ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 8, Special Issue 1, August 2021

Detecting Noise Pollution Using Green Technology

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Abstract

As per the Worldometer elaborations of the latest United Nations data, the current population of India is 1,394,346,143 as of Saturday, July 24, 2021. This decadal growth of urban population has been leading to many public health challenges especially environmental pollution. Actions that cause pollution are necessary to meet the growing population and its development, hence they are inevitable. Therefore preventive measures to minimize pollutants are more practical than their total elimination. It is here Green Technology plays a significant role.. Green Technology is the application of science and technology in generating energy to non-toxic cleaning products which are environment friendly. This technology intends to reduce the impact on humans on the environment. Green Technology has been around for the past two decades but recently started gaining more popularity due to increased alarming ecosystem issues. In this paper we will introduce how to apply green technology in detecting noise pollution.

Keywords: Green Technology

Introduction

Noise can be defined as an unwanted sound or a loud sound which is both harmful and annoying to ear. It can be the source of stress, and exposure to loud sound may result in negative effects on health.The cause of noise pollution are attributable to population density, urbanisation and the increasing use of more powerful and varied noise sources, including means of transport which is considered as one of the main sources of environmental noise. The problem of noise pollution is constantly expanding, producing negative effects from different point of view, affecting social, economic and work aspects, thus entailing a wide range of extra-auditory disturbances. A normal human ear could hear sound levels from 0dB

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to 140dB in which sound levels from 120dB to 140dB are considered to be noise. In this context, it is necessary to have a precise data on noise exposure levels. Once the noise sources have been ranked in order of importance in terms of their contribution to the overall noise problem, it is then useful to rank them in terms of which are easiest to do something about and which affect most people and hence, we could take this into account to decide which source has to be treated the first. Here we will introduce two main equipments used to detect noises around –Arduino Sound Level Meter and MK: 427 Noise Sensor.

1. Analysis of Noise Level in dB with Microphone and Arduino

Loudness or sound levels are commonly measured in Decibel (dB). Here we will use a normal Electret Condenser microphone with Arduino and try measuring the sound or noise pollution level in Db. We will use a normal amplifier circuit to amplify the sound signals and feed it to Arduino in which we will use regression method to calculate the sound signals in dB. To check if the values obtained are correct we use the "Sound Meter "android application else use better meter for calibration.

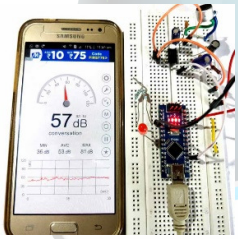

Figure: 1

Materials Required

1. Arduino UNO
2. Microphone
3. LM386
4.10K variable POT
5. Resistors and Capacitors

The use of 10k POT: A potentiometer is a simple knob that provides a variable resistance, which we can read into the Arduino board as an analog value.
The use of LM386: It is an integrated circuit containing a low voltage audio-power amplifier and suitable for battery powered devices.
The use of resistors: we use resistors to limit the amount of current going to certain components in the circuit, such as LEDs and integrated circuits.

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The use of capacitors: A decoupling capacitor's job is to supress high-frequency noise in power supply signals. If the power supply temporarily drops, a decoupling capacitor can supply power at the correct voltage. Decoupling capacitors connect between the power source and ground.
A Capacitor is used to filter the DC noise from Microphone.

Basically when the microphone senses sound the sound waves will be converted to AC signals. This AC signal might have some DC noise coupled with it which will be filtered by this capacitor. Similarly, even after amplification a capacitor C3 is used to filter any DC noise that might have been added during amplification. We have used the popular LM358 amplifier to amplify the signals from microphone. Along with amplifier we have also used two filters, the high-pass filter is formed by R5, C2 and the low-pass filter is used by the C1 and R2. These filters are designed to allow frequency only from 8Hz to 10 KHz, since the low pass-filter will filter anything below 8Hz and the High Pass filter will filter anything above 15 KHz. This frequency range is select is because the condenser microphone taken works only from 10Hz to 15KHZ.

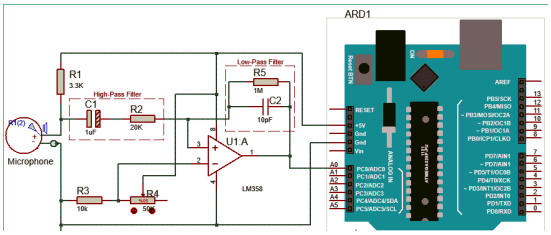

Figure: 2

Result

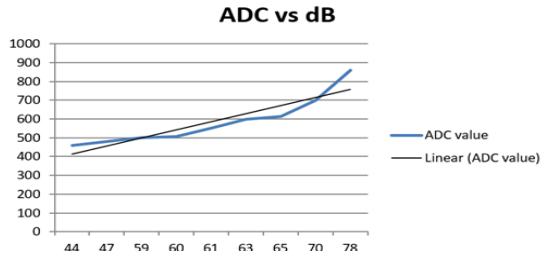

Figure: 3

As we can see the value of dB is not related linearly with ADC, meaning you cannot have a common multiplier for all ADC values to obtain its equivalent dB values. In such case we can utilize the “linear regression” method. Basically, it will convert this irregular blue line to the closest possible straight line (black line) and give us the equation of that straight line. This equation can be used to find the equivalent value of dB for every value of ADC that the Arduino measures.

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2. MK: 427 Noise Sensor

The MK: 427 Noise Sensor is an outdoor noise measurement instrument that has been specifically designed for integration with other data logging and monitoring systems. Unlike a conventional Sound Level Meter, the MK:427 Noise Sensor converts the noise level in decibels into an industry standard 4-20mA output which can be connected to standard DCS/SCADA based systems to add a noise measurement capability. The analogue electronics are highly reliable and operate without any user intervention. No specialist acoustic knowledge is required – simply power-up the Noise Sensor and the measured noise level is continuously fed to the output. The MK:427 Noise Sensor has proved to be a robust, reliable sensor over many years and has been used across a wide range of industries including power generation, construction, demolition, large scale manufacturing sites and public utilities.

Figure: 4

Noise Sensors are:

- Self-contained noise sensor for integration with external data loggers & monitoring systems
- Purpose designed for long term environmental noise monitoring
- Designed for integration into existing environmental conditioning systems like SCADA or DCS Systems
- Industry standard 4-20mA output
- Automatic calibration with electrostatic actuation
- Weatherproof and suitable for most outdoor applications with a range of mounting solutions and an IP65 rating
- Designed & manufactured by Cirrus Research plc.

Some Key features of MK: 427 Noise Sensor

- Robust, fully weather protected Class 1 outdoor microphone
- Eliminates the need for third party software
- Proven long term reliability in harsh outdoor environments
- Outdoor Windshield and bird spikes to protect the microphone

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- Entire length of the MK:427 Noise Sensor is 1m
- Simple mounting and installation for quick deployment
- IP65 rating for long-term outdoor noise measurements

General Guidance for Positioning MK: 427 Noise Sensor

- It is usually worth conducting a noise survey, or referring to measurement data from a recent noise survey to understand the noise profiles for the area.
- Install the sensor at a location nearby to where the environmental noise is most likely to cause annoyance to neighbouring residential areas or other sites.
- Try to mount the unit away from obstacles and building walls.
- The microphone should always be a minimum of 1.2 – 1.5m above the ground level.
- Avoid, where possible, overexposed areas where high wind speeds will affect the noise level reading.

Advantages of MK: 427 Noise Sensor over Arduino Sound Level Meter

- MK:427 Noise Sensor converts the noise level in decibels into an industry standard 4-20mA output which can be connected to standard DCS/SCADA based systems to add a noise measurement capability.
- Long term reliability in harsh environments
- It eliminates the need for third party software
- Fully weather protected class 1 microphone
- Weatherproof and suitable for most outdoor applications

Conclusion

In the recently published guideline by the World Health Organization for the burden of disease from environmental noise, it is concluded that future epidemiological noise research will need to focus on vulnerable groups such as children, older people, and lower socioeconomic groups. From this research paper, out of the two equipments Arduino Sound Level Meter and MK: 427 Noise Sensor, which are commonly used to detect environmental noise, we come to know that the latter has far more advantages and long term use. Since MK: 427 Noise Sensor is eco-friendly as well as a remedy for noise pollution out of the two, we can expect to control noise pollution to some extent with its increased use.

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