NOISE POLLUTION MONITORING

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Phase 5 :

Monitoring noise pollution in a parking lot can be important for various reasons, including the well-being of individuals and compliance with noise regulations.

The problem at hand is the pervasive issue of noise pollution in urban and suburban areas,which poses a significant threat to public health and well-being. Noise pollution results froma variety of sources, including vehicular traffic, industrial activities, construction, and socialevents, and it has adverse effects on individuals and communities. To address this problem,we aim to leverage IoT (Internet of Things) technology to accurately monitor, analyze, andmitigate noise pollution in real-time.

Project objectives :

DEFINE OBJECTIVES :

Clearly define the objectives of your monitoring system, such as measuring noiselevels in a specific area or around a particular source of noise.

SELECT SENSOR :

Choose appropriate noise sensors or microphones capable of accuratelymeasuring noise levels.These sensorsbshould be capable of capturing variousfrequencies and sound pressire levels.

DATA ACQUISITION :

Set up a data acquisition system to collect noise data from the sensors . This caninvolve analog-to-digital converters to digitize the analog sensor readings.

DATA STORAGE :

Design a database or storage system to store the collected noise data.you canuse local servers or cloud-based solutions for data storage.

DATA ANALYSIS :

Develop algorithms or software for analyzing the noise data.Thiscan includecalculating average noise levels,peak levels,and identifying patterns or trends.

VISUALIZATION :

Create a user-friendly interface to visualize the noise data,such asgraphs,charts,or maps. This can help users easily interpret the information.

ALERTING :

Implement alerting mechanisms to notify relevant parties when noise levelsexceed predefined threshold. This could involve email notifications or mobile app alerts.

GEOGRAPHIC INFORMATION :

If needed, incorporate geographic information systems to map noise pollutiondata and correlate it with specific locations.

COMPLIANCE AND REPORTING :

Ensure that your monitoring system complies with local regulations andstandards foer noise pollution monitoring. generate reports for regulartory authorities asrequird.

POWER SUPPLY :

Consider the power source for your sensors and data acquistionsystem.depending on the deployment location,this may involve battery power or a reliable electrical source.

DATA PRIVACY :

Address data privacy and security concerns,especially if you arer collecting noise datain residential areas.Ensure that data is anonymized and protecyted.

PUBLIC AWARENESS :

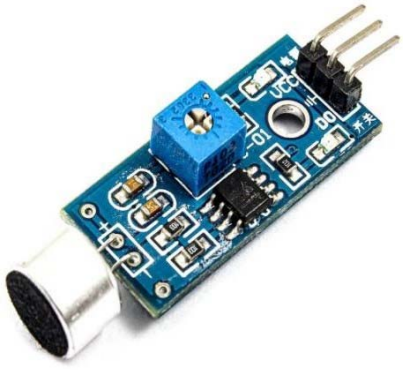
Educate the public and stakeholders aboiut the noise monitoring sytem and itspurpose.Transparency can help gain support and cooperation.

Keep in mind that the complexity of your noise pollution monitoring system will dependon the specific requirements of your project and the level of accuracy needed of yourdata.one innovative idea for noise polution monitoring is to develop a network ofsmart,low-cost,and easily deployable sensors that can be placed throughput urban areas.

IOT Sensor :

The IoT sensor design plays a crucial role in the success of this project .It involves the deployment of various sensors and data collection devices throughput the public places . These sensors should include :

- **Microphones**: Typically, condenser microphones or piezoelectric microphones are used to capture sound waves. These microphones convert sound pressure variations into electrical signals.



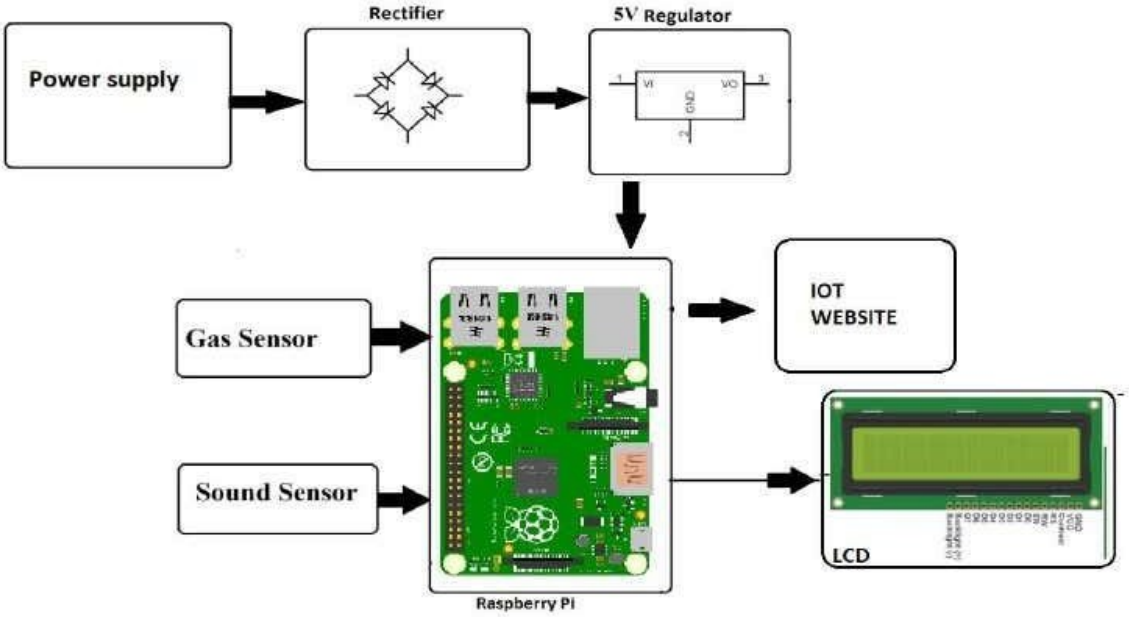
- **Sound Level Meters (SLMs):** SLMs are portable devices equipped with microphones and electronics to measure and display sound levels in decibels

(dB). They are the most common tools for assessing noise pollution. SLMs often come with various frequency weighting filters (A, C, and Z-weighting) to account for the sensitivity of the human ear to different frequencies.

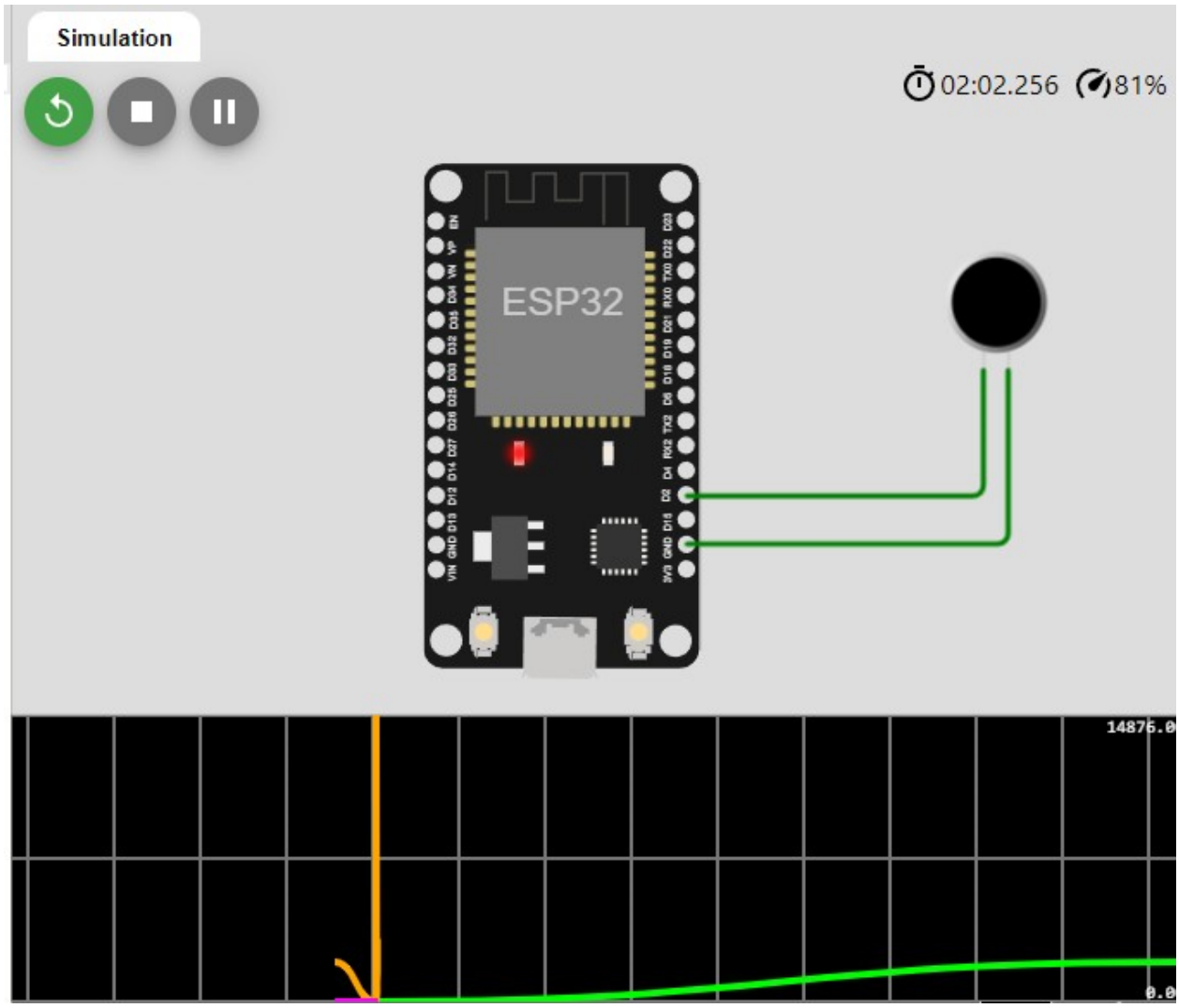
- **Sound sensors:** Sound sensors, also known as acoustic sensors or microphones, are devices designed to detect and capture sound waves and convert them into electrical signals. These sensors are fundamental components in various applications, from noise monitoring and control to voice recognition and communication systems.

- **Gas sensors** : Gas sensors, also known as gas detectors or gas sensing devices, are electronic instruments designed to detect the presence and concentration of various gases in the surrounding environment

Diagram :



Integration :



Source code :

```
#include  <WiFi.h>

#include <ThingSpeak.h>

#include "DHTesp.h"

#include "stm32f4xx_hal.h"

#include "stdio.h"

char ssid[] = "Wokwi-GUEST";

char pass[] = "";
```

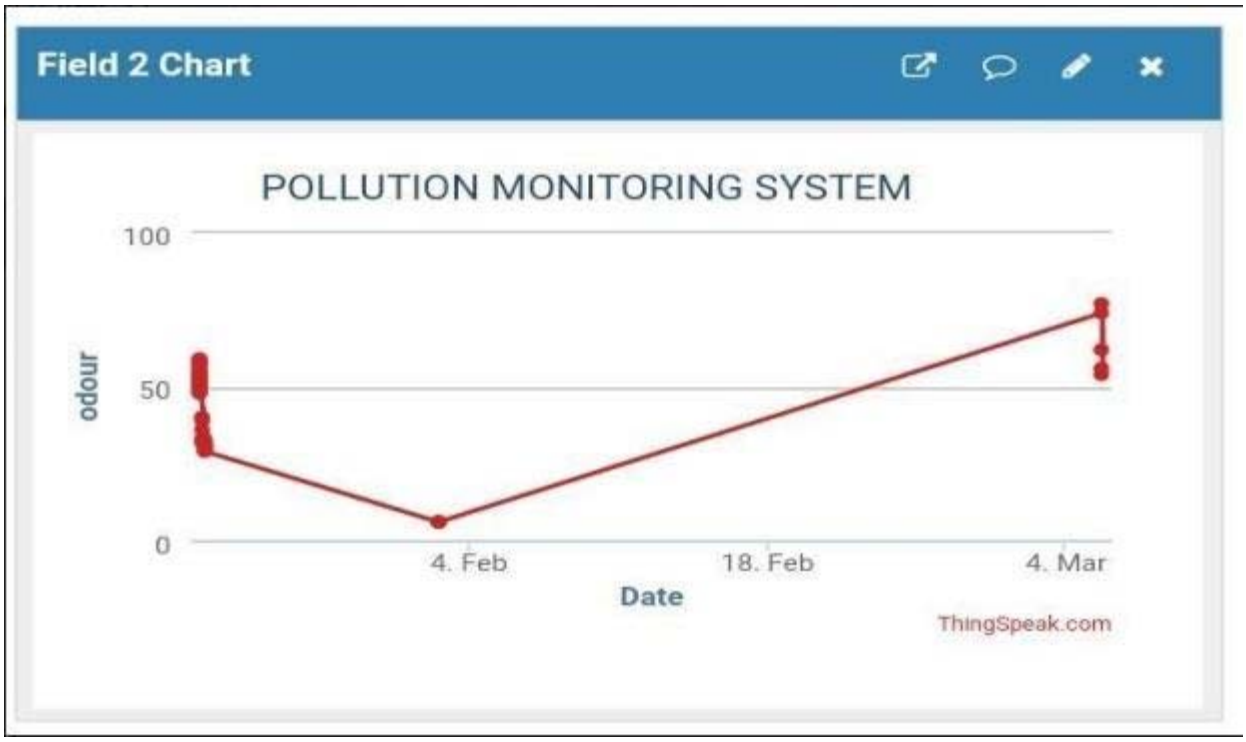
```
WiFiClient client;
unsigned long myChannelNumber = 2066744;
const char *myWriteAPIKey ="DVRJHBHU6XIIN7UY";
int statusCode;
ADC_HandleTypeDef hadc1;
void Error_Handler(void) {
while (1) {
// An error occurred, stay in this loop.
}
}
void SystemClock_Config(void) {
// Configure the system clock here.
}
void ADC_Config(void) {
__HAL_RCC_GPIOA_CLK_ENABLE();
__HAL_RCC_ADC1_CLK_ENABLE();
GPIO_InitTypeDef GPIO_InitStruct;
GPIO_InitStruct.Pin = GPIO_PIN_0; // Assuming you
are using PA0 for ADC
GPIO_InitStruct.Mode = GPIO_MODE_ANALOG;
HAL_GPIO_Init(GPIOA, &GPIO_InitStruct);
hadc1.Instance = ADC1;
hadc1.Init.Resolution = ADC_RESOLUTION_12B;
```

```
hadc1.Init.ScanConvMode = DISABLE;
hadc1.Init.ContinuousConvMode = DISABLE;
hadc1.Init.ExternalTrigConv =
ADC_SOFTWARE_START;
hadc1.Init.DataAlign = ADC_DATAALIGN_RIGHT;
hadc1.Init.NbrOfConversion = 1;
hadc1.Init.DMAContinuousRequests = DISABLE;
hadc1.Init.EOCSelection =
ADC_EOC_SINGLE_CONV;
if (HAL_ADC_Init(&hadc1) != HAL_OK) {
Error_Handler();
}
}
void connectToCloud() {
if (WiFi.status() != WL_CONNECTED) {
Serial.print("Attempting to connect");
while (WiFi.status() != WL_CONNECTED) {
WiFi.begin(ssid, pass);
for (int i = 0; i < 5; i++) {
Serial.print(".");
delay(1000);
}
Serial.println("\nConnected.");
```

```
}
}
}
void writeData() {
// Replace 'Noise' with your actual data
int Noise = 42; // Example value
ThingSpeak.setField(1, Noise);
statusCode =ThingSpeak.writeFields(myChannelNumber,
myWriteAPIKey);
if (statusCode == 200) {
Serial.println("Channel update successful.");
} else {
Serial.println("Problem Writing data. HTTP error code:
" + String(statusCode));
}
delay(15000); // Data to be uploaded every 15 seconds
}
void setup() {
Serial.begin(115200);
WiFi.mode(WIFI_STA);
ThingSpeak.begin(client);
SystemClock_Config();
ADC_Config();
```

```
}
void loop() {
connectToCloud();
uint16_t pot_value;
if (HAL_ADC_Start(&hadc1) == HAL_OK) {
if (HAL_ADC_PollForConversion(&hadc1,
HAL_MAX_DELAY) == HAL_OK) {
pot_value = HAL_ADC_GetValue(&hadc1);
Serial.printf("ADC Value: %d\n", pot_value);
}
}
writeData();
delay(1000);
}
```

Real-time data :



Code implementation :

HTML : (index.html)

```
<!DOCTYPE html>
<html>
<head>
<title>
Polution Project
</title>
</head>
<body bgcolor="#d5aff0">
```

```
<center>
<table bgcolor="black" width="50%">
<tr>
<tH><font size="25" color="#e01ba5">Pollution
Control</font></tH>
</tr>

</table>
<tr>
<th bgcolor="yellow">Sound Pollution</th>
</tr>
</table>
<Html>
```

CSS : (styles.css)

```
body {
font-family: Arial, sans-serif;
background-color: #f0f0f0;
text-align: center;
}

h1 {
color: #333;
```

```
}

#noiseData {

background-color: #fff;
padding: 20px;
border-radius: 10px;
box-shadow: 0 0 10px rgba(0, 0, 0, 0.1);
margin: 20px;
}

h2 {
color: #333;
}

#currentNoise {
font-size: 24px;
color: #0077b6;
font-weight: bold;
}
</style>
</head>
<body>
```

<h1>Noise Pollution Monitoring</h1>

<h2>Current Noise Level: Loading...

dB</h2>

<script>

// Your JavaScript code here

</script>

</body>

</html>ere </script>

Javascript : (script.js)

Var api_key =”DVRJHBHU6XIIN7UY”

Var channel_id=”2066744”

<title>Noise Pollution Monitoring</title>

<style>

body {

font-family: Arial, sans-serif;

background-color: #f0f0f0;

text-align: center;

```
}

h1 {
color: #333;
}

#noiseData {
background-color: #fff;
padding: 20px;
border-radius: 10px;
box-shadow: 0 0 10px rgba(0, 0, 0, 0.1);
margin: 20px;
}

h2 {
color: #333;
}

#currentNoise {
font-size: 24px;
color: #0077b6;
font-weight: bold;
}
```

```
</style>
</head>
<body>
<h1>Noise Pollution Monitoring</h1>

<div id="noiseData">
<h2>Current Noise Level: <span id="currentNoise">Loading...</span>
dB</h2>
</div>

<script>
function updateNoiseData() {
// Simulate fetching noise data (replace this with actual data retrieval).
const fakeNoiseData = {
currentNoiseLevel: Math.floor(Math.random() * 100), // Simulated noise
level
};

// Update the HTML with the new noise data.
const currentNoiseElement = document.getElementById("currentNoise");
currentNoiseElement.textContent = `${fakeNoiseData.currentNoiseLevel}
dB`;
}
```

```
// Call the updateNoiseData function periodically to update the noise data.
// You might use setInterval for real-time updates.
setInterval(updateNoiseData, 5000); // Update every 5 seconds (adjust as
needed).
</script>

</body>
</html>
```

Noise pollution and sustainable practices :

1. **Noise Pollution Monitoring:**

   a. Decibel Meters**:** Use sound level meters to monitor noise levels in different areas. These meters measure sound in decibels (dB) and help identify noisy areas.

   b. Noise Mapping**:** Create noise maps to pinpoint high-noise zones. Geographic Information System (GIS) technology can be used for this purpose.

   c. Community Engagement**:** Involve the community in monitoring noise pollution. Citizen science initiatives and smartphone apps can help gather data.

2. **Noise Regulations and Zoning:**

   a. Noise Ordinances**:** Implement and enforce noise regulations and ordinances that specify permissible noise levels during different times of the day.

   b. Zoning Laws**:** Plan urban development with zoning regulations that separate noisy industrial or commercial areas from residential zones.

3. **Green Urban Planning:**

   a. Green Spaces**:** Increase the number of green spaces and parks in urban areas, as they act as natural sound barriers and can reduce noise pollution.

b. Planting Trees**:** Planting trees and vegetation alongside roads can help absorb and block sound, creating a natural sound barrier.

4. **Transportation Management:**

a. Public Transportation**:** Promote the use of public transportation, walking, and cycling to reduce traffic-related noise and emissions.

b. Electric Vehicles**:** Encourage the use of electric vehicles, which are quieter than traditional gasoline-powered vehicles.

5. **Noise-Reducing Infrastructure:**

a.Sound Barriers**:** Install sound barriers, such as noise walls or berms, alongside highways and railways to reduce noise transmission to nearby areas.

b. Acoustic Pavement**:** Use noise-reducing road surfaces to minimize tire noise on highways.

6. **Sustainable Building Design:**

a.Sound Insulation**:** Use sustainable building materials and construction techniques that provide effective sound insulation for homes, offices, and public buildings.

b. Green Roofs: Implement green roof systems to absorb sound and reduce noise pollution from rain and hail.

7. **Technology and Innovation:**

a.Quiet Technology**:** Develop and promote quieter machinery and equipment, particularly in industries known for generating high noise levels.

b. Noise-Canceling Technologies**:** Employ noise-canceling technologies in public spaces, transportation, and industrial settings.

8. **Awareness and Education:**

a.Public Awareness Campaigns**:** Conduct campaigns to educate the public about the harmful effects of noise pollution and how to reduce it.

b. Noise Reduction Programs**:** Support initiatives that encourage individuals and businesses to voluntarily reduce noise emissions.

9. **Research and Data Analysis:**

a.Environmental Impact Assessments**:** Require noise impact assessments for major projects, and use the data to inform development decisions.

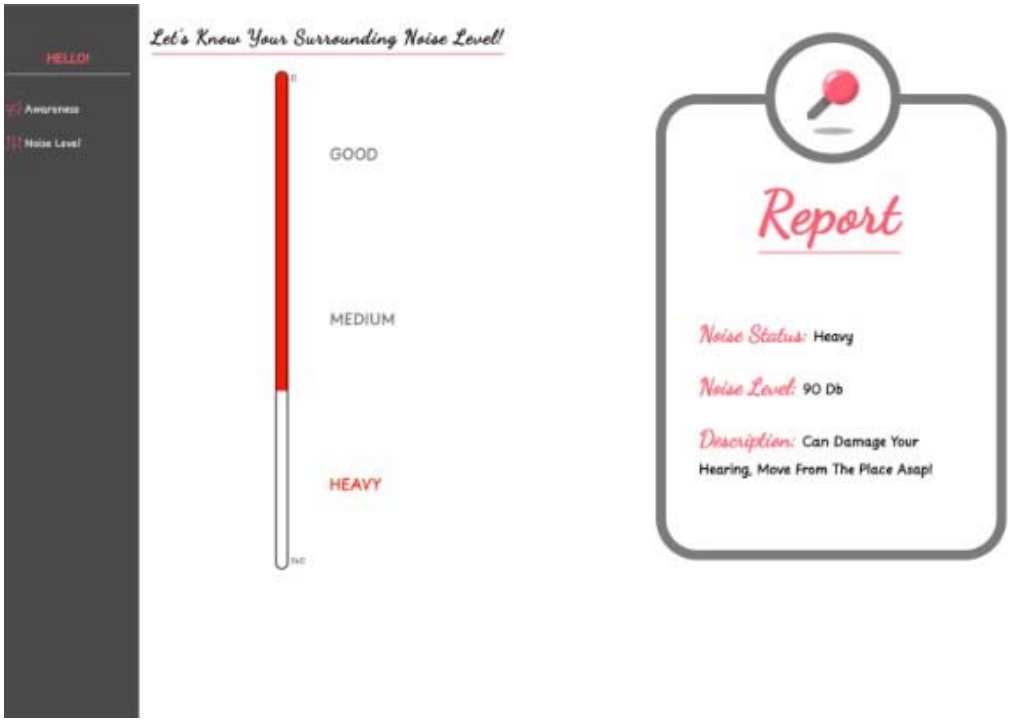
b. Long-Term Monitoring**:** Continuously monitor noise levels and adapt strategies as needed based on data analysis.

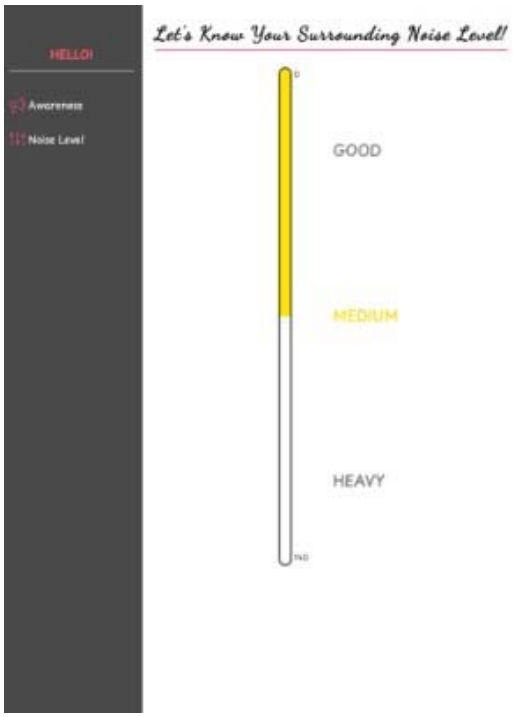
10. **Policy and Regulation Updates:**

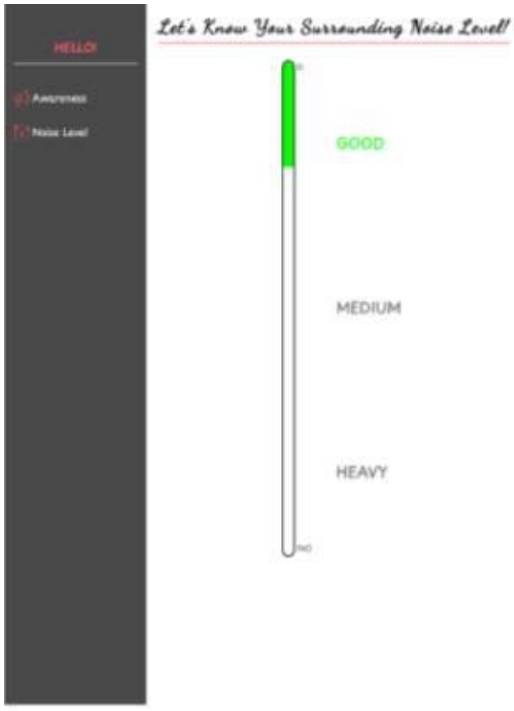
a. Regular Review**:** Periodically review and update noise pollution regulations and policies to keep pace with technological advancements and changing urban landscapes.

By integrating noise pollution monitoring and sustainable practices into urban and industrial planning, it is possible to mitigate the adverse effects of noise pollution while promoting a more environmentally friendly and livable community.

Sample output :




HELLO!
Awareness
Noise Level
Let's Know Your Surrounding Noise Level!
GOOD
MEDIUM
HEAVY
Report
Noise Status: Medium
Noise Level: 70 Db
Description: Surrounding Was Noisy, Better Leave The Place Soon!


HELLO!
Let's Know Your Surrounding Noise Level!
GOOD
MEDIUM
HEAVY
Report
Noise Status: Good
Noise Level: 30 Db
Description: Surrounding Was Quite!

Website :

Noise.bts.dot.gov

Instructions to replicate the project :

1.IoT sensor deployment

2.Sensor configuration

3.Code development

4.Transit information platform development

5.Integration using python :

Python to fetch data from the IoT platform(previously sent by sensors) through the platform's API or library.