

IOT BASED NOISE POLLUTION MONITORING SYSTEM

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Introduction

Pollution is the presence of any foreign object in the environment which has a harmful effect . We as a society have to ensure that all the pollution levels are maintained to the minimum. In today's world, pollution is the biggest concern.

Noise is more than a mere nuisance. At certain levels and durations of exposure, it can cause physical damage to the eardrum and the sensitive hair cells of the inner ear and result in temporary or permanent hearing loss, known as noise-induced hearing loss.

In addition to causing hearing loss, excessive noise exposure can raise blood pressure and pulse rates, cause irritability, anxiety, and mental fatigue, and interfere with sleep, recreation, and personal communication. Children living in areas with high levels of noise pollution may suffer from stress and other problems, such as impairments in memory and attention span. Noise pollution control is therefore important in the workplace and in the community.

Noise pollution is a prevailing issue these days in most of the cities. We propose a noise pollution monitoring system that enables us to monitor the sound pollution in a particular area easily by the use of IOT. Our system uses sound sensors to sense the sound levels and constantly transmit this data to the microcontroller. This will allow authorities to monitor air pollution in different areas and take action

against it. Also, authorities will be able to keep a watch on the noise pollution near No Honking Areas, and the system will alert them if the levels of pollution exceed.

IOT

The internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

An IoT ecosystem consists of web-enabled smart devices that use embedded systems, such as processors, sensors and communication hardware, to collect, send and act on data they acquire from their environments. IoT devices share the sensor data they collect by connecting to an IoT gateway or other edge device where data is either sent to the cloud to be analyzed or analyzed locally. Sometimes, these devices communicate with other related devices and act on the information they get from one another. The devices do most of the work without human intervention, although people can interact with the devices -- for instance, to set them up, give them instructions or access the data.[1]

Literature Review

Our proposed system ensures that we keep a track of the rise and fall of the pollution levels in the area. Our system makes sure that the environment in the designated area is maintained at optimum quality, if not alert the concerned authorities. This system will also send updates to the authorities when there is a change in the pollution levels. The app will show the levels and also show the GPS location of the mobile and according to the location it will display all the related information of the area. We plan of expanding this idea, for centralised data collection, so that all the authorities can keep a good watch on degrading state of the environment. Our app will have an easy to use UI, this will in return help the user to search the pollution levels of different places, this idea will keep the thought of the degrading state of the environment in the users mind. This system will be placed in the areas with high pollution levels. This is important so that we have a database of all the pollution levels of the area. The app helps us display these levels to the user. [2]

Designed to implement an efficient monitoring system through which the required parameters are monitored remotely using internet and the data gathered from the sensors are stored in the cloud and to project the estimated trend on the web browser.

Wireless Sensor Networks (WSN) is gaining the ground in all sectors of life; from homes to factories, from traffic control to environmental monitoring. [3]

Due to the rapid growth in the industries and vehicles in the recent years, there has been a simultaneous increase in the air and sound pollution in the cities. So a proper Sound pollution monitoring system is required in order to efficiently manage the pollution and to properly plan the growth of the cities. Our system is made up by connecting the Air and Sound sensors with a microcontroller, which uses a Wi-Fi module to transmit the data to the server. With our system, we are proposing an efficient, remote

way to monitor the air and sound pollution which will help the responsible authorities to take a suitable action as per the requirement.[4]

Working

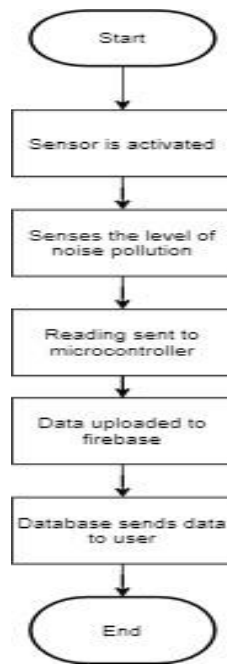


Fig: Flowchart of working of the system

The proposed system is an IOT based noise pollution monitoring device which measures the instantaneous pollution in the location where the system is designed by transmitting data over the internet using IOT

Our device will be installed in locations that are prone to noise pollution such as airports, industrial zones and heavy traffic areas.

Here the sensors are activated when there is a rise in the noise levels, which is then read by the microcontroller. These readings are then uploaded to the firebase over the internet using the Wi-fi module, it also allows one to access this data through a Web UI.

Component Analysis

Hardware Components

Sr.no	Hardware Component	Description
1	Arduino Uno	Open source microcontroller
2	Wifi Module	ESP8266
3	Microphone	Grove sound sensor
4	Power Supply	9V
5	LCD	16*2

Software Used

Sr.no	Software Component	Description
1	Arduino IDE	Program microcontroller
2	Proteus	Online simulation of circuit
3	Firestore	Real time Database
4	ML	Web UI Development

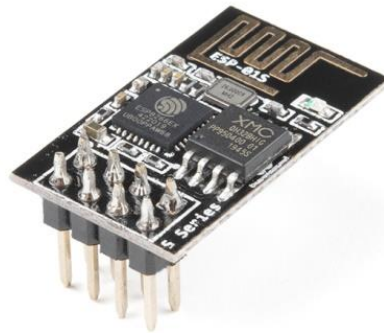
- 1) **Arduino Uno**: The Arduino UNO is an open-source microcontroller board. The board is equipped with sets of digital and analogue input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. It is programmable with the Arduino IDE. We can power it up by a USB cable or by an external 9-volt battery.



Microcontroller	ATmega328P – 8 bit AVR family microcontroller
Operating Voltage	5V
Recommended Input Voltage	7-12V
Input Voltage Limits	6-20V
Analog Input Pins	6 (A0 – A5)
Digital I/O Pins	14 (Out of which 6 provide PWM output)
DC Current on I/O Pins	40 mA
DC Current on 3.3V Pin	50 mA
Flash Memory	32 KB (0.5 KB is used for Bootloader)
SRAM	2 KB
EEPROM	1 KB
Frequency (Clock Speed)	16 MHz

[7]

- 2) **ESP8266 WI-FI MODULE**: The ESP8266 is a low-cost Wi-Fi microchip. This small microchip module allows microcontrollers to connect to a WiFi network. In this system, the module will send the data to the cloud servers.



Specification and Pin-Out of Wi-Fi module:

- 802.11 b/g/n protocol
- Wi-Fi Direct (P2P)
- Integrated TCP/IP protocol stack
- +19.5dBm output power in 802.11b mode
- Integrated temperature sensor
- Supports antenna diversity
- Power down leakage current of $< 10\mu\text{A}$
- Integrated low power 32-bit CPU could be used as application processor

- 3) **GROVE SOUND SENSOR** :The Grove Sound Sensor can detect the sound intensity in its environment. The main module of this sensor is a simple microphone based in the LM386 amplifier and an electret microphone. In our system, this module will be sending analogue outputs based on the intensity of sound to the Arduino board which will be further sending the output to online servers using ESP8266 Wi-Fi module.



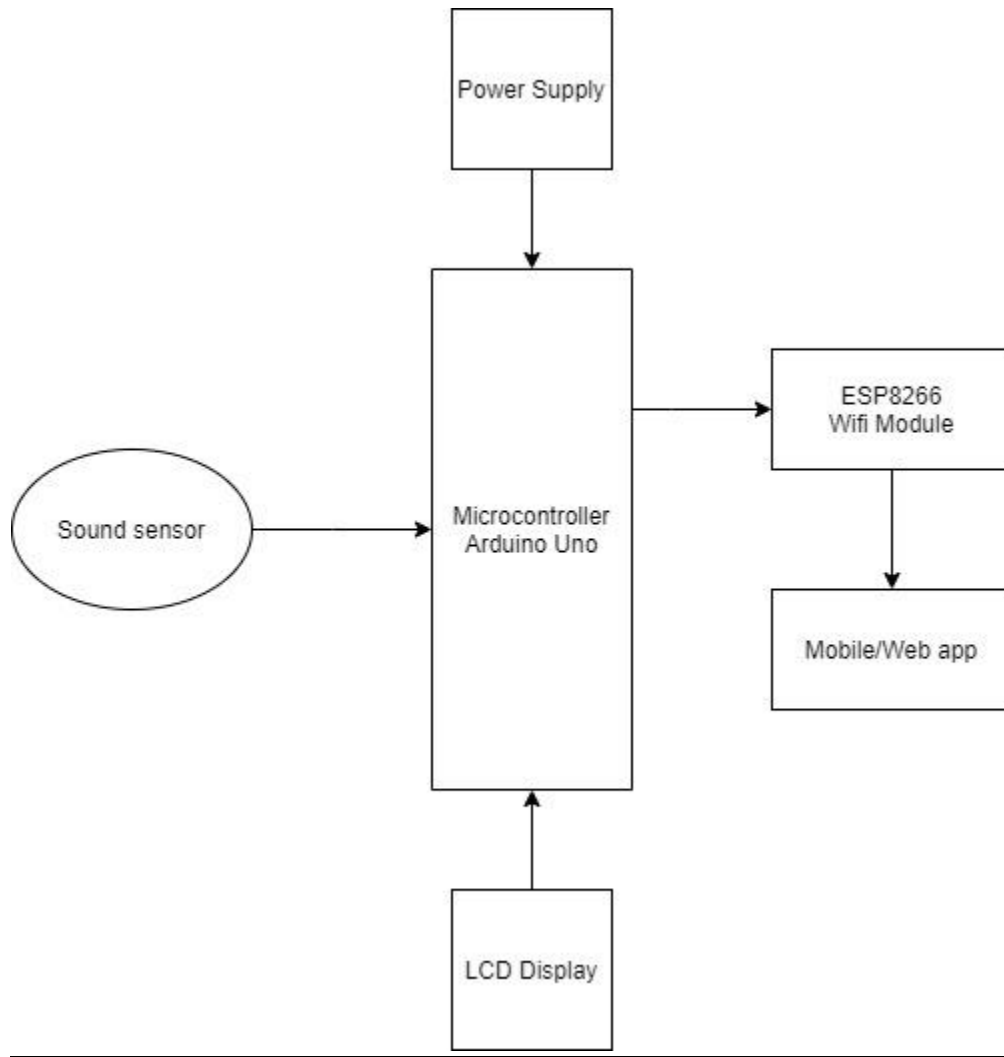
Specification of Sound Sensor:

- Operating voltage 3.3V-5V
- Output model: digital switch outputs (0 and 1, high or low level)
- Voltage Gain 26dB
- Microphone Impedance 2.2k Ω
- Microphone Frequency 16.20 kHz

- 4) **Arduino IDE:** A program for Arduino may be written in any programming language for a compiler that produces binary machine code for the target processor. Atmel provides a development environment for their microcontrollers, AVR Studio and the newer Atmel Studio. The Arduino project provides the Arduino integrated development environment (IDE), which is a cross-platform application written in the programming language Java. It originated from the IDE for the languages Processing and Wiring.
- 5) **Proteus:** The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and electronic technicians to create electronic schematics and electronic prints for manufacturing printed circuit boards.
- 6) **Firebase:** The Firebase Real time Database is a cloud-hosted NoSQL database that lets you store and sync data between your users in realtime. NEW: Cloud Firestore enables

you to store, sync and query app data at global scale. Firebase is Google's mobile application development platform that helps you build, improve, and grow your app

Block Diagram



Applications

- Can be used for monitoring no honking zones like hospitals and schools

- Allows selection of site to be monitored
- Allows Indoor Air Quality Monitoring.
- Design server using IoT and upload data on that server with date and time.
- This data available and accessible to all
- To set limit on that server and inform the authorities to take action for wellbeing.

Updates

The app can have an extra feature of a chatbot, where the chatbot informs the user can the estimated pollution level without actually going there.

Result

The sound pollution monitoring system monitors noise pollution using a web application. It shows the digital value noise pollution and user can analyse it with the help of a graph. It becomes very easy for us to rectify the level of noise pollution around and plan for a healthy living and surrounding. The figures that are included in our paper shows the way the system works and how the output is obtained from the input after processing.[5]

Conclusion

The Automatic Sound management system is a step forward to contribute a solution to the biggest threat. The noise monitoring system overcomes the problem of the highly-polluted areas which is a major issue. It supports the new technology and effectively supports the healthy life concept. This system has features for the people to monitor the amount of pollution on their application. So, it becomes very reliable and efficient for the Municipal officials along with the Civilians to monitor environment. Letting civilians also involved in this process adds an extra value to it. As civilians are now equally aware and curious about their environment, this concept of IOT is beneficial for the welfare of the society. And it is implemented using the latest technology.[6]

References

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