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IOT based Air and Sound Pollution Monitoring System

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Abstract: ***Now a day in metropolitan cities air and noise pollution becomes serious issues, due to high decibels and toxic gases present in the environment which directly effect on human health and thus needs a special attention. Therefore, it has now become necessary to control the pollution (air and noise)to ensure healthy livelihood and better future. In this paper, an effective implementation for Internet of Things is used for monitoring atmospheric conditions of environment like air pollution and sound pollution. This paper presents a conceptual architecture for a versatile, flexible and cost efficient for monitoring the air and sound quality of a particular site. This system propose an air quality as well as sound pollution monitoring system that allows us to monitor and check live air quality as well as sound pollution in an area through IOT. System uses air sensors to sense presence of harmful gases/compounds in the air and constantly transmit this data. Also, system keeps measuring sound level and reports it.***

Keywords: Sound level, Gases, IOT, Pollution, Sensor

I. INTRODUCTION

In this paper System uses air sensors to sense presence of harmful gases/compounds in the air and constantly transmit this data. Also, system keeps measuring sound level and reports it. The sensors interact with raspberry pi which processes this data and transmits it over the application. This allows authorities to monitor air pollution in different areas and act against it. Also, authorities can keep a watch on the noise pollution near schools, hospitals and no honking areas, and if system detects air quality and noise issues it alerts authorities so they can take measures to control the issue. Some future consumer applications envisioned for IOT sound like science fiction, but some of the more practical and realistic sounding possibilities for the technology include: Receiving warnings on your phone or wearable device when IOT networks detect some physical danger is detected nearby. Self-parking automobiles. Automatic ordering of groceries and other home. Automatic tracking of exercise habits and other day-to-day personal activity including goal tracking and regular progress reports. Network Devices and the Internet of Things All kinds of ordinary household gadgetscan are modified to working an IOT system. Wi-Fi network adapters, motion sensors, cameras, microphones and other instrumentation can be embedded in these devices to enable them for work in the Internet of Things. Home automation systems already implement primitive versions of this concept for things like light bulbs, plus other devices like wireless scales and wireless blood pressure monitors that each represents early examples of IOT gadgets.

II. LITERATURE SURVEY

The air and sound pollution monitoring system is absolutely important for detecting wide range of gases, also sensors have long life time, easily available, less cost, easy to handle and are compact. Quality of air can be checked indoor as well as outdoor. This system has simple drive circuit, works on real time and has visual output. The main objective of this paper is to ensure that the air and sound pollution is monitored and kept in control by taking measure accordingly. The proposed paper have certain limitations regarding humidity which should be less than ninety-five percent and exact measurement of contaminating gases cannot be detected in ppm. This paper can be used for monitoring pollution level and also to prevent excess of pollution which can cause huge problem in future. This paper gives an idea on how user can give instant alert to the authorities. The cost effective IOT technology is used. Hence air and sound pollution is monitored by using this technology.[1]

The motive of making a smart city can be fulfilled by using technology, thus making the life better and also enhancing the quality of services, therefore meeting every individual's needs. With modern technology in fields of information and communication, it has become easy to interact with the authorized people of city to tell the where abouts of the area or city, how well the city is developing and how to make it possible to achieve a better life quality. In this system, an application was created to make one more step in the fulfillment of the goal. An area is analyzed for evaluating how much pollution is affecting the area. The components of gases and their amounts are calculated and checked. If the amount is higher than normal then the officials are reported about it. After that the people are made to clear the area and taken to a safe place. The combined network architecture and the interconnecting mechanisms for the accurate estimation of parameters by sensors is being explained and delivery of data through internet is presented [8].

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The Automatic Air & Sound management system is a step forward to contribute a solution to the biggest threat. The air & sound 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 mobile phones using the 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.[2]

This IOT based air and noise pollution monitoring device is a great step towards a healthy livelihood. With the help of this device not only the municipal authorities but even the common people can participate in the process of controlling pollution and ensure safe environment. These automatic devices, once installed are capable of continuously tracking the pollution level and analyze the detected information. The most highlighting feature of this device is that the output is represented in digital as well as analog format with the help of a simple mobile application which is usable on all android devices like smart phones, tablets, PDA's etc. The device itself is very eco-friendly and does not harm the environment in any way. Moreover, it is based on one of the modern technology and also inexpensive as compared to other technologies developed so far and can be installed anywhere.[3]

For creating the system, first author did the research based on the system about IOT and various sensors. Sensors of air and sound based on availability and economical price were selected. For the interaction of internet with the system using a Wi-Fi module which is connected to the microcontroller through the serial port. So, the measured data is sent from the module to any location with its range from the data can be fetched using a laptop /mobile[4].

The Automatic Air & Sound management system is a step forward to contribute a solution to the biggest threat. The air & sound 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 mobile phones using the application. To implement this need to deploy the sensor devices in the environment for collecting the data and analysis. By deploying sensor devices in the environment, system can bring the environment into real life i.e. it can interact with other objects through the network. Then the collected data and analysis results will be available to the end user through the Wi-Fi. The data can be an important source when addressing the issue of the impacts of motorcycles at idles (e.g. waiting for a green light) on air quality. Moreover, to achieve real-time monitoring, the data of CO concentration in a particular place could be reviewed from mobile communication devices, such as PDAs, smart phones, and tablet PCs to help keep air quality in check.[5]

III. PROBLEM DEFINATION

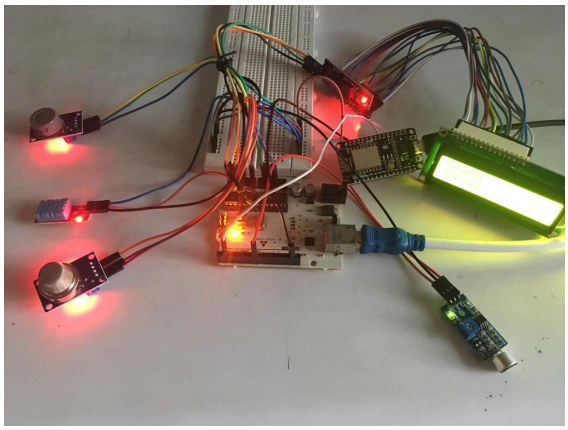
A. Air and sound pollution is a growing issue these days. It is necessary to monitor air quality and keep it under control for a better future and healthy living for all.

B. Here system propose an air quality as well as sound pollution monitoring system that allows us to monitor and check live air quality as well as sound pollution in particular areas.

IV. PROPOSED SYSTEM

This system is made to fulfill the purpose and need of the society to monitor and check the live air quality and sound pollution in an area through IOT. The system uses air sensors to check the presence of harmful and hazardous gases/ compounds [such as Methane, propane, Butane, alcohol, noxious gases, carbon monoxide etc.] in the air and also uses the sound sensor to keep measuring sound level in the surroundings. MQ2 is the air sensors which are used to collect air pollutants and a sound sensor module mic is used to capture sound. These sensors interact with Arduino which processes this data and then transmit it over the mobile application. To send the data over remote location WIFI modem is also installed. And whenever the air pollution is detected, a buzzer immediately beeps and when there is a noise pollution an LED starts blinking continuously. With this system not only the authorities but also the localized people can check the transmitted data through their mobile phone and that too without spending single penny and the people can act against it on their level and try to bring the pollution level under control. This system would contribute as a part in the building of a healthy society.

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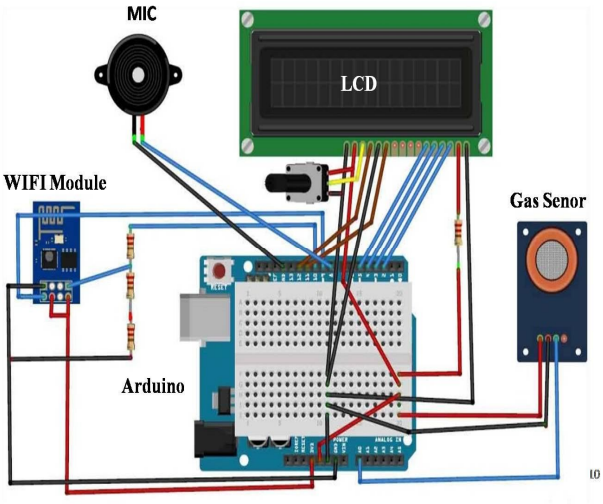


Fig 1: System Architecture

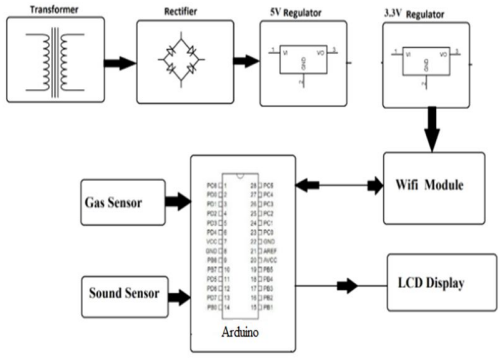


Fig. 2: Block Diagram

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V. COMPONENTS & PIN CONFIGURATION

A. NodeMCU Controller

NodeMCU is an open source IOT platform. It includes firmware which runs on the ESP8266Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the development kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson, and spiffs.

B. Gas Sensor

Gas sensor detects Pollution. The sensor used are MQ135 and MQ7

1) MQ135: It is used to detect various gases such as alcohol, benzene, carbon dioxide etc. This Sensor gives output in analog format. This Sensor operates on 5V supply. This Sensor can be used in buildings and offices.

MQ135 Config:
GND - GND
VCC - 5V
A0 - A3



Fig 3: MQ135 Sensor

2) MQ7: It is used to detect carbon monoxide. This sensor is used in industry and car.

MQ7 Config:
GND - GND
VCC - 5V
A0 – A2



Fig 4: MQ7 Sensor

C. Sound Sensor

It is used to Detect sound intensity.
This sensor operates on 3.5V-5V.This sensor gives output in High and Low.
SOUND SENSOR Config:
GND - GND
VCC - 5V

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OUT- 7



Fig 5: Sound Sensor

D. Temperature and Humidity Sensor: DHT11

This sensor is basic, ultra-low-cost digital temperature and humidity sensor. This sensor gives Digital output.

DHT11 Config:

GND - GND

VCC - 5V

DATA - A0

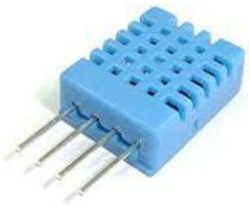


Fig 6: DHT11 Sensor

E. Wi-Fi module

A WIFI module is used to communicate with IOT platform.

NODEMCU Config:

GND - GND

VCC - 5V

RX - TX

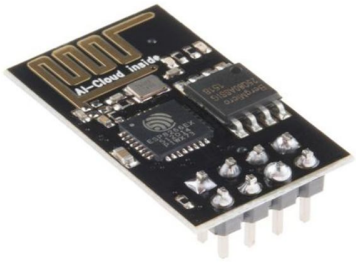


Fig 7: WiFi Module

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F. LCD Display

The air pollution is detected; a buzzer immediately beeps and when there is a noise pollution an LED starts blinking continuously.



Fig 8: LCD Display

VI. ALGORITHM (DECESION TREE)

A decision tree is a flowchart-like structure in which each internal node represents a "test" on an attribute (e.g. whether a coin flip comes up heads or tails), each branch represents the outcome of the test, and each leaf node represents a class label (decision taken after computing all attributes). The paths from root to leaf represent classification rules. In decision analysis, a decision tree and the closely related influence diagram are used as a visual and analytical decision support tool, where the expected values (or expected utility) of competing alternatives are calculated. A decision tree consists of three types of nodes: Decision nodes typically represented by squares Chance nodes typically represented by circles End nodes typically represented by triangles Decision trees are commonly used in operations research and operations management. If, in practice, decisions have to be taken online with no recall under incomplete knowledge, a decision tree should be paralleled by a probability model as a best choice model or online selection model algorithm. Another use of decision tree is as a descriptive means for calculating conditional probabilities.

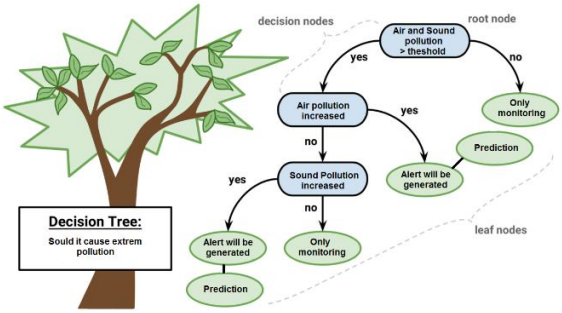


Fig 9: Decision Tree

VII. CONCLUSION

The Proposed System proposes, an effective implementation for Internet of Things is used for monitoring atmospheric conditions of environment like air pollution and sound pollution. This paper presents a conceptual architecture for a versatile, flexible and cost efficient for monitoring the air and sound quality of a particular site. System propose an air quality as well as sound pollution monitoring system that allows us to monitor and check live air quality as well as sound pollution in an area through IOT.

VIII. RESULTS

The output of this pollution monitoring device is provided using a mobile application as well as website. We measure several gases and high intensity noise that can lead to degradation of the atmosphere. Noise Intensity and Gases like Carbon Monoxide, Smoke, Cooking Fumes and Carbon Dioxide are Monitored In Real Time Using this System. Real Time Monitoring enables to take timely action (display warning on LCD screen and also gets uploaded on cloud) using IoT to prevent any major mishaps. The indication will be given through the device if the air and noise pollution increase from the given threshold value (decided by the programmer). Each IoT device is identified by the channel Id allocated to it. This application can be used to get the knowledge regarding pollution

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in a particular area, and then the concerned authority can take relative measures accordingly and can warn various industries about the level of pollution they contribute in and take the required steps and measures.

A. Result for MQ7

INPUT	EXPECTED O/P	ACUTAL O/P	RESUT
0<= ppm <= 50	Normal Level	Normal Level	Pass
51<= ppm <=70	Dangerous Level	Dangerous Level	Pass
71<= ppm	Deadly if exposed to more than 50mins	Deadly if exposed to more than 50mins	Pass

B. Result for SOUND SENSOR

INPUT	EXPECTED O/P	ACUTAL O/P	RESULT
No Sound/ Normal Sound	NO Sound	NO Sound	Pass
Noise	High Sound	High Sound	Pass

C. Result for MQ135

INPUT	EXPECTED O/P	ACUTAL O/P	RESUT
0<= ppm <= 139	Normal Air Quality	Normal Air Quality	Pass
140<= ppm <=150	Unhealthy for Sensitive people	Unhealthy for Sensitive people	Pass
151<= ppm <=200	Unhealthy for Sensitive people and children	Unhealthy for Sensitive people and children	Pass
201<= ppm <=300	Very Unhealthy for All	Very Unhealthy for All	Pass

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300<=ppm	Hazardous for All	Hazardous for All	Pass

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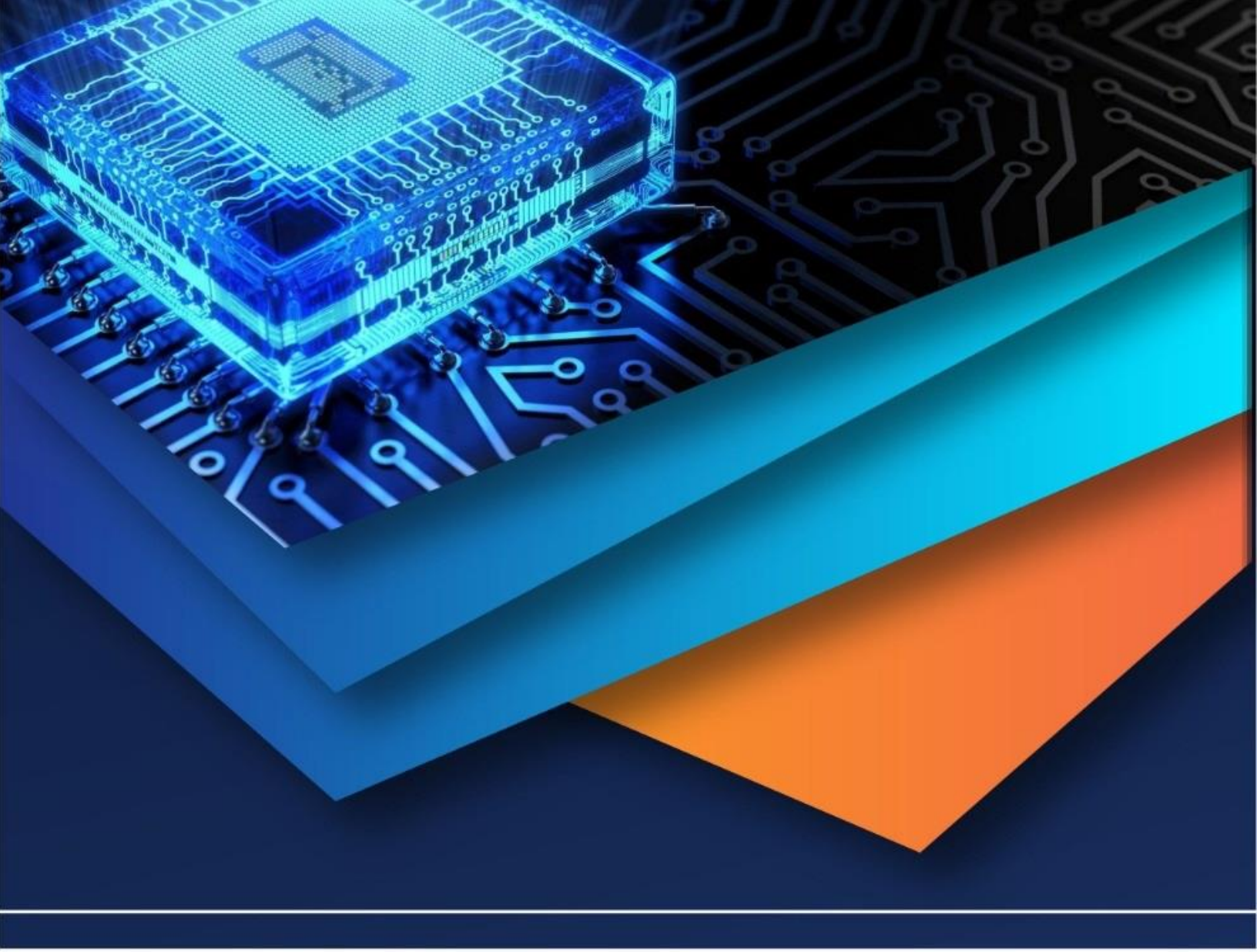


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