# IoT Based Air and Sound Pollution Monitoring System

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***Abstract***— Air and sound pollution is a rising issue these days. It is utmost important to monitor air quality and keep it under control for a better future and healthy living. Here, we propose a system that allows us to monitor and check live air quality and sound pollution in particular areas through a Wi-Fi module. This system uses air sensors to sense the presence of harmful gases/compounds in air and constantly transmit this data to microcontroller. Also, the system keeps measuring the sound level and reports it to the online server. It also monitors temperature in a particular area and transmits the data to web server via Wi-Fi module. The sensors interact with microcontroller which processes this data and transmits it over internet.

***Keywords***— *Air quality, sound pollution, sensors, micro-controller, Wi-Fi module.*

## I. INTRODUCTION

Real-Time monitoring of air and sound pollution using traditional methods is very expensive and time consuming process. The major pollutants in ambient air are carbon monoxide, nitrogen oxides, hydrocarbons, sulphur and particulate matter. In infrastructure and industrial plants the rapid growth has led to environmental issues like pollution (air, noise, water etc.) and even temperature changes has created a requirement of operationally adaptable, efficient, cheap and smart monitoring systems. The technology like IoT is utilized as a form of solution for monitoring the fluctuations of parameters. The Internet of Things (IoT) is the network of physical devices , vehicles home appliances and other things embedded with electronics , software ,sensors ,actuators & network connectivity which enables these objects to connect and exchange data. IoT is a major technology by which we can produce various useful internet applications. The monitoring system can be used as a vehicular based mobile approach for fine based air quality; two devices are represented public transport and personal sensing device. The system can be installed in industries and near traffic where gases are mostly to be found and give an alert message when the system crosses threshold limit.

## II. LITERATURE REVIEW

In response analysis of Air Pollution Monitoring, Zigbee module replaced GSM and GPRS as it had low installation and maintenance cost [1]. Continuous online monitoring used sensors to monitor the parameters, and then sent to control centre by network. PIC microcontroller with in-built ADC, system measured the concentration of gases such as CO, SO2, and NO2 using electrochemical sensor. This thesis focused only on air pollution. As industrialization is rising at a very rate, pollution is also getting introduced at large manner. In the present scenario, there is air pollution, water pollution, soil pollution worldwide. This thesis only focuses on air pollution. The World Health Organization (WHO) states that 2.3 million people die each year due to vulnerable causes directly attributed by air pollution.

Using wireless standard [2], the hardware unit integrated a single-chip microcontroller, air pollution sensors array, a Bluetooth module. The Central-Server is a high-end personal computer application server with internet connectivity. The hardware unit gathered air pollutants levels (CO, NO2) and packed them in a frame, the frame subsequently uploaded and transmitted to the Central-Server through wireless network via Bluetooth. Wireless Sensor Networks are a new and very challenging research field for embedded system design automation, as their design must enforce strict constraints in terms of power and cost.

Noise pollution in metropolitan cities is a growing concern as it is slowly affecting our lifestyle. Sound level above 90 dB is considered as noise and may lead to distraction of mind. Using real-time data transmission [4], environmental noise monitoring system stored and transmitted the noise levels to a Central Station. Moreover, a website application was made to disseminate the data in real time for public awareness. The application accessed that database to display the measured data to the users as numeric data or as time series in graphs.

The IoT technology supports in developing a progress of a device in a real-time environment. It helps in sensing various parameters continuously and transmits the data to the server. In this work, we propose a real-time monitoring system which not only monitors air pollution and noise but also the temperature parameters through the various air, sound and temperature sensors which sends the data to the microcontroller, which in turn sends the data by using serial communication to the Wi-Fi module. Then, the Wi-Fi module posts the data onto the designed web page over internet with

the application of IoT. This system also uses a buzzer to indicate the dangerous levels of the parameters.

## III. ARCHITECTURE

*A. Hardware Requirements*

1. ARM7 LPC2148
2. Wi-Fi Module ESP8266
3. 16x2 LCD
4. Buzzer
5. MQ-2 gas sensor
6. LM-35 Temperature Sensor
7. Sound Sensor

*B. Software Requirements*

1. Language: Embedded C
2. Keil µVision (Version 4)
3. Flash Magic
4. Platform: Windows

The architecture as shown in Fig. 1 consists of three sensors- MQ-2 gas sensor, LM-35 Temperature sensor and Sound sensor, Power supply and connected as inputs to LPC2148. Here, Wi-Fi Module ESP8266 is used as both input and output as serial communication takes places. The outputs include 16x2 LCD and Buzzer.

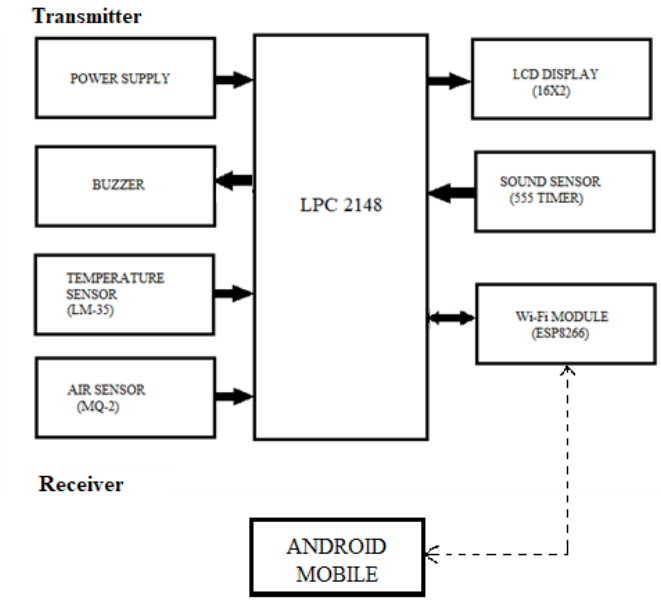


FIGURE I. BLOCK DIAGRAM

## IV. WORK FLOW

The power supply has to be given to the micro-controller and the different sensors. The sensors are to be interfaced with the ARM7 LPC2148 through connecting wires. The micro-controller and the sensors are to be programmed using Keil micro-vision and Flash magic. We can make sure that the program is working by debugging using Keil software. This program has to be dumped onto the micro-controller using a serial RS-232 cable. It should be seen that the wires are connected properly to the ports and should match with the connected ports on the ARM7 LPC2148. The ARM LPC2148 is interfaced to: MQ-2 gas sensor to detect the amount of Carbon Monoxide present in the air (threshold limit- 100PPM), a mic and 555 timer (Sound sensor) is used to monitor the sound levels (threshold limit- 90dB), LM-35 temperature sensor (threshold limit- 450C), a buzzer to the indicate the changes in sound and air pollution levels, a 16x2 LCD display which displays the monitored values of air, sound and temperature as seen from Fig. 2. A Wi-Fi module (ESP8266) is also interfaced with the micro-controller which gives the live monitoring of noise and air pollution levels along with the temperature on a webpage.

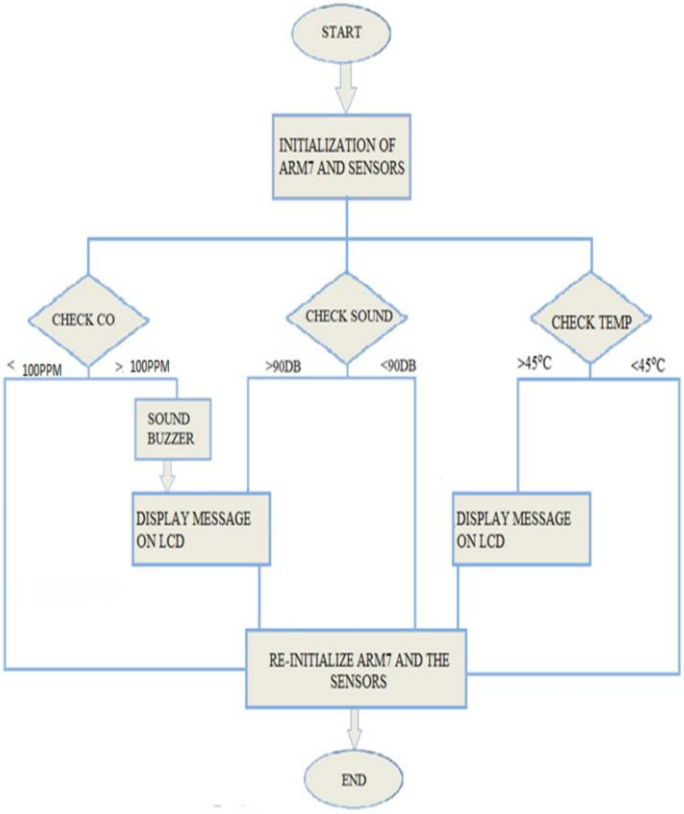


FIGURE II. WORK FLOW

## V. RESULT

The output from the sound sensor is shown in terms of decibels, messages are displayed as clear if the sound is below threshold limit and LCD displays above audible message if the sound is above threshold limit. Similarly, gas sensor displays value of pollutants present in the air in terms of PPM. Buzzer is also present to give alerts if the values of the parameters exceed the given threshold limit. Temperature sensor is also present to give the current temperature values in that particular area. The same results are also displayed on the webpage as the data is transmitted through the Wi-Fi module. The data transfer from the Wi-Fi module to the web page is possible only when the mobile is paired with the Wi-Fi module. The IP address is entered in the browser to display the require web

page with real-time monitored parameters- air pollution level, sound level and temperature.

## VI. CONCLUSION

This IoT based air and sound pollution monitoring system analyses and monitors sound and air pollution, assess how bad air and sound pollution is in the environment. This system monitors the air and sound pollution as well as gives the temperature. This monitoring system is designed in less time with low power consumption. The application requires less space and it is dynamic. This system is eco-friendly and does not harm the environment. Not only authorities but also common people can view the parameters by accessing the web page.

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