

# **NOISE POLLUTION MONITORING**

## **Phase 3 Submission Document**

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**Project:** Noise Pollution Monitoring

**Phase 3:** Development Part 1

### **Introduction:**

Noise pollution is a growing concern in urban and industrial areas, impacting the quality of life and overall well-being of people. To effectively address this issue, there is a need for continuous and real-time monitoring of noise levels in different environments. This is where Internet of Things (IoT)-based noise pollution monitoring systems come into play. IoT-based noise pollution monitoring systems offer a modern, efficient, and data-driven approach to address the pressing issue of noise pollution. IoT-based noise pollution monitoring is a smart and innovative approach to gather, analyse, and manage noise data in various settings. By integrating IoT technology, sensors, and data analytics, these systems provide a comprehensive solution to measure, record, and respond to noise pollution.

## **IoT -enabled Noise Pollution Monitoring System:**

### **1.Noise Sensors:**

- IoT noise pollution monitoring systems use specialized noise sensors or microphones to capture sound data. These sensors are often calibrated to measure noise levels in decibels (dB) and can be omnidirectional or directional depending on the monitoring needs.

### **2.Data Acquisition:**

- The noise sensors collect acoustic data from the environment. This data is usually in the form of Analog signal and is converted into digital data by the sensors.

### **3.Data Transmission:**

- IoT-enabled noise sensors are equipped with communication modules (e.g., Wi-Fi, cellular, Long Range, or NB-IoT) to transmit the collected noise data to a central server or cloud platform. Wireless connectivity ensures real-time data transfer.

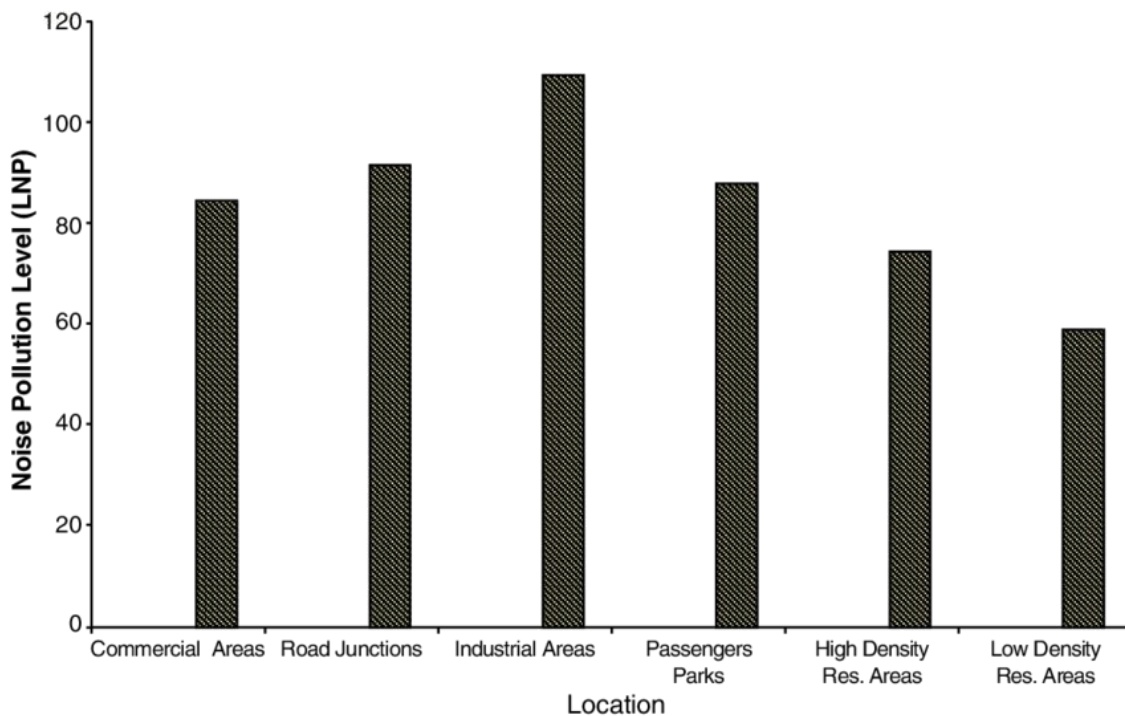
### **4.Central Server or Cloud Platform:**

- The collected data is sent to a central server or cloud-based platform for storage and analysis. Cloud platforms offer scalability, accessibility, and data security.

### **5.Data Processing and Analysis:**

- Once the data reaches the server or cloud platform, it undergoes processing and analysis. Advanced algorithms and machine learning techniques can be applied to detect noise patterns, calculate noise levels, and identify anomalies.

## Measuring noise levels:



### 1. Select Appropriate Sensors:

- Choose noise sensors capable of accurately measuring sound levels. These sensors typically use a microphone to capture sound and convert it into electrical signals.
- Consider factors like sensitivity, frequency range, and environmental robustness when selecting the sensors.

### 2. Data Collection and Processing:

- Set up a network of IoT noise sensors across the public area you want to monitor. These sensors should be connected to the internet to transmit data.
- Collect and process the data in real-time or at predefined intervals to calculate noise levels. The data can be transmitted to a central server or a cloud platform for analysis.

### 3.Connectivity:

- Utilize wireless communication protocols such as Wi-Fi, Long Range, or cellular networks to connect the sensors to the central system.
- Ensure that the data transmission is secure and reliable to prevent data breaches or loss.

### 4.Power Supply:

- Choose a suitable power source for the sensors. Battery-powered sensors might need periodic maintenance, while those connected to a power source offer continuous monitoring.

### 5.Data Analysis:

- Implement algorithms to analyse the collected noise data. You can calculate noise levels in decibels (dB) and compare them to established standards and regulations.
- Create visualization tools or dashboards to display noise levels in a user-friendly manner.

## **Data collecting:**

### 1. Noise Sensors:

- IoT noise sensors are placed in various locations to collect data. These sensors can range from basic microphones to more advanced noise measurement devices.
- These sensors are equipped with the capability to convert sound waves into electrical signals and transmit data to a central system or the cloud.

### 2. Data Collection and Transmission:

- The IoT noise sensors continuously collect noise data, including sound levels, frequencies, and timestamps.

- This data is transmitted to a central server or cloud platform through various communication technologies, such as Wi-Fi, cellular networks, (Long Range), or satellite connections.

### 3. Real-Time Monitoring:

- IoT allows for real-time monitoring of noise levels, which is particularly valuable in dynamic urban environments where noise can fluctuate rapidly.

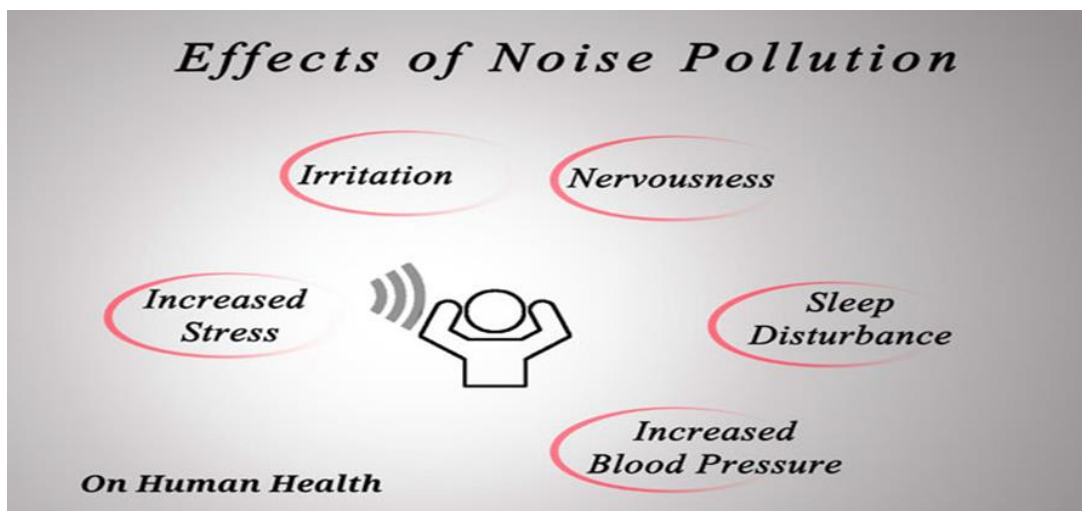
### 4. Data Processing and Analysis:

- The collected data is processed and analysed to determine noise levels and patterns. Algorithms can be employed to identify peak noise events, calculate average noise levels, and assess compliance with noise regulations.
- The analysis can also involve filtering out background noise or identifying specific noise sources.

### 5. Data Storage:

- Noise data is typically stored in a secure and scalable database. Historical data can be used for trend analysis, reporting, and urban planning.

## Effects of noise pollution monitoring system:



- The most common health problem it causes is Noise Induced Hearing Loss (NIHL). Exposure to loud noise can also cause high blood pressure, heart disease, sleep disturbance and stress.

## **IoT sensors to send a real-time noise level data:**

### **Input:**

```
import paho.mqtt.client as mqtt

import time

import random

# Initialize MQTT client
client = mqtt.Client()

# Connect to the IoT platform
client.connect("mqtt.broker.com", 1883, 60)

# Subscribe to the noise data topic
client.subscribe("noise/sensor")

# Start monitoring noise pollution
while True:
# Read the noise data from the sensor
noise_level = random.randint(50, 100)

# Publish the noise data to the topic
client.publish("noise/sensor", noise_level)

# Wait for 10 seconds
time.sleep(10)
# Disconnect from the IoT platform
client.disconnect()
```

**Output:**

noise/sensor: 50

noise/sensor: 55

noise/sensor: 60

noise/sensor: 65

noise/sensor: 70

**Conclusion:**

IoT devices can continuously collect and transmit data on noise levels from various sources, enabling real-time monitoring. This immediate feedback allows for rapid response to noise violations and better management of noise pollution. In summary, the use of IoT in noise pollution monitoring is a promising and innovative approach to addressing a critical environmental and public health issue. It offers numerous advantages in terms of real-time monitoring, data accuracy, cost-efficiency, and data analytics, with the potential to create quieter, more sustainable urban environments while enhancing the quality of life for residents.

Thank you