Noise pollution monitoring

IoT_phase5

Project Objectives: The primary objectives of this project are to:

- ❖ Develop a real-time noise level monitoring system.
- ❖ Deploy IoT sensors for data collection.
- ❖ Create an interactive platform for data visualization and analysis.
- ❖ Develop a mobile app for user-friendly access to noise level data.
- ❖ Raise public awareness about noise pollution and contribute to its mitigation.

IoT Sensor Deployment: IoT sensors will be strategically deployed throughout a target area to measure noise levels. These sensors will consist of a microphone for sound detection, a microcontroller for data processing, and wireless connectivity for data transmission. Sensors will be installed at various points within the area of interest, such as residential neighborhoods, industrial zones, or transportation hubs.

Platform Development: A noise pollution information platform will be created to aggregate and display real-time noise data. The platform will include a web-based dashboard accessible through a browser. Key features of the platform include:

- Real-time data visualization: A dashboard with live graphs and maps showing noise levels from various sensor locations.
- Historical data analysis: Users can access historical noise data and generate reports.
- User registration and notification: Users can register, set noise level alerts, and receive notifications when noise levels exceed predefined thresholds.
- Data analytics: Advanced analytics tools to identify noise pollution trends and hotspots.

Mobile App Development: A mobile app will be developed for both iOS and Android platforms. The app will allow users to access noise level data on the go and receive alerts. Key features include:

- Real-time noise level display: Users can see live noise levels from the closest sensors to their current location.
- Location-based data: The app will use GPS to provide relevant data based on the user's location.
- Notifications: Users can receive notifications and set custom alert thresholds.
- Data history: Access to historical noise level data and personalized usage statistics.

Code Implementation: The IoT sensor code will include sound data collection and processing, as well as data transmission to the platform through a secure connection (HTTPS or MQTT). The platform and mobile app will be developed using appropriate programming languages and frameworks. The platform will use databases to store and analyze data, while the app will include geolocation and push notification functionalities.

To promote public awareness and contribute to noise pollution mitigation, the system will have several benefits:

- Real-time data: Residents can monitor noise levels in their areas, helping them understand the extent of noise pollution.
- Data-driven decisions: Local authorities and organizations can use the data to make informed decisions about urban planning and noise control measures.
- Alerting: The app's notification feature empowers users to take immediate action if noise levels become harmful.
- Reporting: Historical data allows users to report noise disturbances to relevant authorities.
- Advocacy: Public access to noise data can raise awareness about noise pollution issues, encouraging communities to advocate for change.

Mobile app interface:

- Home Screen:
  - The app's home screen displays real-time noise levels based on the user's location.
  - Users can see nearby sensor locations, their noise levels, and any active alerts.
- Noise Level Details:
  - Tapping on a sensor location on the map or a nearby point provides detailed information about noise levels at that location.
  - Users can view historical data, trends, and times when noise levels exceeded acceptable thresholds.
- Alerts and Notifications:
  - Users can set personalized noise level thresholds and receive push notifications when noise levels exceed their chosen limits.
  - The app provides an alert history for users to review past alerts.
- Historical Data Access:
  - Users can access historical noise level data, allowing them to track changes in their area over time.
  - The app offers easy-to-read graphs and charts for data visualization.
- Community Reporting:
  - A reporting feature allows users to report noise disturbances or anomalies to local authorities or community organizations.
- User Profile and Settings:
  - The app includes a user profile section where users can set their preferences, including notification settings and unit preferences.

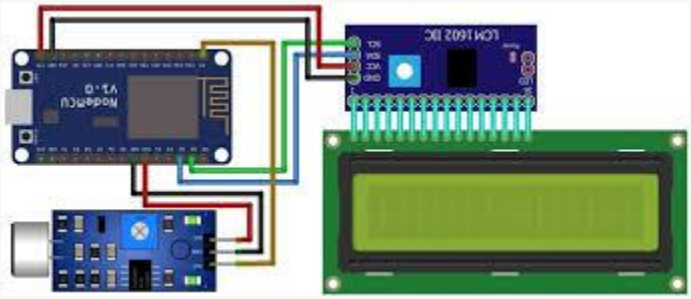
```
# Import necessary libraries

import datetime

from flask import Flask, request, jsonify

import RPi.GPIO as GPIO

import time

# Set up Raspberry Pi GPIO pins for sensor

GPIO.setmode(GPIO.BCM)

GPIO.setup(17, GPIO.IN)

app = Flask(__name__)



@app.route('/noise', methods=['GET'])

def get_noise_level():

    # Read data from the sensor (you'll need to adapt this part to your specific sensor)

    noise_level = read_noise_level()

    timestamp = datetime.datetime.now().isoformat()
```

```
    data = {
        'timestamp': timestamp,
        'noise_level': noise_level
    }

    return jsonify(data)

def read_noise_level():
    # Read noise level from the sensor (adjust for your specific hardware)
    return GPIO.input(17)
import sqlite3

# Initialize SQLite database
conn = sqlite3.connect('noise_data.db')
cursor = conn.cursor()
```

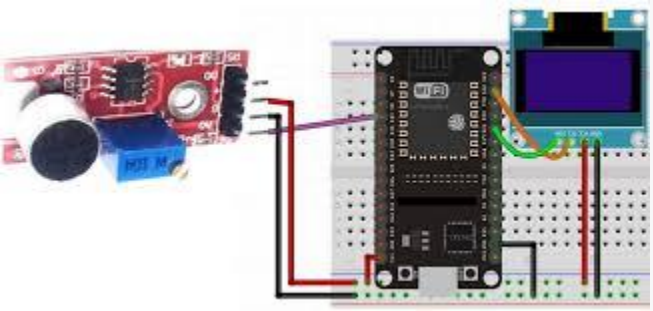
```
# Create a table for storing historical data
cursor.execute('''CREATE TABLE noise_data (timestamp TEXT, noise_level INTEGER)''')
conn.commit()

# Function to insert data into the database
def insert_noise_data(timestamp, noise_level):
    cursor.execute("INSERT INTO noise_data VALUES (?, ?)", (timestamp, noise_level))
    conn.commit()
while True:
    # Read noise level
    noise_level = read_noise_level()

    # Store data in the database
    timestamp = datetime.datetime.now().isoformat()
    insert_noise_data(timestamp, noise_level)
```

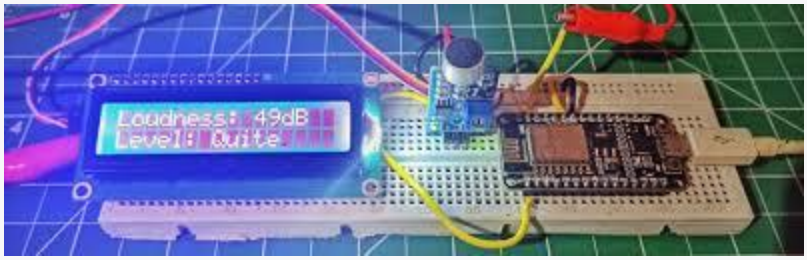
```
# Sleep for a while (adjust as needed)

time.sleep(1)
```

Noise sensor



Noise pollution monitoring system





Example of noise pollution monitoring

public awareness and contributes to noise pollution mitigation

Data Transparency: By providing real-time noise level data to the public, the system increases transparency about noise pollution in specific areas. This transparency allows individuals and communities to better understand the extent of the issue, which is a critical first step in addressing it.

Education and Awareness: Access to real-time noise data through the platform and mobile app educates the public about the harmful effects of noise pollution on health and well-being. When people are more aware of the risks, they are more likely to take action to mitigate noise pollution.

User Engagement: The mobile app's features, such as alerts and historical data access, engage users in actively monitoring noise levels in their surroundings. This engagement empowers individuals to take control of their exposure to noise and advocate for change in their communities.

Community Advocacy: Real-time data can serve as evidence in community discussions and advocacy efforts. Residents and community groups can use the data to support their claims and lobby for noise reduction measures, such as the implementation of quieter infrastructure or changes in local regulations.

Local Government and Policy Influence: Local authorities and urban planners can use the data to make informed decisions regarding land use and zoning. They can identify noise pollution hotspots and develop policies or regulations to control noise emissions in problematic areas.

Public Health Benefits: With access to real-time data, individuals can take proactive steps to protect their health by avoiding noisy areas when noise levels are elevated. This self-awareness can lead to a reduction in the number of people exposed to high noise levels.

Immediate Action: The alerting feature of the mobile app enables users to take immediate action when noise levels exceed acceptable thresholds. For instance, they can close windows to reduce indoor noise exposure or report disturbances to authorities.

Long-term Monitoring and Mitigation: Historical data collected by the system helps in identifying noise pollution trends and understanding its causes. This knowledge can guide long-term mitigation efforts, such as improving urban planning, implementing noise barriers, or enforcing noise control regulations.

Behavioral Change: Awareness of one's noise environment can encourage behavioral change. For instance, businesses might adopt quieter practices, and individuals may choose quieter transportation options, ultimately reducing noise emissions.

Public Participation: Real-time noise monitoring systems can be accompanied by mechanisms for public participation. Communities can actively contribute to data collection, reporting disturbances, and suggesting mitigation measures, fostering a sense of shared responsibility for noise pollution reduction.