# GOVERNMENT COLLEGE OF ENGINEERING,ERODE

B.E Electronics and Communication Engineering

## NOISE POLLUTION MONITORING

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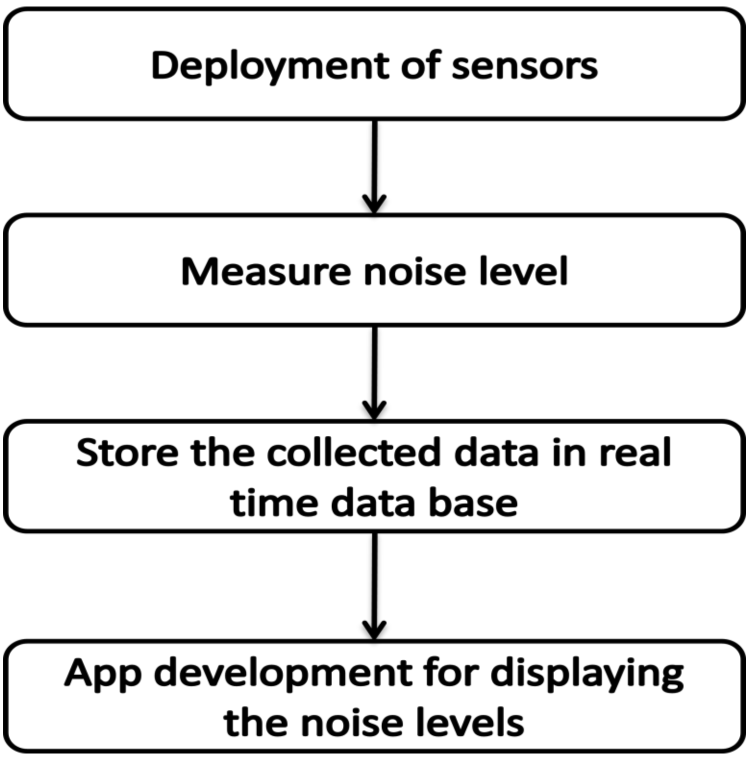
## INTRODUCTION:

Noise pollution is the propagation of noise with ranging impacts on the activity of human or animal life, most of which are very harmful. Large amount of increasing noise pollution has made human life prone to large number of diseases. To control and reduce the noise, the first step is to measure the noise. So the noise pollution monitoring system is developed using IOT. Initially the sensors are deployed on the areas like industries, schools, hospitals, railway stations etc.,. These sensors detect the sound levels in the above mentioned areas. An application is developed, and the detected noise levels are displayed in this application.

## OBJECTIVES:

- The main objective of this project is to utilize IoT data to raise public awareness about noise pollution.
- The awareness fosters a sense of responsibility among communities for reducing the environmental impact of noise pollution.
- Noise pollution monitoring contributes significantly to create quieter, healthier and sustainable living environment.

## FLOWCHART:



## IOT DEVICE SETUP:

### IoT Sensor Deployment:

A network of IoT noise sensors which are capable of measuring noise levels, collecting data at regular intervals are deployed in strategic locations throughout the area of interest, ensuring even coverage.

### Storage of data in real time data base:

Data collected from various sensors are stored in real time data base developed using firebase platform.

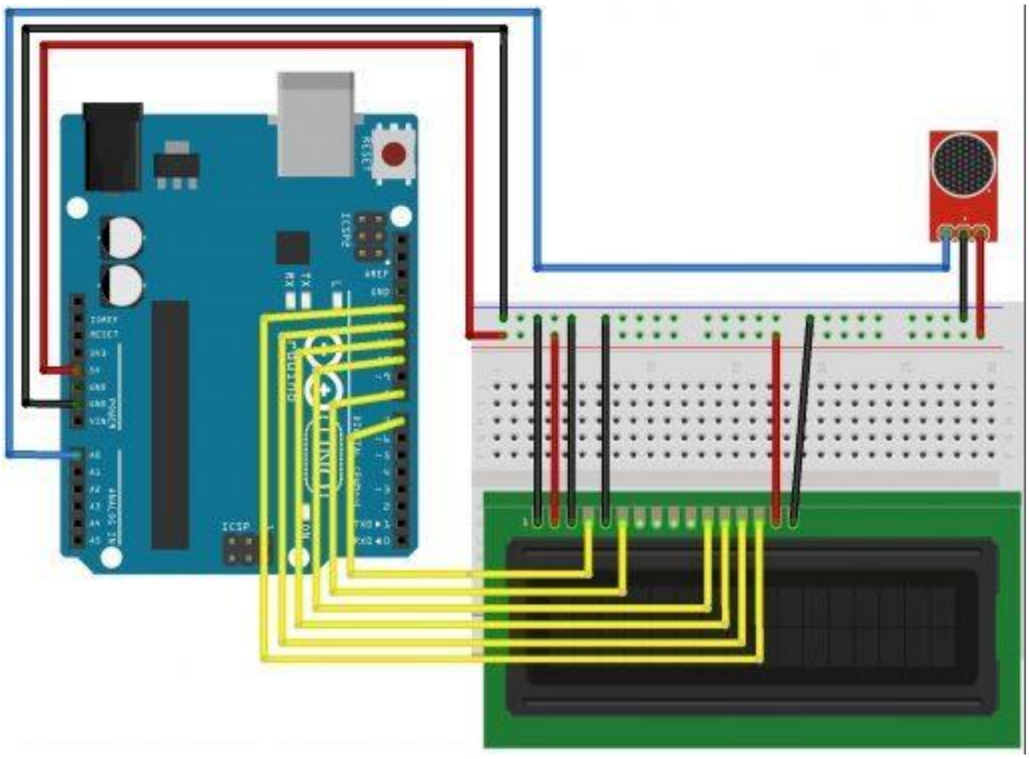
### App-development for data analysis:

An IoT-based app is developed using MIT app inventor that continuously collects and monitors noise levels in urban areas and creates real-time noise map which is used to identify high-noise areas and provide visualizations accessible to the public.

## IMPLEMENTATION:

### HARDWARE APPROACH:

### CIRCUIT DIAGRAM:

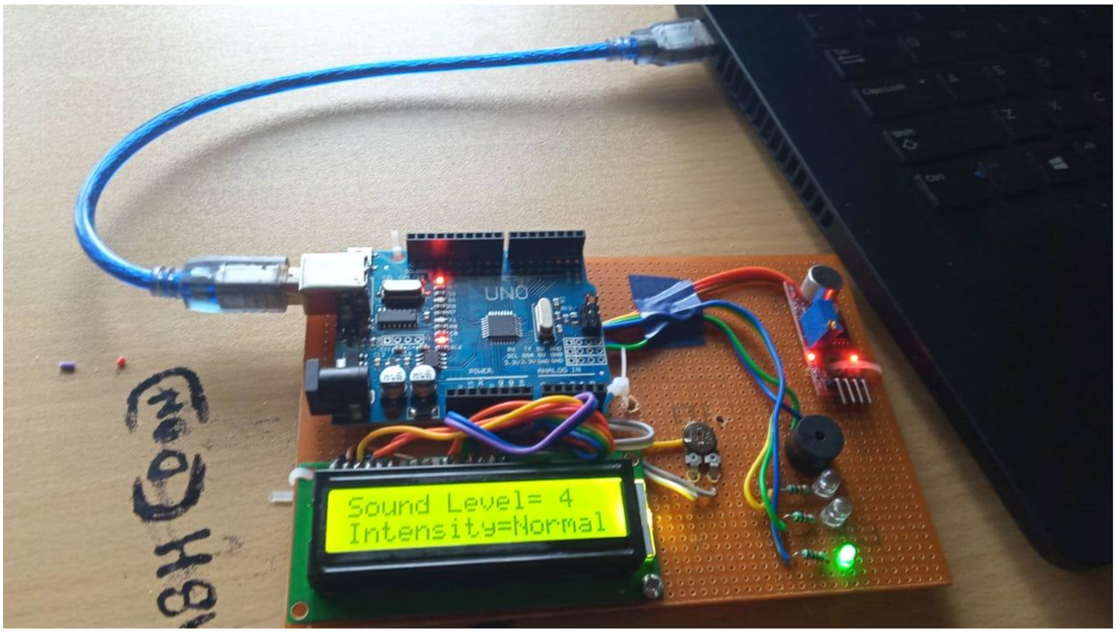


**PROGRAM:**

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(7,8,10,11,12,13);
int num_Measure = 128 ; // Set the number of measurements
int pinSignal = A0; // pin connected to pin O module sound sensor
int greenLed = 4;
int blueLed = 5;
int redLed =  6;
int buzzer = 3;
long Sound_signal;    // Store the value read Sound Sensor
long sum = 0 ; // Store the total value of n measurements
long level = 0 ; // Store the average value
int soundlow = 40;
int soundmedium = 200;

void setup ()
{
  pinMode (pinSignal, INPUT); // Set the signal pin as input
  pinMode (greenLed,OUTPUT);
  pinMode (blueLed,OUTPUT);
  pinMode (redLed,OUTPUT);
  pinMode (buzzer,OUTPUT);
  Serial.begin (9600);
  lcd.begin(16,2);
  lcd.print("Noise Detector");
  delay(1000);
}

void loop ()
{
  // Performs 128 signal readings
  for ( int i = 0 ; i <num_Measure; i ++)
  {
   Sound_signal = analogRead (pinSignal);
    sum =sum + Sound_signal;
  }

  level = sum / num_Measure; // Calculate the average value
  Serial.print("Sound Level: ");
  lcd.print("Sound Level= ");
  Serial.println (level-33);
  lcd.print(level-33);
  if(level-33<soundlow)
  {
    lcd.setCursor(0,2);
    lcd.print("Intensity=Normal");
     digitalWrite(greenLed,HIGH);
      digitalWrite(blueLed,LOW);
       digitalWrite(redLed,LOW);
```

```
      digitalWrite(buzzer, LOW);
      delay(500);
  }
  if(level-33>soundlow && level-33<soundmedium)
  {
    lcd.setCursor(0,2);
    lcd.print("Intensity=Medium");
     digitalWrite(blueLed,HIGH);
      digitalWrite(redLed,LOW);
       digitalWrite(greenLed,LOW);
        digitalWrite(buzzer, LOW);
       delay(500);
  }
  if(level-33>soundmedium)
  {
    lcd.setCursor(0,2);
    lcd.print("Intensity= High");
    digitalWrite(redLed,HIGH);
     digitalWrite(greenLed,LOW);
     digitalWrite(blueLed,LOW);
     digitalWrite(buzzer, HIGH);
  }
  sum = 0 ; // Reset the sum of the measurement values
  delay(200);
  lcd.clear();
}
```

**IMPLEMENTATION:**

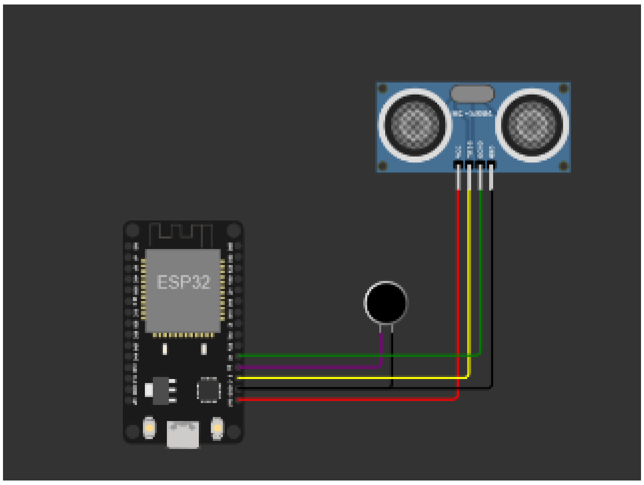


**CONDITION:**

- If sound level is less than 40dB, Green LED turns on, which denotes normal sound intensity.
- If sound level is in between 40-200dB, Blue LED turns on, which denotes medium noise intensity.
- If sound level is >200dB, Red LED turns on, which indicates very high level of noise.

**SOFTWARE APPROACH:**

**CIRCUIT DIAGRAM:**




**PROGRAM:**

```
import machine
import time
import urequests
import ujson
import network
import math

# Define your Wi-Fi credentials
wifi_ssid = 'Wokwi-GUEST'
wifi_password = ''  # 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
```

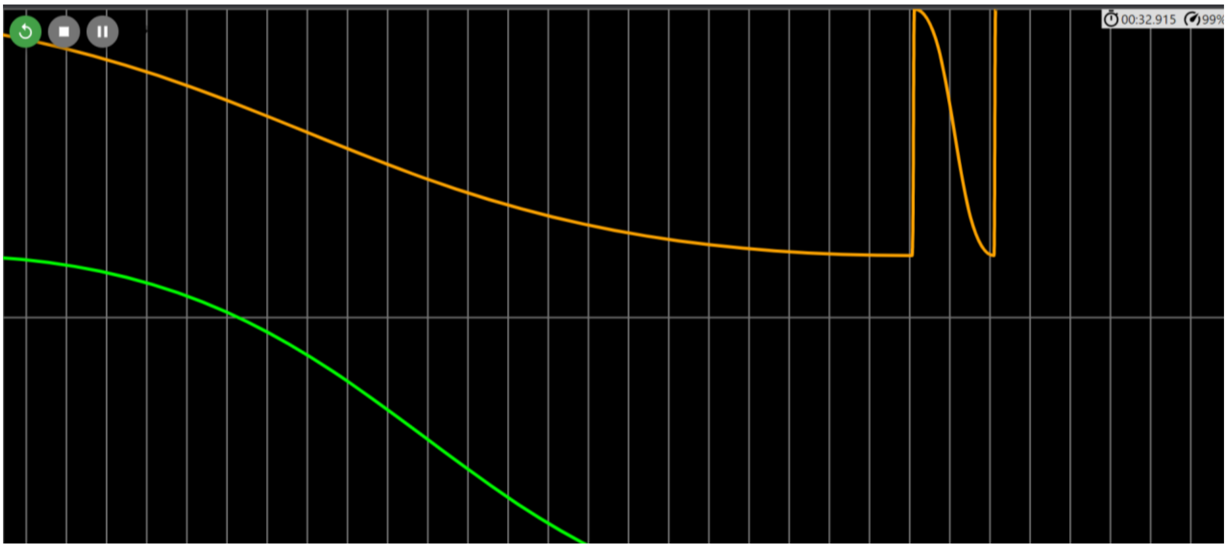
```
# Define ultrasonic sensor pins (Trig and Echo pins)
ultrasonic_trig = machine.Pin(15, machine.Pin.OUT)
ultrasonic_echo = machine.Pin(4, machine.Pin.IN)

# 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-monitori-9196a-default-rtdb.asia-
southeast1.firebasedatabase.app/'
firebase_secret = 'aANDKcKQEK3ky7G38Uuq5WDdvPP5OUmtBxsSMN2C'

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")
```

**WORKING:**

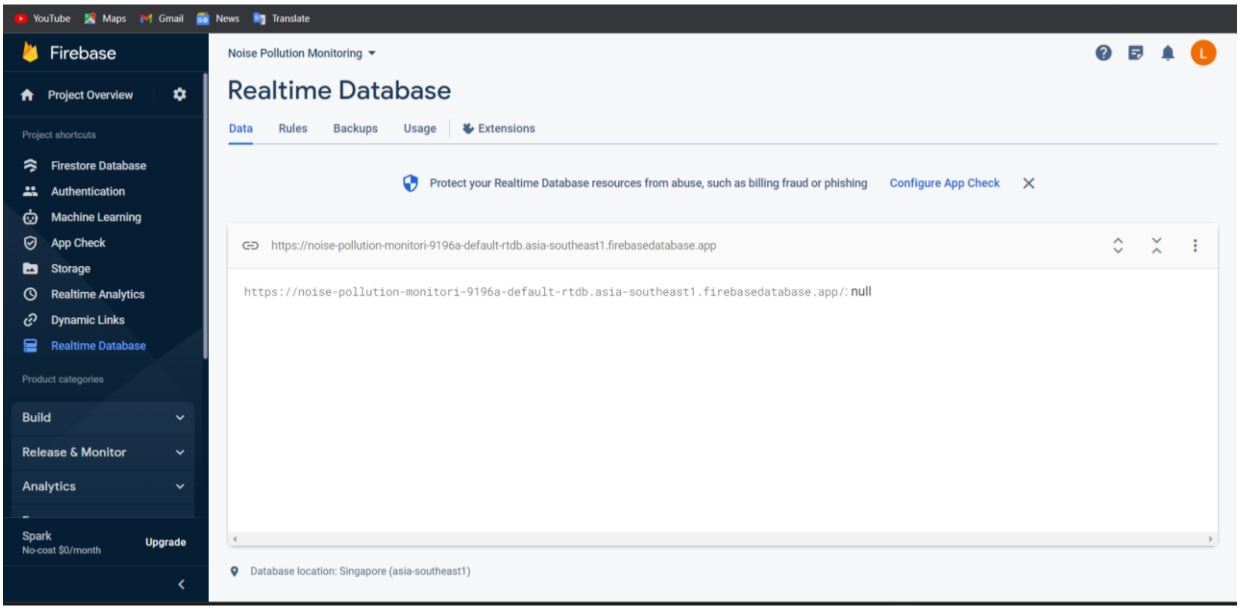
The circuit is simulated using wokwi. The real time data base is created in firebase whose URL and secret ID is added to this program. Real time noise data measured using sensor is sent to the firebase for data storage.

**SIMULATED OUTPUT:**



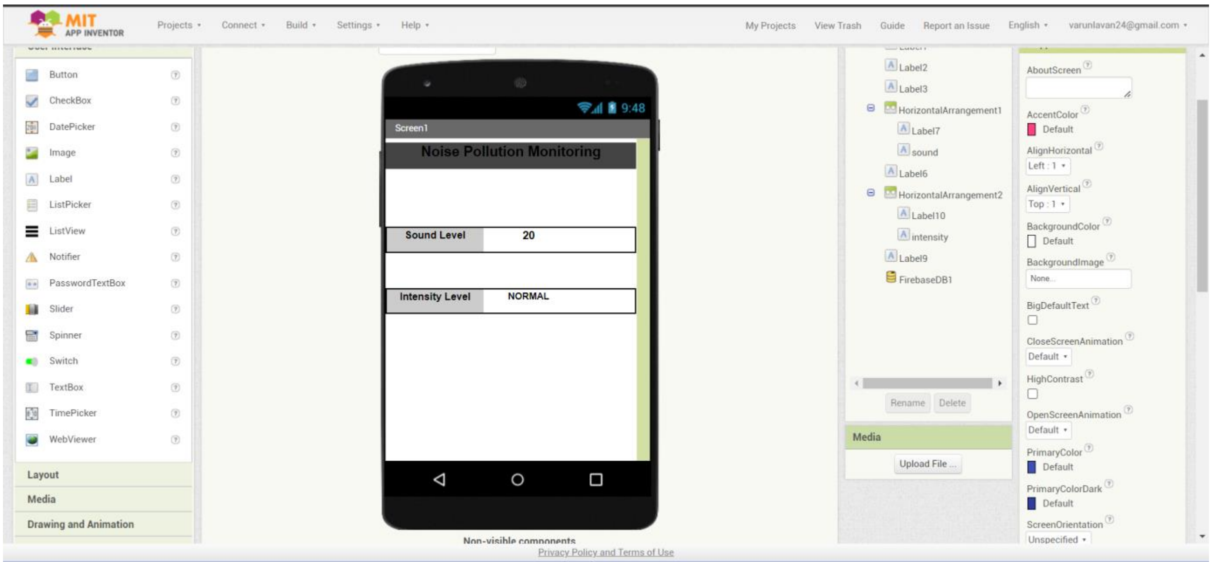
## REAL TIME DATABASE USING FIREBASE:

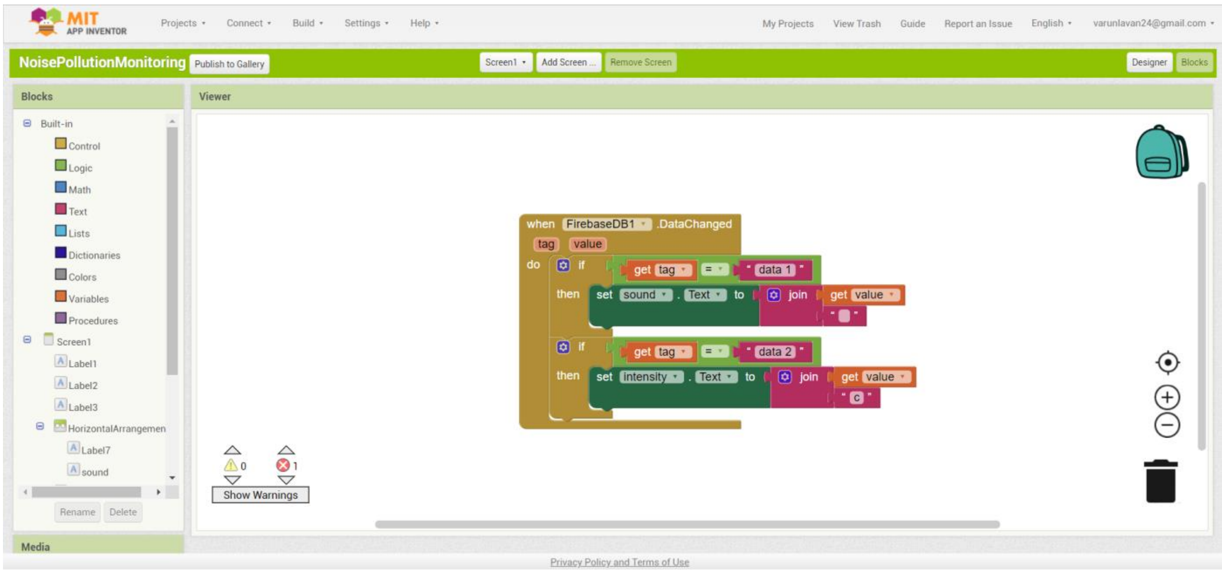
A real time database using firebase with necessary configurations was created, which is used to store the collected real time data which was detected by noise sensors.




## MIT INTERFACE:

The home page is developed using MIT app inventor. The home page shows the level and intensity of the noise.





## FUTURE ENHANCEMENTS:

- Noise pollution monitoring can be integrated into urban planning processes to design noise-resistant buildings and plan noise friendly urban spaces.
- The manufacturers should set a noise limit (a maximum of 70dB) during manufacturing the electronic devices like televisions and speakers etc.,.
- They should attach a noise monitoring sensors in each device.
- A sensing unit should be developed along with manufacturing unit.
- The sensing unit should monitor each device whether the device is working under the noise limit. If the device exceeds the limit then they should automatically reduce the volume.

## CONCLUSION:

Noise pollution has become one of the major problems for people which also affects the health of the inhabitants. So the system should be developed to major the amount of noise level and accordingly actions should be taken. In some cases noise pollution monitoring systems are integrated with other systems, like smart city, industrial noise control, to create real-time feedback loops for reducing noise.