NOISE POLLUTION MONITORING SYSTEM

INTRODUCTION

According to a WHO report half of India live in noisy surroundings and one third of Indians experience sleep disturbances due to traffic noise. One fifth of Indians are regularly exposed to sound levels at night that could significantly damage health. There should be a system which shall quantity the noise coming from railways, major airports, highways and other sources of noise. Noise maps are based on numerical calculations and having display to give good measures of long term averaged noise level. However, these maps does not take into account the variation of the noise levels, temporary construction work, emergency vehicles, squeak from hanging brakes on

trains etc [1]. Automatic environmental noise monitoring has been around for many years, but it is in use since last few years. There are several reasons for using such system like communication become faster, cheaper and more reliable. Automated noise monitoring system with real time access to noise data should be implemented for measuring noise level and for taking actions accordingly.

ENVIRONMENTAL NOISE ASSESSMENT

Nowadays measurements of environmental noise in urban areas are only carried out by officials who collect data at different set of locations e.g. railways, airports and industrial estates by setting up noise level meters during a short span of time. Broadcasting models are then used to generate noise maps by extrapolating local measurements to wider areas. This practice has limitations, notably regarding the requirements of the Indian Noise Directive [4]. Spatio-temporal data graininess, computational models frequently produce results with an undetectable error margin, which may lead to wrong conclusions. The cost of noise mapping campaigns is high due to need of human resources and expertise, the deployment of expensive noise level meter devices and the processing effort. This restricts cities with limited budgets from conducting such assessments for noise monitoring[4][5].

ALTERNATIVE APPROACH

In past few years we have seen an increasing interest in wireless sensor networks for urban sensing and environmental monitoring. A WSN [2] is network consisting of autonomous devices using sensors to cooperatively monitor parameters like temperature, humidity, pressure, noise pollution conditions at different locations. Wireless sensor networks have the power to revolutionize noise pollution monitoring. Wireless Sensor Network uses large numbers of simple and cheap sensor devices [2]. Sensors are embedded into the environment and operate simultaneously. We can combine this network with the IoT based noise pollution monitoring device. Internet of things mean interrelated device which communicate without the interaction of humans. Using such device we can monitor the level of noise pollution, and after collecting data we can take action accordingly. IoT based noise pollution monitoring device is shown in below figure.

In this IOT device, the equipment can be used are given below:

1) Arduino
2) Sound sensor
3) Open log
4) Groove OLED Display
5) Electric Imp
6) Power from 5v DC to DC setup – 2xAA

The reason we decided to use IoT based device is that there is no need of human interaction. They are interrelated computing devices and having ability to transfer data over network without human-machine interaction. The reason for using arduino micro controller[6] is, it consist of both physical and programmable circuit and piece of software. In this device circuit board is programmed to monitor the noise pollution, which is done using the sound sensor which can collect data of noise level and then data is stored locally in memory card attached in this device. Display can also be attached to device so that we can check data and analyze it. Data is also stored on particular server using electric imp. Electric imp is very powerful for the IOT devices to connect with network. In electric imp code libraries already exists to send data from imp to services.

ADVANTAGES AND DISADVANTAGES

Advantages: IoT[7] based noise pollution monitoring system is a machine to machine communication system so data to be recorded will have great accuracy. Also devices are wirelessly connected so automation and controlling of it becomes an easy task for a person. It can record data without any human interaction. This system saves good amount of time because once it is installed, it works automatically. we just have to read the data and analyze it. Most of the current noise pollution recording devices are costly compared to the IoT based devices, they are cheap so they will save good amount of money also.

Disadvantages: As this devices are interconnected via internet there are possibilities that they can get hacked or monitored by malicious users or can be tracked by other systems as well. So the security of the recorded data can be an issue using this type of devices.

APPLICATION OF IOT BASED NOISE POLLUTION MONITORING

- We can use it at industrial area as there is lot of noise pollution.
- In city roads traffic noise
- Activities like shooting, open air events, football and cricket matches.
- At small level, in schools and colleges we can use this device.

Measurement of Noise Level Using Noise Testing Equipment

Noise Level Monitoring – Perfect Pollucon Services

Sound/Noise level meter equipment measures noise pollution. It consists of several parts, mainly Microphone, Pre-amplifier, frequency weighting, Processor, Display System, communication System and Power

communication System and Power Supply. dB(A) Leq denotes the time-weighted average of the level of sound in decibel on scale A which is relatable to human hearing.

A "**decibel**" is a unit in noise measurement. "A", in **dB (A) Leq**, denotes the frequency weighting in the **measurement of noise** and corresponds to frequency response characteristics of the human ear.

Leq: It is an energy mean of the noise level over a specified period.

Noise level Survey schedule is planned in such a way that it covers the noise generation by normal daytime activities i.e. from 08:00 am to 10:00 pm and a part of nighttime activities i.e. 10:00 pm to 12:00 am (at night).

Due to the increase in noise pollution in recent years, it is recommended to conduct a **measurement of noise**

recent years, it is recommended to conduct a **measurement of noise pollution** program on company premises.

Table 1. Data Analysis from Prototype.

Time	Weekend (Saturday) (dBA)	Weekday (Sunday) (dBA)	Allowable Noise Level according to Environmental Department of Malaysia (dBA)	Permissible Level of Comfort according to CIBSE (dBA)
Morning 7.00am-12.00pm	47 – 60	57 – 71	55	60
Afternoon 12.01pm-14.00pm	43 – 49	54 – 69	55	60
Evening 2.01pm-7.00pm	43 – 49	62 – 69	55	60
Night 7.01pm-12.00am	42 – 59	48 – 63	55 (7.01pm–10.00pm) 45 (10.00pm– 12.00am)	60
Midnight 12.01am-6.59am	34 – 35	34 – 35	45	60

The allowable noise level that is suggested for researched area is below 55dBA for daytime and 45dBA for night. This justification is based on the researched area which is categorized as medium density residential area. Based on CIBSE, 60dBA is the maximum allowable sound level to achieve comfort in a building. Any sound that exceeds 60dBA will interrupt the speech intelligibility and the learning process. Based on Table 1, during weekend, the sound level in the morning and night are in between 47dBA to 60dBA and 42dBA to 59dBA. It shows that noise problem does occur during that time because the value of 55dBA is included in the range. As for afternoon, evening and midnight, all readings of sound level are below the allowable noise level standard which are during afternoon (43dBA – 49dBA), evening (43dBA – 49dBA) and midnight (34dBA -35dBA). Thus, during these times, noise problem does not occur. As for weekend, the suitable time for students to study is the whole day starting from morning until midnight because all readings are showing that they are within permissible level of comfort which is 60dBA.. As for weekday, the sound level during morning until night are all above the allowable noise level standard which are; morning (57dBA – 71dBA), afternoon (54dBA – 69dBA), evening (62dBA – 69dBA) and night (48dBA – 63dBA). It can be concluded that during that specific time, the noise problem does occur. As for midnight, the sound level recorded is 34dBA to 35dBA which indicates no noise problem. The reading at midnight also shows that it is less than 60dBA which makes it a comfortable study time for students.

1. Field Data Collection

- Construction site terrain
- Meteorological data
- Noise sensing data

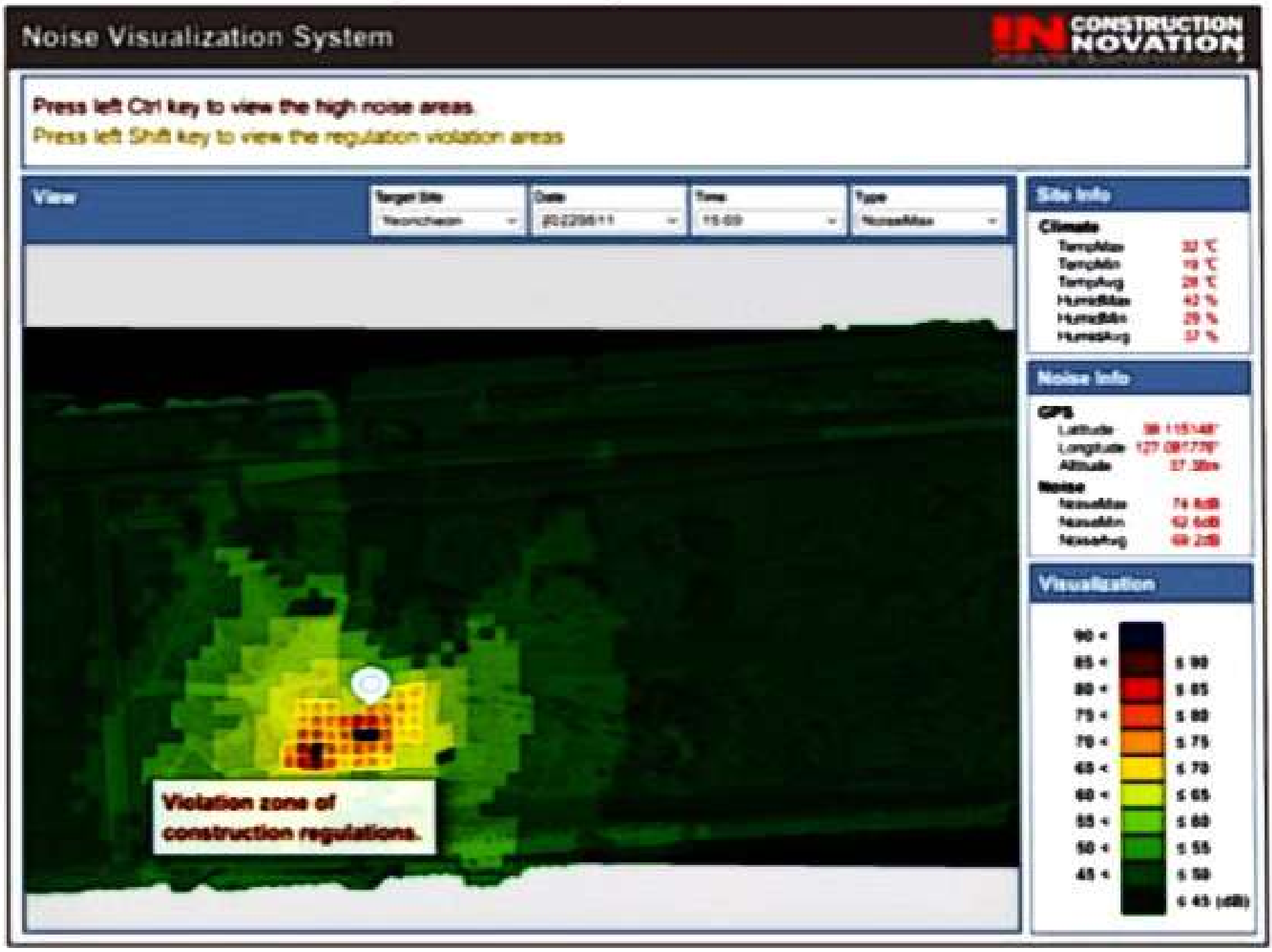
2. Development of Noise Estimation Model inside the Construction Site

- Field constraints identification to be considered when installing sensors on construction site
- Development of noise-customized spatial interpolation model

3. Development of Noise Estimation Model in the Nearby Region

- Obstacle modeling
- Noise source modeling
- Development of real-time construction noise propagation model

UI Module for Noise Information Visualization

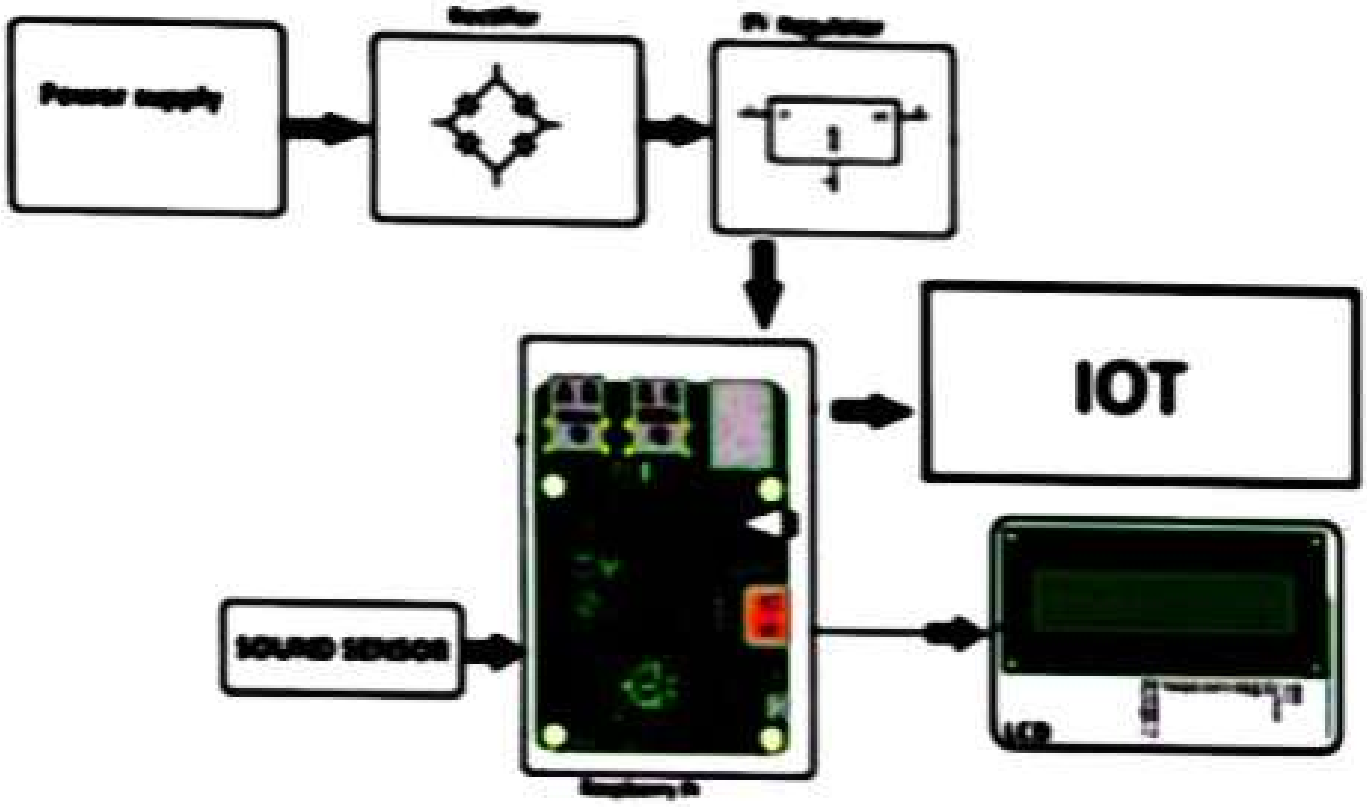


Types of Noise Pollution

Following are the three types of pollution:

- Transport Noise
- Neighbourhood Noise
- Industrial Noise

Block Diagram:



HARDWARE SPECIFICATIONS:

- Sound Sensors
- Node MCU (ESP8266 Wi-Fi SoC)
- Wi-Fi Modem
- LCD Display
- LED's
- Transformer
- Resistors
- Capacitors
- Diodes
- Relay

SOFTWARE SPECIFICATIONS:

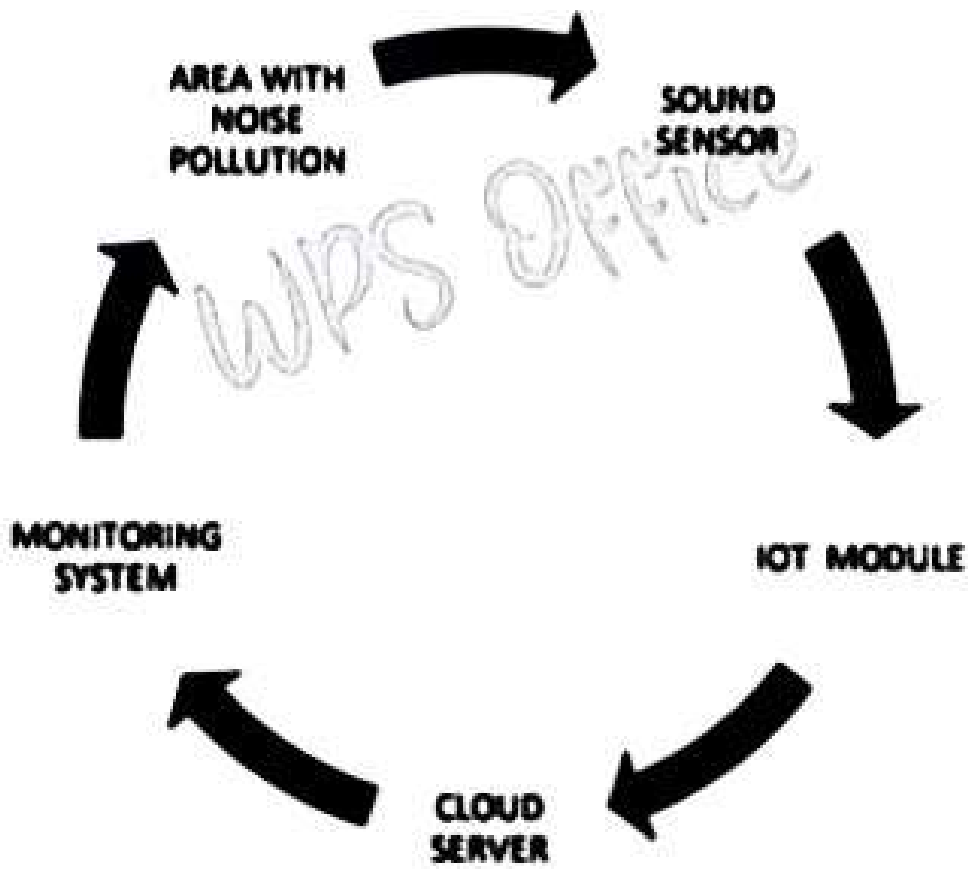
- Arduino IDE
- MC Programming Language: C

WORKING PRINCIPLE:

The sound sensor senses the rate of noise as a analog value then its send the analog value through relay to the Node MCU where the Microcontroller reads the value and send it to the cloud server. The sound sensor works on the principle of the vibration of the diaphgram is converted by the sensor into an electrical signal that is sent to the LEGO brick, which knows that sound is

heard. The values are in analog which is made possible through use of Relay as Node MCU only posses one analog pin, the Relay provides 200ms delay which make the reading of 5 different analog reading possible through one analog pin of Node MCU The corresponding values are then send to Microcontroller where with the help of coding a threshold values are set which compares the data from the sensors to the set threshold values. Then these data are send to the server where the server app token is included in the coding done where the server cloud is defined. The app is customized in user friendly way where a gauge for sound sensor value is designed showing the level of noise in dB. Its done in such a way that user can easily understand the effect of the noise pollution in their or any other area.

SUMMARY:



CONCLUSION:

This research proposed a noise pollution monitoring system that constantly keeps track of noise polluted in an area and displays the rate of noise polluted is measured on an application named Blynk Through IOT platform where a device connects with internet on real time slot. The system helps to create awareness of noise pollution in our dailylife. This monitoring device can deliver real-time measurements of noise in a user friendly way.