrial plants the increase in environmental issues like pollution (Air,Noise,etc.),climatechange,malfunctioning causes great consequence and which gives rise to demand for an , operationally adaptable , efficient, cheap and smart monitoring system. In this paper a solution to monitor air and noise pollution in industrial areas as well as public society is proposed. Now a days technologies which provides an case of using softwares and devices are in demand and IOT is such a platform which provides real time access to the devices through the internet which is attracting the younger generation.we just have to connect the sound sensor to one of the analog pin and the LCD to the I2C pins

**FLOWCHART**

**Noise data acquisition**

**Noise value>80**?///??//?

**CO value<10**

**% of window open**

**!=0?**

### **Steps for NPM**

* The most common instruments used for measuring noise are the sound level meter (SLM), the integrating sound level meter (ISLM), and the noise dosimeter.
* A 20-foot-wide plantation inside the property isolates the house from the noise of moving vehicles.
* Putting in place acoustic zoning, which involves dividing populous areas from noise-producing areas like airports, train stations, and other industrial facilities. Silence zones should be established in hospitals, schools, and essential offices.
* Safety gear like cotton plugs or ear muffs should be provided to employees working on noisy projects.
* Noise pollution from air traffic can be reduced with the right insulation and noise introduction.
* Airport takeoff and landing regulations.
* Power tool use at night, loud music, land movers, loudspeaker use at public events, etc., should all be forbidden. It is forbidden to utilize appliances—such as horns, sirens, and refrigerators—excessively. Avoid using too many noisy, air-polluting firecrackers.
* By planting a lot of trees to create buffer zones that are covered in flora and absorb noise.
* It’s important to keep musical instrument noise within appropriate limits.

**DATASEAT FOR NPM**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Location | Highest value | Lowest value | Average(db) | Std Dev+ or - |
|  |  |  |  |  |
| Chennai Merina | 80.6 | 64.5 | 72 | 78.4 |
| Marine Lines | 80.3 | 54.3 | 34.3 | 70.3 |
| charni Road | 82.5 | 87.3 | 78.01 | 72.4 |
| Mumbai central  (tardo) | 91.4 | 23.5 | 23.34 | 99.4 |
| Haji Ali | 84.3 | 62.3 | 43.3 | 103.2 |
| Mahalakshmi | 84.2 | 78.9 | 23.3 | 104.2 |
| Dr.E. Moses Road | 94 | 33.2 | 67.3 | 99.3 |
| OMR | 86.6 | 67.4 | 34.8 | 70.4 |
| light house | 104.2 | 33.5 | 98.3 | 22.3 |
| Guindy | 78.3 | 22.9 | 109.3 | 65.3 |
| Saidapet | 62.9 | 99.1 | 64.3 | 98.4 |
| koyambedu | 43.2 | 211.3 | 45.3 | 55.4 |
| Thenapet | 64.9 | 106.4 | 98.6 | 22.4 |
| Mount Road | 50.9 | 54.3 | 54.2 | 54.3 |
| Meenambakkam | 78.4 | 78.4 | 99.01 | 22.3 |
| Thirisulam | 65.8 | 89.4 | 63.2 | 24.9 |
| Pallavaram | 45.3 | 34.2 | 44.3 | 34.5 |
| Pazhavanthangal | 43.7 | 34.2 | 45.4 | 23.7 |
| Egmore | 89 | 89.3 | 67.4 | 87.4 |
| Chennai central | 55.7 | 76.3 | 22.3 | 66.5 |
| kodambakkam | 65.9 | 23.01 | 98.4 | 8.5 |
| Nungambakkam | 33.4 | 43.3 | 88.3 | 102.4 |
| Chethpat | 76.9 | 102.3 | 67.3 | 87.2 |
| Mambalam | 22.4 | 112.4 | 78.3 | 99.5 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Std Error | Varience | Leq | Nc | Lnp(NPL) |
| 77.3 | 23.3 | 45.3 | 104.5 | 67.3 |
| 56.3 | 43.3 | 34.6 | 90.1 | 30.2 |
| 32.4 | 67.3 | 87.5 | 30.4 | 90.23 |
| 55.4 | 104.2 | 90.5 | 35.67 | 67.3 |
| 66.4 | 64.2 | 45.3 | 89.2 | 45.32 |
| 98.4 | 67.3 | 89.4 | 88.33 | 78.34 |
| 32.5 | 11.2 | 90.4 | 45.9 | 66.34 |
| 56.2 | 108.3 | 85.3 | 33.22 | 12.45 |
| 88.3 | 56.3 | 46.7 | 10.3 | 98.57 |
| 87.2 | 88.3 | 102.5 | 56.3 | 87.33 |
| 45.3 | 22 | 105.3 | 29.4 | 55.1 |
| 86.4 | 87.3 | 78.4 | 68.44 | 108.2 |
| 99.4 | 98.3 | 13.45 | 78.34 | 139.3 |
| 99.3 | 199.3 | 90.3 | 108.3 | 78.22 |
| 88.3 | 178.3 | 99.3 | 45.2 | 64.23 |
| 22.3 | 67.3 | 78.3 | 46.2 | 78.33 |
| 77.8 | 34.1 | 90.2 | 78.4 | 33.22 |
| 45.6 | 98.5 | 89.3 | 26.2 | 89.45 |
| 107.3 | 102.5 | 44.3 | 90.3 | 46.34 |
| 66 | 56.2 | 23.5 | 23.4 | 78.3 |
| 77.4 | 87.4 | 90.4 | 90.28 | 33.44 |
| 64.2 | 98.4 | 45.7 | 45.67 | 90.33 |
| 54.2 | 32.4 | 78.4 | 104.8 | 66.3 |
| 12.4 | 90.4 | 87 | 104.6 | 78.5 |

**Program for Noise pollution monitoring**

import smtpplib

from email.mime.text import MIMEText

from email.mime.mulipart import MIMEMulipart import struct

import math

import numpy as np import http.client

from scipy.fftpack import fftfreq,fft import urllib.request

import scipy.io.wavfile import json

import sys import getopt

def print\_usage(name):

print("usage: python", name,"-1 number.number.number.number:port")

def get\_streaming\_link(argv): if len(argv) == 1:

print\_usage(name=argv [0]) sys.exit(2)

try:

opt\_vals, args = getopt.getop(argv[1:],’1:’,[’link=’]) except getopt,GetoptError:

print\_usage(argv[0]) sys.exit(2)

for opt, val in opt\_vals: if opt in (’-1’, ’--link’):

return ’http://’ + val

print\_usage(argv[0]) sys.exit(2)

streaming\_time = 4 # in seconds streaming\_lenth = streaming\_time \* 4 frame\_rate = 22500

number\_of\_frames = streaming\_length \* frame\_rate // 4 file\_location = "Soundtemp.mp3"

IoT\_platform\_url = "ubec’s IoT platform address" #for example’askini.hub.ubeac.io’ IoT\_platform\_gateway = "ubec’s gateway" # for example ’/lanmic’

def get\_audio(r):

audio = r.read(frame\_rate)

for i in range(streaming\_length - 1): audio += r.read(frame\_rate)

return audio

def get\_rate\_and\_data(audio):

format\_float = ’<’ + str(number\_of\_frames) + ’i’ result = struct.unpack(format\_float, audio) abs\_numbers = np.abs(np.array(result)

max\_number = np.max(abs\_numbers)

audio\_data = (abs\_numbers/max\_number).astype(np.float32) scipy.io.wavfile.write(file\_location, frame\_rate, audio\_data) rate, data = scipy.io.wavfile.read(file\_location)

return rate, data

def get\_amplitude(data):

rms\_amplitude = np.sqrt(np.mean(np.square(data))) log\_of\_rms\_amp = 20 \* math.log10(rms\_amplitude) return -1 \* log\_of\_rms\_amp

def prep\_sensor\_data(id, data): sensor\_data = {

’id’: id, ’data’: data

}

return sensor\_data

def get\_max\_freq(data, rate):

frequencies = fftfreq(data.shape[0], 1/rate) freqspos = frequencies[:frequencies.size // 2] fft\_of\_data = fft(data)

fftabs = abs(fft\_of\_data)[:frequencies.size // 2]

#peakfreq = np.max(fftabs) #NOTE: may produce bug max\_idx = np.argmax(fftabs)

max\_freq = freqspos[max\_idx] return max\_freq, max\_idx

def send\_data\_to\_IoT\_platform(sensors): device = [{

’id’: "Android Microphone", ’sensors’: sensors

}]

connection = http.client.HTTPSConnection(IoT\_platform\_url) connection.request(’POST’, IoT\_platform\_gateway, json.dumps(device)) response = connection.getresponse()

print(response.read().decode())

import time time\_previous = 0

def send\_notification(amplitude): global time\_previous

time\_now = time.time()

if time\_now - time\_previous < 60: return

elif float(amplitude[’data’][’Amplitude’]) < 22: return

time\_previous = time\_now

mail\_content = ’’’Hello, noise detected!!!!

Cheers ’’’

#The mail addresses and password sender\_address = [’your@email.address’](mailto:your@email.address) with open(’pass.txt’, ’r’) as f:

sender\_pass = f.read() receiver\_address = [’your@email.address’](mailto:your@email.address) #Setup the MIME

message = MIMEMultipart() message[’From’] = sender\_address message[’To’] = receiver\_address

message[’Subject’] = ’Noise Detection Notification’ #The subject line #The body and the attachments for the mail message.attach(MIMEText(mail\_content, ’plain’))

#Create SMTP session for sending the mail

session = smtplib.SMTP(’smtp.gmail.com’, 587) #use gmail with port #session = smtplib.SMTP\_SSL(’smtp.gmail.com’)

session.starttls() #enable security

session.login(sender\_address, sender\_pass) #login with mail\_id and password text = message.as\_string()

session.sendmail(sender\_address, receiver\_address, text) session.quit()

print(’email notification sent’) link = get\_streaming\_link(sys.argv)

with urllib.request.urlopen(link) as r: print(’the program is running’)

\_ = r.read(44) # skip header while True:

audio = get\_audio(r)

rate, data = get\_rate\_and\_data(audio) log\_of\_rms\_amp = get\_amplitude(data)

amplitude = prep\_sensor\_data("Average Amplitude", {"Amplitude": str(log\_of\_rms\_amp)}) send\_notification(amplitude) # sends an email when apmplitude is high

max\_freq, max\_freq\_idx = get\_max\_freq(data, rate)

frequency = prep\_sensor\_data("Frequency", {"Max Frequency" : str(max\_freq)}) peak = prep\_sensor\_data("Max Peak", {"Amplitude" : str(max\_freq\_idx)}) sensors = [amplitude, frequency, peak]

send\_data\_to\_IoT\_platform(sensors)

**NPM HTML CODE**

<!DOCTYPE html>

<html>

<head>

<title>Noise Pollution Monitoring</title>

</head>

<body>

<header>

<h1>Noise Pollution Monitoring</h1>

</header>

<section>

<h2>Real-time Noise Data</h2>

<p>Monitor noise levels in your area.</p>

<div id="noise-data">

<!-- Real-time noise data will be displayed here -->

</div>

</section>

<section>

<h2>Threshold Alerts</h2>

<p>Set noise level thresholds and receive alerts.</p>

<label for="threshold">Set Threshold (dB):</label>

<input type="number" id="threshold" min="0" step="1">

<button id="set-threshold">Set</button>

<p id="alert-message"></p>

</section>

<footer>

<p>&copy; 2023 Noise Pollution Monitoring System</p>

</footer>

<script>

// JavaScript code for real-time data retrieval and threshold alerts

// You need to implement this part separately.

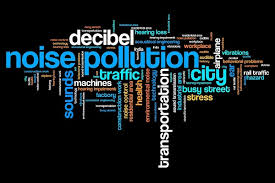
// It would involve audio streaming, data analysis, and notifications.

</script>

</body>

</html>

**Explanation for Noise pollution monitoring**



Noise or sound level monitoring or measurement is a process to measure the magnitude of Noise in industries and residential area. Data collected from Noise level monitoring & Testing helps us to understand trends and action can be taken to reduce noise pollution. Noise pollution is Low or High-frequency sound that can cause/harm the activity of human life. It can be caused by various industrial Machines, Motor Vehicles and Craft etc. **Noise Pollution Monitoring** process is a part of Environmental Monitoring & Testing as noise pollution is also increasing exponentially in recent years.

### What is Noise Pollution?

Noise pollution is unwanted and unpleasant sound which can deteriorate human health and other living organisms present in the Environment.

### Types of Noise Pollution

There are multiple way from which noise pollution can occur. Major reasons for noise pollution are deforestation, Construction, Air traffic, Road traffic, Population, etc.

Noise Pollution can be divided into 2 types:  
1) Man-made Noise  
2) Environmental Noise

Description of parameters

Zone Category: (Silence, Residential, Commercial, Industrial)  
LAF/S and LCF/S: (Average and Instantaneous)  
Lpeak: Lpeak-day; Lpeak-night;  
Leq A Day; Leq A Night;  
Leq A Day Min; Leq A Night Min;  
Leq A Day Max; Leq A Night Max;  
Leq C Day; Leq C Night;  
Leq C Day Min; Leq C Night Min;  
Leq C Day Max; Leq C Night Max;  
L10 & L90

### Why to Measure Noise at the Workplace?

At workplace machines, traffic, vehicles create occupational noise. Employees and occupants are exposed to this harmful noise. Due to this occupants can face many health problems such as headache, hearing impairment, hypertension, heart problem, annoyance and sleep disorder. to Avoid this situation Perfect Pollucon Services conducts Noise Testing in the company or home to measure high noise within premises. Actions can be taken once the locations and source are identified which are causing the noise. it helps to keep your employee or family safe from Harmful Noise.

## Why is Noise Monitoring Important?

Noise monitoring is crucial for several reasons. First and foremost, it safeguards human health. Prolonged exposure to high levels of noise can lead to hearing loss and various physiological and psychological disorders, such as stress, sleep disturbances, and reduced productivity.

Additionally, noise monitoring helps ensure compliance with legal regulations and standards set by authorities to protect workers’ well-being. Monitoring also identifies areas of concern, enabling proactive implementation of noise control measures to mitigate risks, improve working conditions, and maintain a harmonious environment for employees.

Furthermore, noise monitoring contributes to good community relations, as industries that proactively manage noise pollution demonstrate their commitment to environmental responsibility and social welfare.

## Measurement of Noise Level Using Noise Testing Equipment

[](https://www.ppsthane.com/wp-content/uploads/2014/07/Noise-Measurement.jpg)

Sound/Noise level meter equipment measures noise pollution. It consists of several parts, mainly Microphone, Pre-amplifier, frequency weighting, Processor, Display System, communication System and Power Supply. dB(A) Leq denotes the time-weighted average of the level of sound in decibel on scale A which is relatable to human hearing.

A “**decibel**” is a unit in noise measurement. “A”, in **dB (A) Leq**, denotes the frequency weighting in the **measurement of noise** and corresponds to frequency response characteristics of the human ear.

Leq: It is an energy mean of the noise level over a specified period.

Noise level Survey schedule is planned in such a way that it covers the noise generation by normal daytime activities i.e. from 08:00 am to 10:00 pm and a part of nighttime activities i.e. 10:00 pm to 12:00 am (at night).

Due to the increase in noise pollution in recent years, it is recommended to conduct a **measurement of noise pollution** program on company premises.

## Noise level Monitoring & Testing

The answer to the question of how to measure sound lies in Noise level Monitoring or sound Measurement for a particular instance or for 24X7 hrs to analyze trends for better understanding of the environment. these Processes also used in Noise Impact Assessment (We love to do this  ) by Noise level Testing companies. This process is also called as Noise level Measurement

### A) Industrial Noise Measurement



Industrial Noise is the loud sound in industries. In general, it is produced, at every stage in the industry by various aspects like welding, hammering, drilling, blowing, running machinery, motors, sheet metal work, lathe machine work, operation of cranes, grinding, turning, fabricating, forging, compressing, breaking, moulding, steaming, boiling, cooling, heating, venting, painting, pumping, packing, transporting etc. It creates very serious of large-scale noise problems; significantly affect the working people as well as surrounding people.

### B) Non-Industrial Noise Measurement

#### i)Road Traffic Noise:

Road traffic is the most widespread source of the noise. It is directly proportional to the volume of vehicles. Increasing the population is increasing in vehicles and hence increasing of Noise pollution. The major sources of noise in automobiles are exhaust, intake, engine and fan, and tires at high-speed. Noise Level Monitor instrument (or with noise level data logger) measures the noise level.



#### ii) Residential Noise Measurement

In normal day –to – day activities, various home appliances in our residences produce noise. Some of the major sources are Exhaust Fans, lawn movers, grinders, Fan, Cooling & Heating System, T.V & Music System, motors used for pumping etc.

[Read here how to reduce noise pollution](https://www.ppsthane.com/blog/how-to-reduce-noise-pollution)

## Noise Level Testing Standards

Limits or noise level standards defined by pollution control board during Day time for Residential Noise < 55 dB and Limits during Night time for Residential Noise < 45 dB

In industry, there are of two types Sound Monitoring & testing or Noise Level Measurement:

* **Ambient Noise level Monitoring**
* **In-plant Noise level Monitoring**

### A) Ambient Noise Level Testing Standards

Ambient Noise level Monitoring or Noise pollution Measurement within the industrial zone at ambient conditions. (e.g. Near Main Gate, Near Canteen, Near Manufacturing plant etc.) As per Central Pollution Control Board (as per Factory act 1948):  
Limits or acceptable noise level during Day time for Ambient Noise < 75 dB and Limits during Night time for Ambient Noise < 70 dB.

### B) In-plant Noise level Testing Standards

In-plant Noise level means Sound level measurement allocated in the plant. As per Central Pollution Control Board (as per Factory act 1948) Limits for In-plant Noise level < 90 dB.

[Learn more about Workplace or Office Environment Monitoring for employee health and safety](https://www.ppsthane.com/services/environmental-quality-monitoring/workplace-monitoring)

## Noise Monitoring & Testing Company

Perfect Pollucon Services is a leading **Noise Level Testing Company** in India. We have highly trained

and highly experienced professionals who can take care of Noise level Monitoring or testing.

## Noise level Monitoring Procedure

Noise level measurement procedure are processes which record sound level or acoustic energy level in the specified area. Sound or Noise level meter measures noise in Unit decibel (dB). We will see what are important factors to keep in mind while measuring noise level. You can also read more about [Noise level measurement procedure](https://www.ppsthane.com/blog/noise-level-measurement-procedure).

## Noise Level Monitoring Instruments

Below are some of the popular Noise Level Meter Instruments available in market:

1. **Brüel & Kjær 2250 Handheld Sound Level Meter:** Known for its precision and versatility, it offers advanced functionalities and is widely used in professional applications.
2. **SVANTEK SV 971 Sound Level Meter:** Highly regarded for its compact design, ease of use, and robust features, suitable for various noise measurement tasks.
3. **RION NA-28 Sound Level Meter:** Renowned for its accuracy and user-friendly interface, it is ideal for professional noise measurements.
4. **Extech 407730 Digital Sound Level Meter:** A budget-friendly option with good accuracy and user-friendly features for general noise measurements.
5. **TES-1358 Sound Level Meter:** Known for its affordability and portability, making it a suitable choice for basic noise level measurements.
6. **Cirrus Optimus+ Sound Level Meters:** Offers a range of models with advanced features for different applications, known for their reliability and precision.
7. **3M Quest EDGE Personal Noise Dosimeter:** Designed for personal noise exposure monitoring, providing accurate data for compliance assessments.
8. **Casella CEL-633A1 Sound Level Meter:** Offers a wide dynamic range and real-time octave band analysis, suitable for detailed noise studies.
9. **Testo 815 Sound Level Meter:** A compact and reliable option for general noise level measurements.
10. **Norsonic Nor131 Sound Level Meter:** Known for its ruggedness and high-quality measurements, suitable for various industrial applications.

## Noise Pollution Monitoring System using IoT

A noise pollution monitoring system utilizing IoT technology represents a cutting-edge approach to addressing the challenges posed by excessive noise in urban environments. By deploying a network of smart sensors equipped with noise detectors, this system continuously gathers real-time acoustic data from various locations.

This data is then transmitted to a centralized platform via the Internet, where it is processed, analyzed, and visualized in user-friendly interfaces accessible to relevant stakeholders, such as local authorities, environmental agencies, and the general public.

By harnessing the power of IoT, this monitoring system empowers cities to identify noise pollution hotspots, enact timely interventions, enforce noise regulations, and engage in evidence-based urban planning to create healthier and more liveable urban spaces.

## Noise Monitoring / Testing Services

We offer Noise monitoring services to measurement noise pollution for D.G. stacks, traffic, machines etc. Our professionals use technically advanced monitoring and analysis tools. We offer Noise Quality monitoring services as per national standards and regulations backed up by timely execution, efficient professionals and cost-effectiveness.

**IOT DEVICE**



## 

## **IoT Device Authentication Methods**

### **Single/one-factor authentication**

This is the most basic form of IoT device authentication, in which devices or users present something they know to verify their identity. Usernames and passwords are the most popular form of one-factor authentication.

Unfortunately, most people recycle usernames and passwords on multiple devices and websites. This means if malicious actors gain access to one device, they can potentially access multiple accounts, so one-factor authentication can leave entire systems susceptible to various attacks.

### **Two-factor authentication**

This extends the one-factor authentication of username/passwords by adding another layer in which users or devices need to verify themselves through something they possess. This could be a one-time password sent to your email address or something unique like your fingerprints.

### **Three-factor/multi-factor authentication**

Three-factor authentication takes security to the next level by combining multiple mechanisms to authenticate:

* Something you know (e.g., a password)
* Something you are (e.g. fingerprint or iris scan)
* Something you possess (e.g. a one-time code or password generator)

While two-factor and multi-factor authentication provide a higher level of security, they may add some friction in user experience (UX) because the user has to work harder to gain access.

### **Cryptographic authentication**

All of the above fall somewhere under the realm of password protection, whereas encryption/cryptography is another category of authentication. Cryptographic authentication is more secure than usernames and passwords. It generally overcomes brute force attacks and provides a good user experience.

Mutual authentication or two-way authentication is a process in which two parties – often clients and servers – authenticate each other simultaneously using an authentication protocol. Mutual authentication can be realized through cryptographic public keys, which are widely used in IoT and are the de facto mode of authentication in many IoT security protocols.

[Nabto’s own mutual authentication](https://docs.nabto.com/developer/guides/security/public_key_auth.html) is based on elliptic curve cryptography public keys that provide robust security with resource requirements that are suitable for IoT applications.  We’ll touch on all this in greater detail throughout the guide.