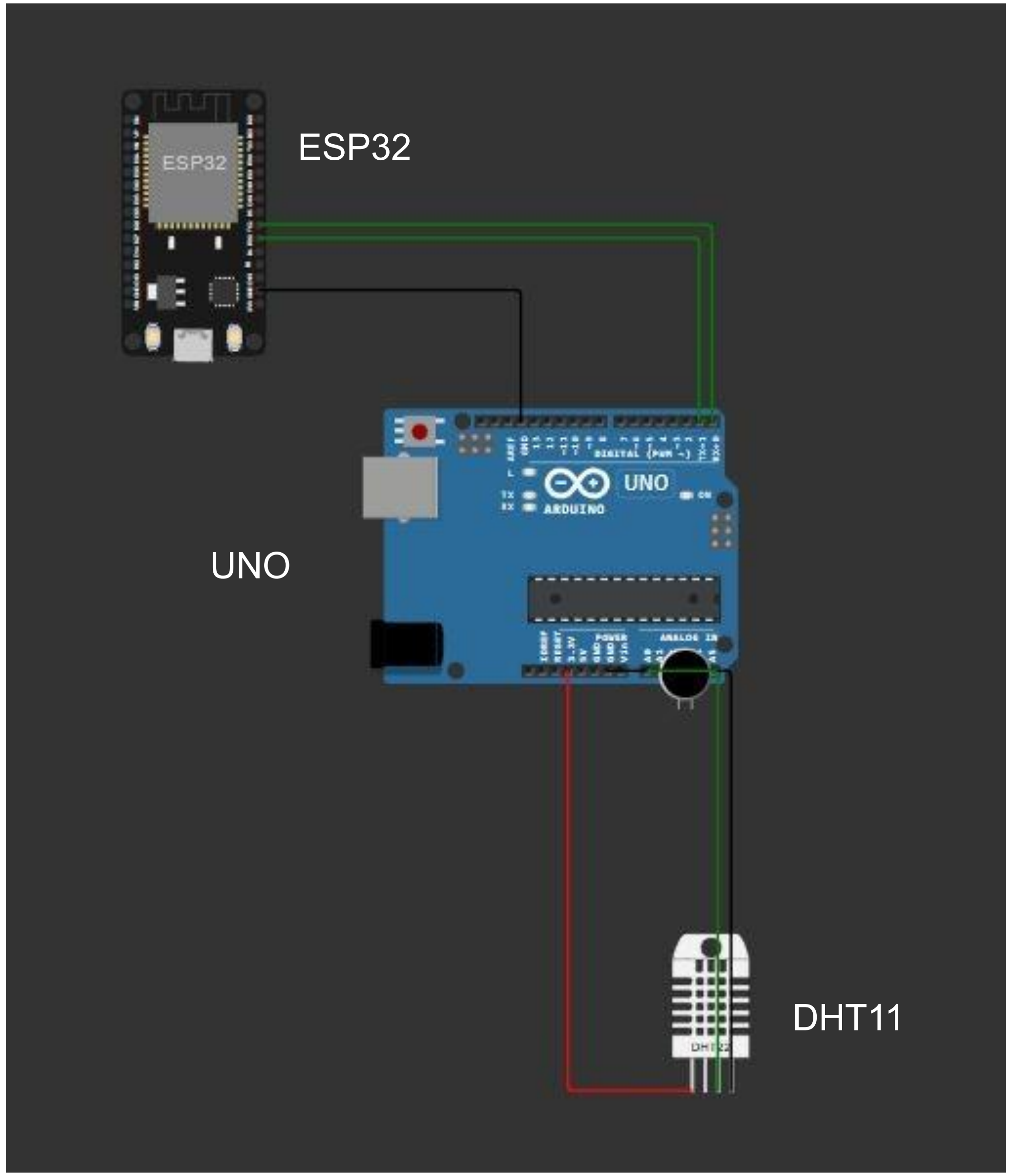
Problem Statement

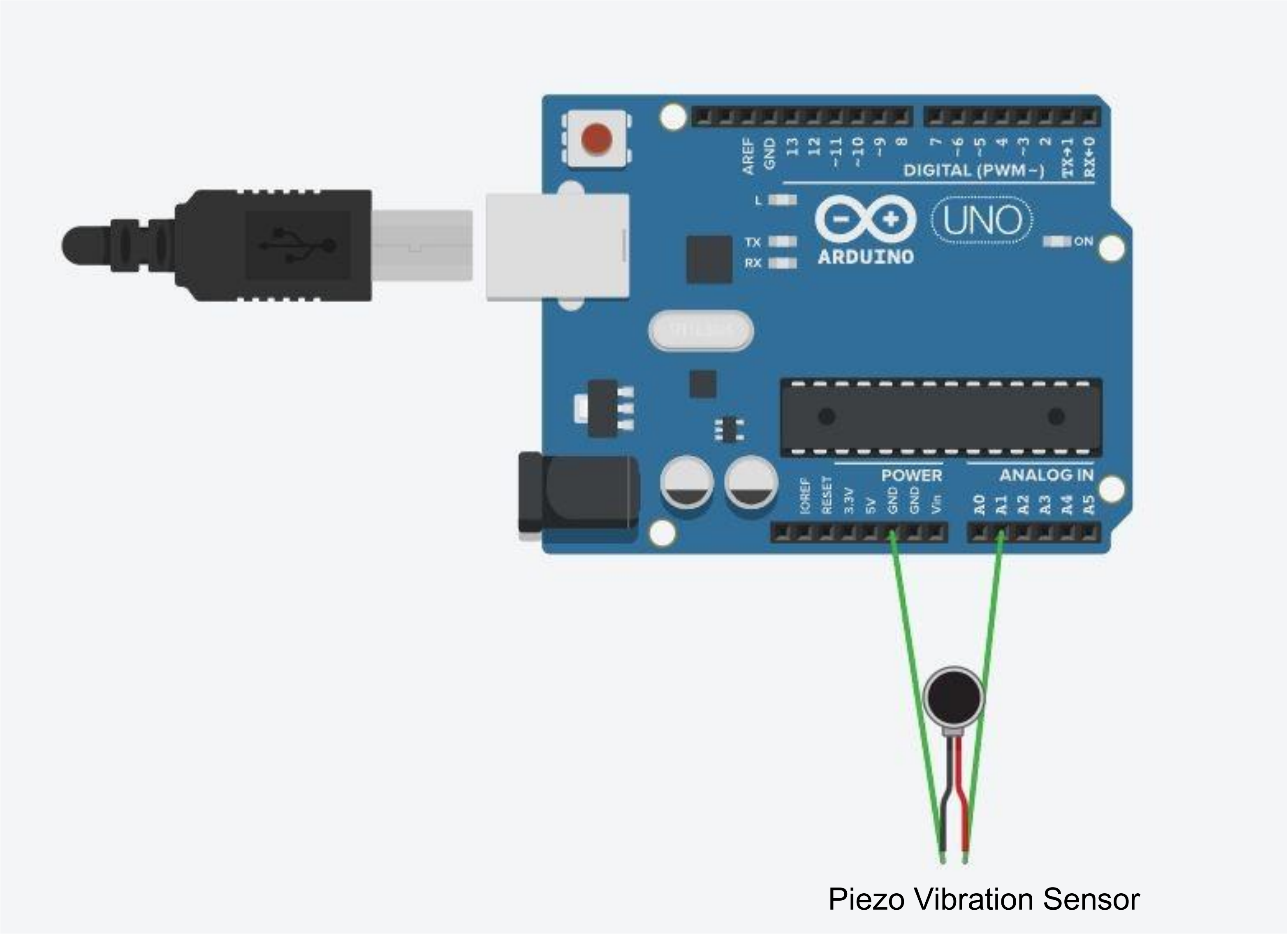
Urban areas face increasing noise pollution due to traffic, construction, and industrial activities. Excessive noise levels negatively impact public health, leading to stress, sleep disturbances, and even cardiovascular issues. Existing noise monitoring systems are either expensive, lack real-time reporting, or do not integrate multiple environmental factors. There is a need for a smart, cost-effective, and real-time noise pollution monitoring system that can provide accurate data for better urban planning and environmental management.

Project Abstract

The **Smart Noise Pollution Monitor** is an IoT-based system designed to measure noise pollution levels in real-time. It uses a **Sound Sensor** to detect noise intensity, a **Piezo Vibration Sensor** to capture structural vibrations, and a **Temperature/Humidity Sensor (DHT11)** to monitor environmental conditions. The collected data is transmitted via **MQTT (Message Queuing Telemetry Transport)** to an online dashboard, allowing authorities to analyze trends, identify high-pollution zones, and implement corrective measures. This system aims to provide an efficient, scalable, and cost-effective solution for monitoring urban noise pollution.

Circuit





Sensors Used

1. Sound Sensor (Microphone-based Sensor)

Function: Measures the intensity of sound in decibels (dB) to determine noise pollution levels.

Working Principle:

- The sound sensor consists of a **microphone (condenser or electret mic)** that converts **sound waves (pressure variations in the air)** into **electrical signals**.
- These signals are then processed by an **amplifier and analog-to-digital converter (ADC)** to provide a measurable output.
- The microcontroller reads these values and categorizes them into different noise levels (low, moderate, high, extreme).

2. Piezo Vibration Sensor

Function: Detects vibrations caused by external sources like traffic movement, construction, and heavy machinery.

Working Principle:

- The **piezoelectric material** inside the sensor generates an electric charge when subjected to mechanical stress (vibrations).
- The **generated voltage is proportional to the intensity of vibration**, allowing the system to detect excessive structural disturbances.
- The microcontroller processes this data to assess whether the vibrations exceed a predefined threshold.

3. Temperature Sensor (DHT11/DHT22 or LM35)

Function: Measures temperature variations in the environment to understand how heat influences noise propagation.

Working Principle:

- The **DHT11/DHT22** uses a **thermistor (temperature-sensitive resistor)** to measure temperature and humidity.
- The **LM35 sensor** converts temperature changes into proportional voltage signals, which are then read by the microcontroller.
- Temperature affects the **speed and propagation** of sound waves, which helps in accurate noise pollution analysis.

Alternative Sensors

- **Gas Sensors (MQ-135):** Monitors air pollution alongside noise levels.
- **GPS Module:** Provides location-based noise pollution data for better analysis.
- **Camera Module:** Can be used for visual monitoring and traffic density analysis.

Final Setup Overview

The sensors are connected to a microcontroller (e.g., Arduino/Raspberry Pi) and placed in key urban locations. The collected data is processed and sent to an **MQTT-enabled** online dashboard, where noise levels and environmental parameters are visualized in real-time. This setup enables continuous monitoring, quick response to noise pollution hotspots, and data-driven policymaking for urban noise management.

Thank you