NOISE POLLUTION MONITORING

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OBJECTIVE:

The objective for noise pollution monitoring using IoT (Internet of Things) can be multifaceted and can address various environmental, health, and urban planning concerns. Here is a comprehensive objective statement for a noise pollution monitoring project:

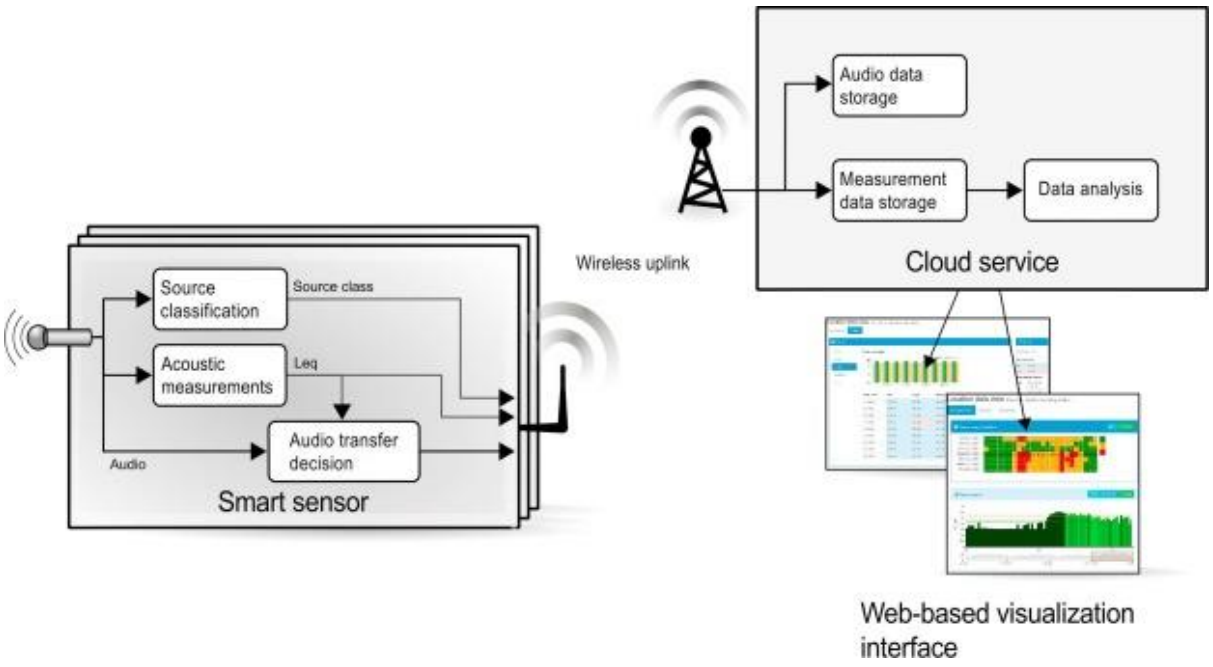
"To design and implement an IoT-based noise pollution monitoring system with the following objectives:

- **Real-time Data Collection:** Collect real-time noise data from multiple urban locations to continuously monitor and assess noise pollution levels.
- **Accurate Noise Measurement:** Develop and deploy high-precision sensors and equipment to ensure accurate noise level measurements in decibels (dB) and the frequency spectrum.
- **Data Aggregation and Analysis:** Aggregate collected data into a centralized platform for analysis, visualization, and historical trend tracking, enabling data-driven decision-making.
- **Noise Mapping:** Create interactive noise pollution maps that illustrate noise hotspots and trends, aiding urban planners, policymakers, and citizens in identifying areas of concern.
- **Threshold Alarms:** Implement threshold alarms and alerts to notify relevant authorities and residents when noise pollution exceeds acceptable limits, ensuring timely response to noise-related issues.
- **Public Awareness:** Develop a user-friendly interface, such as a mobile app or website, to provide residents with access to noise pollution data, fostering public awareness and engagement.
- **Compliance Monitoring:** Facilitate regulatory compliance by businesses and construction sites by providing noise data for verification and enforcement.
- **Historical Data Analysis:** Analyze historical noise data to identify long-term trends, assess the impact of noise-reduction initiatives, and make informed decisions about urban development and transportation planning.
- **Environmental Impact Assessment:** Support environmental impact assessments for construction projects and infrastructure development by providing data on the potential noise impact on nearby communities.
- **Resource Optimization:** Enable the optimization of resource allocation, such as traffic management, by using real-time noise data to improve the efficiency of urban services.
- **Health and Well-being:** Raise awareness of the health effects of noise pollution and promote measures to mitigate its impact on the well-being of residents.
- **Cost Reduction**: Optimize noise monitoring costs through IoT technology, reducing the need for manual data collection and analysis.
- **Scalability:** Design the system to be scalable, allowing for easy expansion to cover more areas as needed.
- **Data Privacy and Security:** Ensure the security and privacy of collected data, adhering to relevant regulations and guidelines.

- **Feedback Mechanism:** Establish a feedback mechanism to incorporate community input and suggestions, ensuring the system's relevance and effectiveness.
- **Partnerships:** Collaborate with local authorities, environmental organizations, and relevant stakeholders to foster a comprehensive and sustainable approach to noise pollution control.

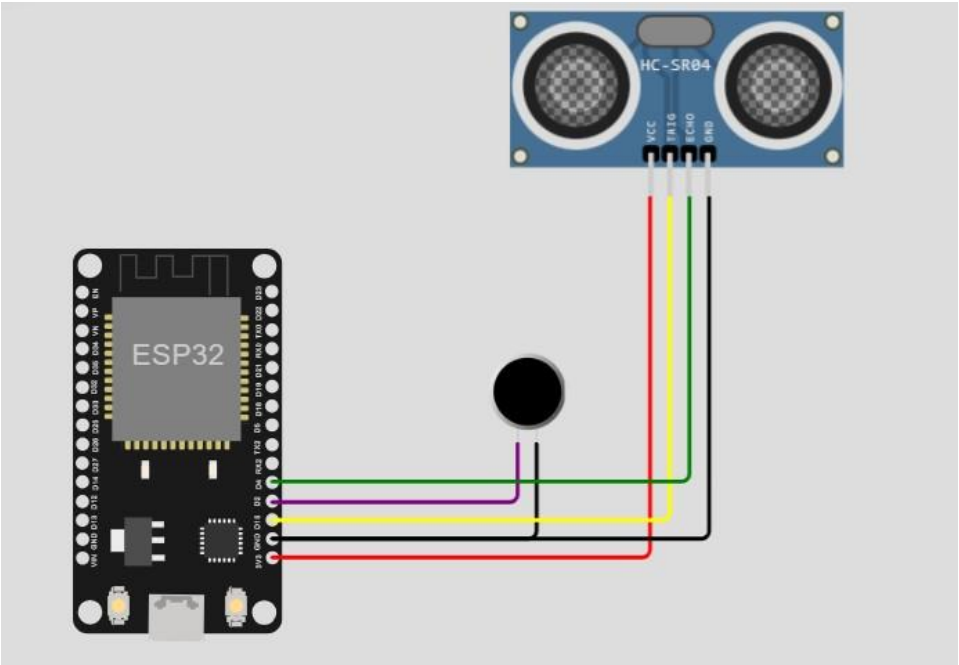
Overall, this IoT-based noise pollution monitoring system aims to enhance the quality of urban life, protect public health, and support informed decision-making in the management and reduction of noise pollution in our communities."

BLOCK DIAGRAM:



Environmental noise monitoring systems continuously measure sound levels without assigning these measurements to different noise sources in the acoustic scenes, therefore incapable of identifying the main noise source.

CIRCUIT DIAGRAM:



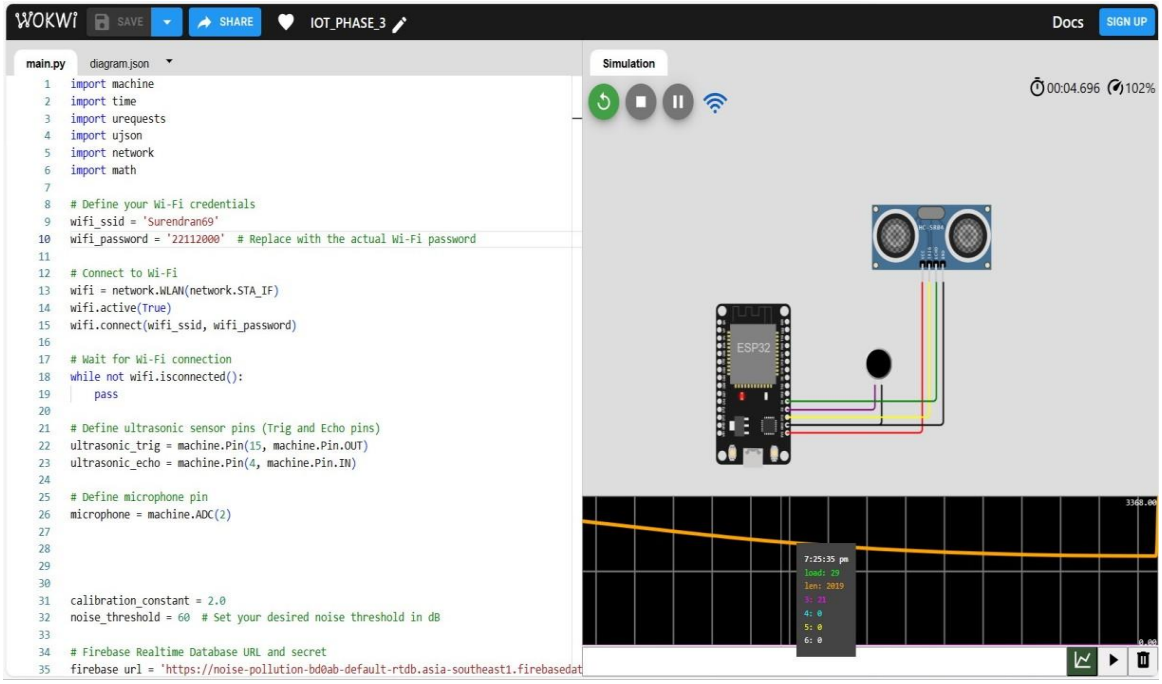
CODING:

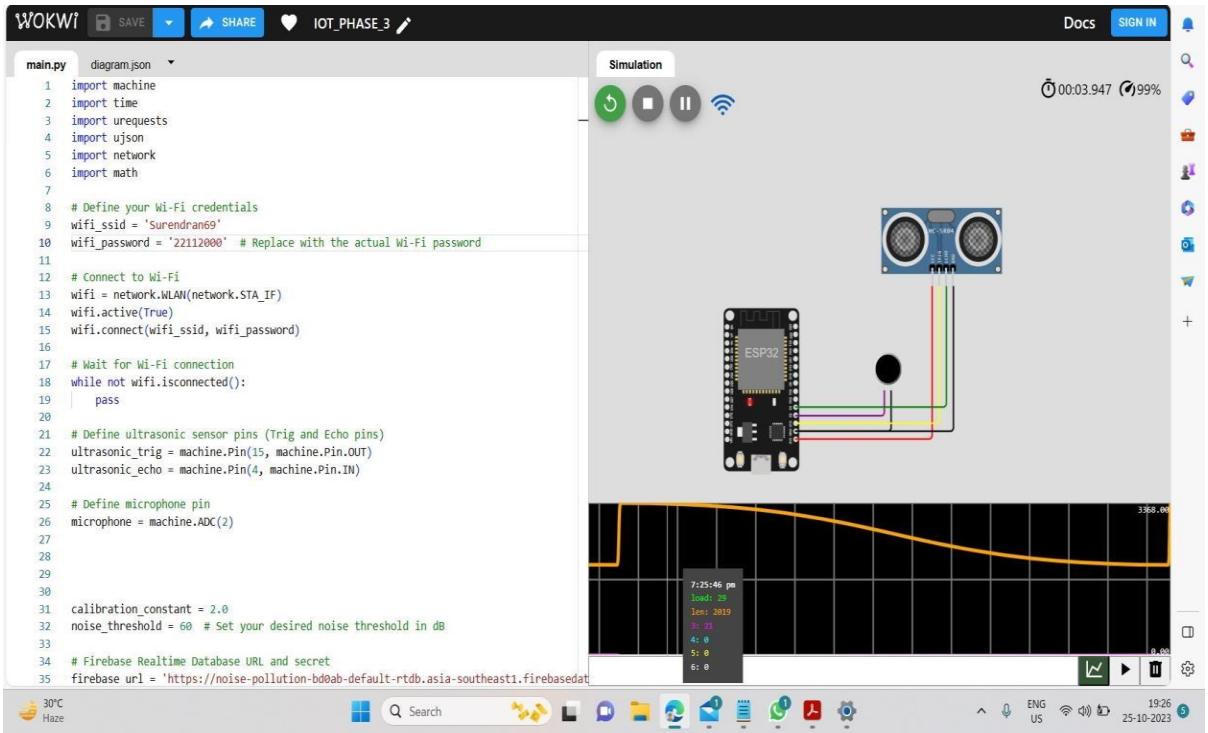
```
import machine
import time
import urequests
import ujson
import network
import math
# Define your Wi-Fi credentials
wifi_ssid = 'Surendran69'
wifi_password = '22112000'  # Replace with the actual Wi-Fi password
# Connect to Wi-Fi
```

```
wifi = network.WLAN(network.STA_IF)
wifi.active(True)
wifi.connect(wifi_ssid, wifi_password)
# Wait for Wi-Fi connection
while not wifi.isconnected():
    pass
# Define ultrasonic sensor pins (Trig and Echo pins)
ultrasonic_trig = machine.Pin(15, machine.Pin.OUT)
ultrasonic_echo = machine.Pin(4, machine.Pin.IN)
# Define microphone pin
microphone = machine.ADC(2)
calibration_constant = 2.0
noise_threshold = 60  # Set your desired noise threshold in dB
# Firebase Realtime Database URL and secret
firebase_url = 'https://noise-pollution-bd0ab-default-rtdb.asia-
southeast1.firebasedatabase.app/'  # Replace with your Firebase URL
firebase_secret = 'nBsgyQFTqHUe4qExlaZX6VL3mpf5gn6BlpnMiuR0' # Replace with
your Firebase secret
def measure_distance():
    # Trigger the ultrasonic sensor
    ultrasonic_trig.value(1)
    time.sleep_us(10)
    ultrasonic_trig.value(0)
    # Measure the pulse width of the echo signal
    pulse_time = machine.time_pulse_us(ultrasonic_echo, 1, 30000)
    # Calculate distance in centimeters
    distance_cm = (pulse_time / 2) / 29.1
    return distance_cm
def measure_noise_level():
    # Read analog value from the microphone
    noise_level = microphone.read()
```

```
    noise_level_db = 20 * math.log10(noise_level / calibration_constant)
    return noise_level, noise_level_db
# Function to send data to Firebase
def send_data_to_firebase(distance, noise_level_db):
    data = {
        "Distance": distance,
        "NoiseLevelDB": noise_level_db
    }
    url =
    f'{firebase_url}/sensor_data.json?auth={firebase_secret}'
    try:
        response = urequests.patch(url, json=data)  # Use 'patch' instead of
        'put'if response.status_code == 200:
            print("Data sent to
        Firebase")else:
            print(f"Failed to send data to Firebase. Status code:
    {response.status_code}")except Exception as e:
        print(f"Error sending data to Firebase: {str(e)}")
try:
    while True:
        distance = measure_distance()
        noise_level, noise_level_db = measure_noise_level()
        print("Distance: {} cm, Noise Level: {:.2f} dB".format(distance,
        noise_level_db))if noise_level_db > noise_threshold:
            print("Warning: Noise pollution exceeds
        threshold!")# Send data to Firebase
        send_data_to_firebase(distance, noise_level_db)
        time.sleep(1)  # Adjust the sleep duration as needed
except KeyboardInterrupt:
    print("Monitoring stopped")
```

OUTPUT:



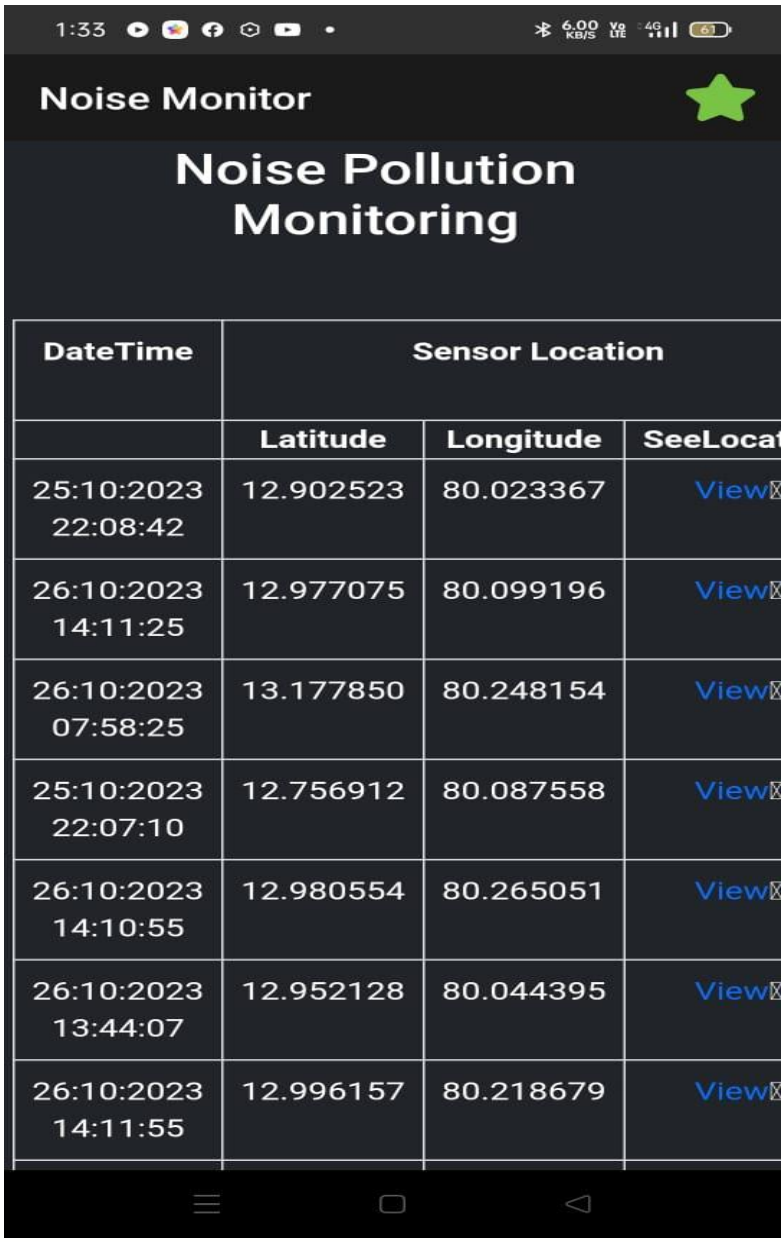


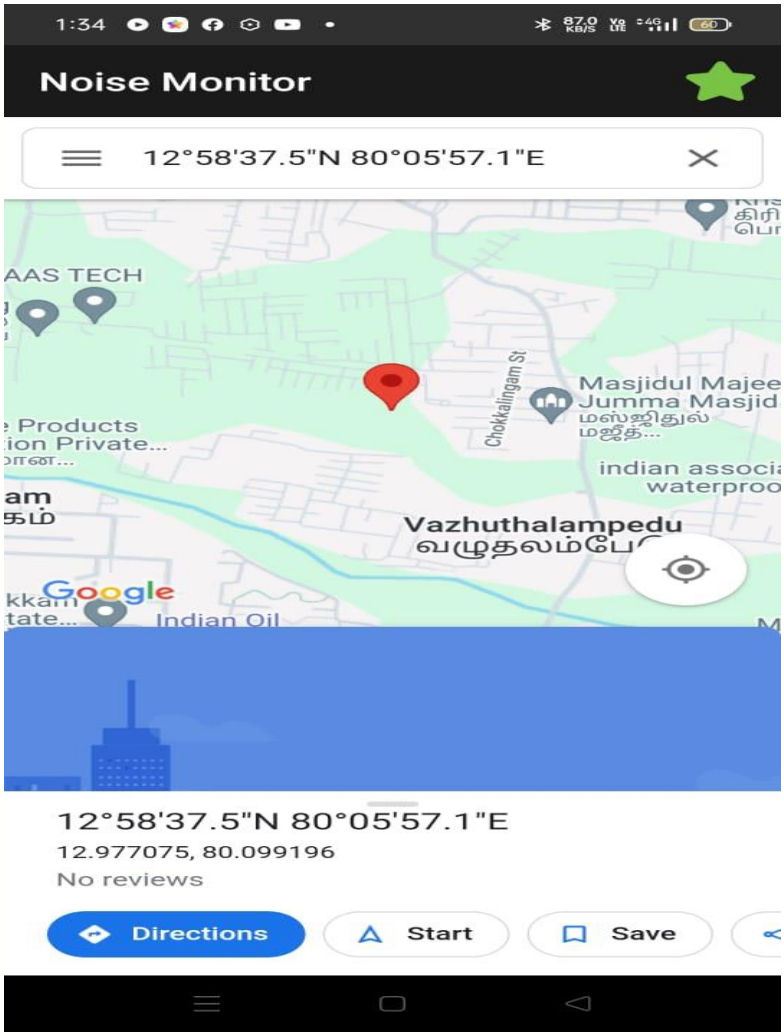
SIMULATION LINK:

https://wokwi.com/projects/378994972326086657

USER MOBILE APP INTERFACE:

The mobile application is to display real-time noise level data involves several steps including data acquisition, user interface design, data processing, and presentation.





A real-time noise level monitoring system is a technology that continuously measures and records noise levels in a particular area, providing valuable data to promote public awareness and contribute to noise pollution mitigation. Here's how such a system can achieve these goals:

Data Collection and Visualization:
Real-time noise monitoring systems use sensors and data collection devices to measure noise levels in specific locations. This data is then processed and displayed in real-time, often through web-based interfaces or mobile apps. By making this information accessible to the public, individuals and communities can easily access information about current noise levels in their area.

Public Awareness:
By providing real-time noise level information, these systems raise public awareness about noise pollution. When people can see and understand the actual noise levels in their neighbourhood or public spaces, they are more likely to recognize the extent of the problem and its impact on their lives.

Educational Tool:
Real-time noise monitoring systems serve as educational tools, helping the public better understand the sources of noise pollution and the times when it is most prevalent. This knowledge can lead to more informed and motivated communities interested in addressing noise pollution.

Complaint Verification:
These systems also enable individuals to verify and substantiate noise complaints. When people report excessive noise, authorities can use the real-time data to confirm the validity of the complaints. This can expedite the resolution of noise-related issues and ensure that enforcement measures are taken when necessary.

Community Engagement:
Real-time noise monitoring systems can facilitate community engagement and activism. Residents can use the data to advocate for quieter and more pleasant living conditions. They may organize campaigns, lobby for noise regulations, or work with local authorities to address specific noise issues.

Public Policy and Regulation:
The data collected by these systems can be used by local governments to formulate and adjust noise pollution regulations. Accurate, real-time information allows policymakers to make evidence-based decisions and enact laws that can lead to noise reduction measures.

Mitigation and Planning:
With continuous noise level data, urban planners, architects, and developers can design and construct buildings and infrastructure with noise reduction in mind. This proactive approach can help prevent or reduce future noise pollution issues.

Behavioral Changes:
Public awareness of real-time noise data can also lead to behavioral changes. People may become more mindful of their own noise levels, which can contribute to a reduction in noise pollution through voluntary efforts.

Industry and Commercial Compliance:
Industrial and commercial facilities can use real-time noise monitoring to ensure they are operating within acceptable noise limits. This promotes self-regulation and adherence to noise regulations, reducing noise pollution at its source.

CONCLUSION:

A real-time noise level monitoring system promotes public awareness and contributes to noise pollution mitigation by empowering communities with information, fostering advocacy and policy changes, and encouraging responsible behavior and industrial compliance. It can be a valuable tool in the fight against noise pollution, leading to quieter and more pleasant urban environments.