Noise Pollution Monitoring using IoT

Phase-3 Document submission

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Project: Monitoring environmental noise pollution.

Phase-3: Development Part-1

INTRODUCTION:

» Noise pollution is a pervasive environmental issue that can have detrimental effects on human health, wildlife, and the overall quality of life in urban and industrial areas. To effectively address and mitigate noise pollution, real-time monitoring and data collection are essential. This is where Internet of Things (IoT) devices play a crucial role.IoT devices are interconnected sensors and devices that collect and transmit data over the internet. When applied to noise pollution monitoring, IoT devices offer a cost-effective, scalable, and efficient solution.

PROJECT OBJECTIVE:

» The objective of this project is to create an Internet of Things (IoT) device for environmental noise monitoring. The device will be designed to capture and analyze ambient sound levels in various locations to gather valuable data for environmental research, urban planning, noise pollution control, and public health. The project aims to develop a scalable and cost-effective solution that can be deployed in different urban and rural settings.

» The primary objective is to design a sensor-based system that can accurately collect data on ambient noise levels in real-time. This includes the ability to capture sound intensity and frequency.

» Ensure the IoT device is energy-efficient by utilizing low-power components and sleep modes to extend the device's operational lifespan.

EXPECTED OUTCOME:

» The successful completion of this project will result in an IoT-based environmental noise monitoring system that empowers communities, urban planners, researchers, and local authorities with valuable data to make informed decisions about noise pollution control and urban development. Additionally, this project will contribute to public awareness and engagement in noise pollution issues, promoting healthier and more sustainable living environments.

HARDWARE COMPONENTS:

» ESP8266 NodeMcu.
» KY-038 Sound Sensor.
» SSD1306 OLED display.
» Jumper wires.
» PCB Board.

SOFTWARE COMPONENTS:

» Thonny IDE
» MicroPython(for programming)

CONNECTION INSTRUCTIONS:

1. Connect the OLED Display:

» Connect the OLED display's VCC pin to the ESP8266's 3.3V pin.
» Connect the OLED display's GND pin to the ESP8266's GND pin.
» Connect the OLED display's SDA pin to the ESP8266's D2 (NodeMCU) or GPIO4 (Wemos D1 Mini) pin.
» Connect the OLED display's SCL pin to the ESP8266's D1 (NodeMCU) or GPIO5 (Wemos D1 Mini) pin.

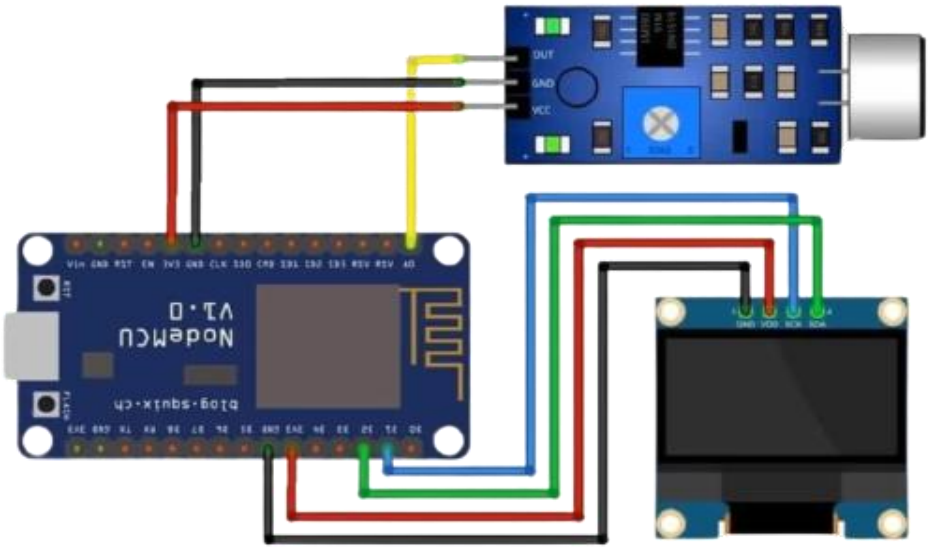
2.Connect the KY-038 Sound Sensor:

» Connect the KY-038 sensor's GND pin to the ESP8266's GND pin.
» Connect the KY-038 sensor's + pin to the ESP8266's 3.3V or 5V pin.
» Connect the KY-038 sensor's OUT pin to a digital pin on the ESP8266, e.g., D3 (NodeMCU) or GPIO0 (Wemos D1 Mini).

3.Power Supply:

» The ESP8266 board is properly powered USB or with battery module. Connect the 3.3V or 5V and GND pins to a reliable power source, and don't forget to connect the common GND between the ESP8266, OLED display, and KY-038 sound sensor.

Circuit Diagram for Iot noise meter:



Program:

» The below given code is used to initialize the SSD1306 OLED display and display the observed noise level in decibles to the user.

```
from machine import Pin, ADC, I2C
from ssd1306 import SSD1306_I2C
import time

i2c = I2C(scl=Pin(5), sda=Pin(4))
oled = SSD1306_I2C(128, 64, i2c)

adc = ADC(Pin(0))

while True:
    noise_level = adc.read()
    oled.fill(0)
    oled.text("Noise Level:", 0, 0)
    oled.text(str(noise_level), 0, 20)
    oled.show()
```

```
        time.sleep(1)
```

» This part of code reads the sound sensor's voltage, converts it into dB, and prints the noise level to the console. It continues to do at a 1-second interval.

```
from machine import ADC, Pin
import time
import math

adc = ADC(Pin(0))
sensor_voltage_at_silence = 0.04
sensor_voltage_at_max_noise = 1.00
reference_sound_pressure = 20e-6

def voltage_to_pressure(voltage):
    return reference_sound_pressure * math.pow(10, ((voltage - sensor_voltage_at_silence) / (sensor_voltage_at_max_noise - sensor_voltage_at_silence) * 60) - 120.0)

while True:
    sensor_voltage = adc.read() / 1024.0
    sound_pressure = voltage_to_pressure(sensor_voltage)
    sound_pressure_dB = 20 * math.log10(sound_pressure / reference_sound_pressure)
    print("Noise Level (dB): {:.2f}".format(sound_pressure_dB))
    time.sleep(1)
```

EXPECTED OUTPUT:

```
Noise Level (dB): 40.12
Noise Level (dB): 42.75
Noise Level (dB): 45.08
Noise Level (dB): 43.92
Noise Level (dB): 41.75
...
```

Conclusion:

In conclusion, noise pollution monitoring using IoT devices offers a powerful solution to address the challenges posed by excessive noise in our urban and industrialized environments. By leveraging real-time data collection and analysis, IoT technology empowers communities and authorities to take proactive measures to reduce noise pollution and improve the quality of life for residents.