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DEPARTMENT OF

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

NAAN MUDHALVAN - INTERNET OF THINGS

NOISE POLLUTION MONITORING

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Phase 3: Development Part 1

Building a Noise pollution Monitoring system using IoT sensors and Raspberry Pi integration

Hardware and Software Components Needed:

Hardware :

1. Raspberry Pi (with internet connectivity)
2. Sound Sensor (such as the KY-038 Microphone sound sensor)
3. Jump wires
4. Noise Sensor: Use a noise sensor (such as a sound level sensor) to measure the noise levels.
5. Microcontroller: ESP8266 or ESP32 boards can be used for this purpose, which can communicate with the internet using Wi-Fi.
6. Cloud Service: Use a cloud service like Thing Speak or Firebase to store and analyse the data.
7. Display Unit: You can use an LCD screen or LEDs to display real-time noise levels locally.

Software :

- Python installed on Raspberry Pi
- Requests library for making HTTP requests (install it using pip install requests)

1. Microcontroller Code (Python on MicroPython):

- Connect the noise sensor to the microcontroller.
- Read data from the sensor.
- Send data to the cloud service at regular intervals.

2. Data Analysis and Visualization:

- Retrieve data from the database.
- Analyse noise patterns over time.
- Visualize the data using libraries like Matplotlib or Plotly.

3. Cloud Service (Python using Flask for API):

- Create a REST API using Flask to receive data from the microcontroller.
- Store the received data in a database.
- Implement endpoints for data retrieval and analysis.

Procedure:

Step 1: Define Project Requirements and Components

- Define Project Scope: Determine the area you want to monitor for noise pollution and establish specific goals for the monitoring system.
- Select Components: Choose suitable noise sensors (such as sound level sensors or microphones), Raspberry Pi board, and necessary accessories (wires, resistors, breadboard, etc.).
- Choose IoT Platform: Select an IoT platform (e.g., ThingSpeak, AWS IoT, Google Cloud IoT) for storing and analyzing sensor data.

Step 2: Set Up Raspberry Pi and Connect Sensors

- Set Up Raspberry Pi: Install the latest Raspbian OS on your Raspberry Pi. Configure Wi-Fi and update packages using terminal commands: sudo apt-get update and sudo apt-get upgrade.
- Connect Noise Sensor: Connect the noise sensor to the Raspberry Pi's GPIO pins. Refer to the sensor's datasheet for wiring instructions.

Step 3: Write Python Code for Data Collection

- Install Necessary Libraries: Install Python libraries for GPIO control and sensor communication (e.g., RPi.GPIO, Adafruit_GPIO, Adafruit_ADS1x15).
- Write Python Code: Write Python code to read data from the noise sensor. Use appropriate libraries and communication protocols (e.g., I2C, SPI) based on your sensor's specifications.
- Test Sensor Reading: Verify that your Raspberry Pi can read data from the noise sensor accurately. Print sensor values to the console for testing.

Step 4: Set Up IoT Platform

- Create Account: Sign up for an account on the chosen IoT platform (e.g., ThingSpeak).
- Create Channels: Create channels to store noise level data. Define fields for storing sensor values and metadata.
- Generate API Key: Obtain an API key from the IoT platform to authenticate your Raspberry Pi for data transmission**.**

Step 5: Write Python Code for Data Transmission

- Install Requests Library: Install the requests library for making HTTP requests: pip install requests.

- Write Transmission Code: Write Python code to send sensor data to the IoT platform using HTTP requests. Include the API key and appropriate endpoint URLs in your code.
- Implement Error Handling: Implement error handling in your code to handle network issues and server errors gracefully.

Step 6: Schedule Data Transmission (Optional)

- Use Cron Jobs: Set up a cron job on your Raspberry Pi to run the Python script at regular intervals (e.g., every 5 minutes).
- Ensure Stability: Test the scheduled data transmission to ensure the system works reliably over extended periods.

Step 7: Data Visualization and Analysis

- Retrieve Data: Implement code to retrieve data from the IoT platform's API for visualization and analysis.
- Visualize Data: Use libraries like Matplotlib or Plotly to create graphs and charts visualizing noise levels over time.
- Implement Analysis: Implement basic analysis algorithms to identify noise patterns, peaks, and trends.

Step 8: Documentation and Reporting

- Document Your Project: Create detailed documentation covering hardware connections, software components, code explanations, and system architecture.
- Write Project Report: Prepare a comprehensive project report detailing the objectives, methodology, implementation, challenges faced, and results obtained. Include visualizations and analysis findings in your report.

Step 9: Testing and Calibration

- Test System: Conduct thorough testing of the entire system to ensure sensor accuracy, data transmission reliability, and notification functionality (if implemented).
- Calibration: If required, calibrate the sensors to ensure accurate measurement based on real-world noise levels.

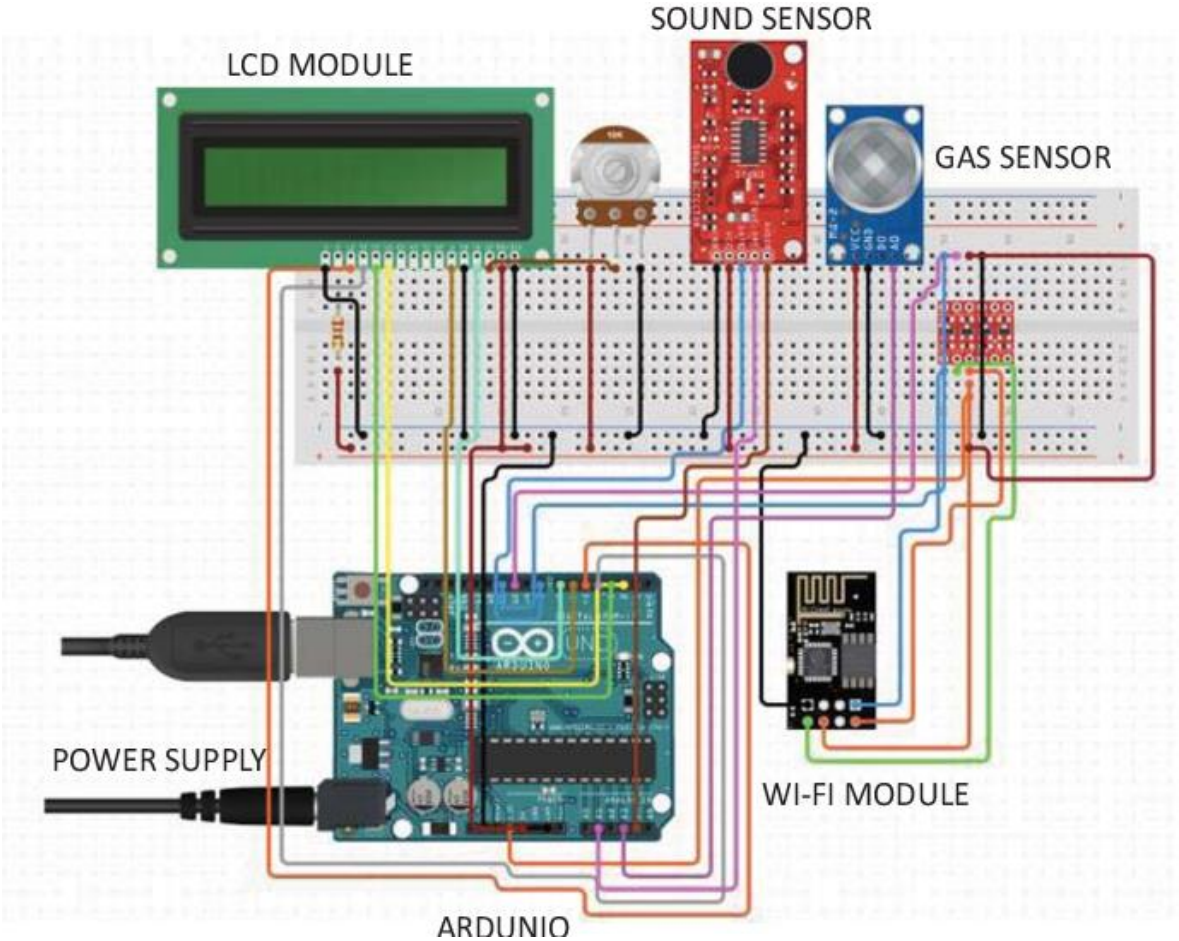
Step 10: Deployment

- Deploy the System: Install the noise pollution monitoring system in the target location.
- Monitor and Maintain: Regularly monitor the system's performance and address any issues promptly. Maintain the system to ensure continuous and accurate operation.

SOURCE CODE:

```
import time
import requests
from gpiozero import InputDevice
from flask import Flask, request, jsonify

# Define the GPIO pin connected to the noise sensor
noise_sensor = InputDevice(17)  # Replace 17 with the actual GPIO pin

# Define the endpoint of your noise pollution information platform
platform_url =  "https://noisepollution.com/api/noise-data"

app = Flask(__name)

@app.route('/update', methods=['POST'])
def update_noise_level():
    try:
        noise_level = request.json.get('noise_level')
        if noise_level is not None:
            # Simulate sending data to the platform
            print(f"Received noise level: {noise_level}")
            return jsonify({"message": "Data received successfully"})
        else:
            return jsonify({"error": "Invalid data format"}), 400
    except Exception as e:
        return jsonify({"error": str(e)}), 500

def send_noise_data():
    while True:
        try:
            noise_level = noise_sensor.value

            # Create a JSON payload with the noise data
            data = {"noise_level": noise_level}

            # Send the data to the platform
            response = requests.post(platform_url, json=data)

            if response.status_code == 200:
```

```
            print("Data sent successfully")
        else:
            print(f"Failed to send data. Status code: {response.status_code}")

        # Adjust the frequency of data transmission as needed
        time.sleep(60)  # Send data every 60 seconds
    except Exception as e:
        print(f"An error occurred: {str(e)}")

if __name__ == '__main__':
    send_noise_data()
    app.run(host='0.0.0.0', port=8080)
```



CONCLUSION:

In conclusion, building a Noise Pollution Monitoring using IoT sensors and Raspberry Pi integration is a valuable. Project that offers solutions to Noise Pollution challenges. By following the step-by-step procedure outlined above, we can create a reliable and efficient Noise Monitoring system.