# IoT Technology Based Vehicle Pollution Monitoring and Control

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***Abstract*— Every year, the number of people who die because of pollution rises, with air pollution being the major cause. Air pollution is generated by a variety of factors, one of which being pollution caused by automobiles. Our study considers pollution caused by vehicles that not only monitors pollution levels but also indicates the vehicle owner about the gas released from the vehicle and alert them to rectify the problem, in addition to that this record will be updated to the server to have a data analysis. When the vehicle releases gases greater than the threshold value, this device will send a data to the server which in turn send to the portal for transport department for monitoring and penalizing purpose. Normally aging of vehicle causes it to produce lot of pollution causing gases. Regular service should be done to reduce the gas emission. Hence the message from our device will give an information about the emission and the user could rectify it. Few people will not take any actions even if they receive the warning from transport officials, they will be penalized further.**

***Keywords:-* Arduino, MQ-135 sensor, nRF24L01, GSM SIM800L, GFSK, GPRS, Transmission, Receiving, Data.**

## I. I. INTRODUCTION

In recent years, pollution has a direct influence on human health. According to data statistics, India is at the top of the list of nations with pollution-related transience in 2015, with 2.51 million people dying ahead of time due to illness connected to air, water and other kinds of pollution.[1] According to The Lancet analysis, air pollution was the leading cause of 6.49 million catastrophe in 2016, followed by water pollution (1.76 million) and industrial pollution (0.83 million). [1] Oxides of Carbon, Nitrogen and Sulphur, Volatile Organic Compounds (VOCs) and other pollutants are examples of air pollutants. Statistics also suggest that automotive emissions account for around 30% of total air pollution. This pollution can have a variety of health consequences, including breathing problems and apnea disease. The goal of vehicle pollution control is not just to collect information, but also to give the data's needed by scientists, policymakers, and planners to make educated decisions about regulating and enhancing the surroundings, as well as to deliver valuable information to public consumers. [4] Our study considers the rising issue of vehicle pollution and proposes a answer to continuous look out over CO emission of vehicles and alert if exceeds a certain threshold

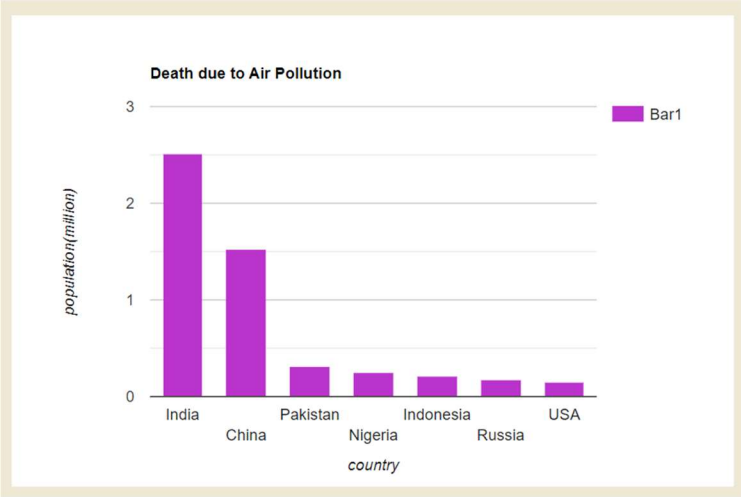



Fig. 1. Lancet Statistics

Delhi, India's capital, is widely regarded as one of the world's most polluted cities. Vehicle Pollution control was achieved by adhering to an even strange policy of automobiles on the road. Thus, it can arbitrarily reducing the number of vehicles on the road, this system can send message to the vehicles owner to service vehicles which will help in reduce the pollution in the country and it will transmit the messages to the pollution board, when the vehicle owner didn't take any action regarding the pollution.

## II. LITERATURE REVIEW

The Prototype senses the vehicle pollution of the confined zone with the use of the prototype mounted at tolls, lamp posts etc... The sensed values are sent to a mobile application which makes the automobile users to take route which is less polluted [1]. This paper describes about a prototype which uses a raspberry pi for monitoring and control. Here the vehicle user will be warned by buzzer and if it is ignored ,challan is filed to the user and it is sent to his mail id [2]. This project describes the sending of sensed values to the cloud, which can be analyzed and interpreted. This sensing and sending the data is done with the help of a Wi-Fi module addition to the alert message displayed in the LCD [3]. A real deployment of a wireless network is presented in this paper and the net goal is to track and assess Doha's air quality. Wireless sensor stations on a small scale connects with a security server in real time to broadcast their measured values. Data which is stored on the server is intelligently processed and analyzed before being presented in various ways for different types of end users. It also explains how to present data to environmental professionals using specialized software tools.[4]. The Proposed System is used in detection of the harmful CO gas emitting from the vehicle and to intimated to the vehicle owner regarding its emission level. An initial alert is given to automobilist regarding the amount of carbon monoxide gas using the buzzer.[5]. This Paper describes about the continuous monitor of the system and its forecasting module with the use of cost-efficient monitor of air quality that are fitted with an array of vapor's and excavating model which will communicated wirelessly to an brilliant detecting forums that consists of several modules. Finally presenting the information through different gadgets, such as mobile-phones, Website, and SMS.[6]. The major goal is to create an innovative and time-saving method that will help to solve environmental pollution. The goal of this system is to create a vehicle pollution system based on the IoT. With the help of sensors connected to an Arduino, the amount of pollution released by the vehicles may be detected. [7]. Air pollution monitoring has traditionally been done with a High-Volume Sampler, portable multigas monitors, and gas chromatography. All of these procedures, however, necessitate the employment of stationary and expensive monitors. As a result, the suggested system provides a complementary alternative for air pollution monitoring through the application of sensor technologies. The system makes use of an Arduino, a sensor, and a display to show the contaminated level from exhaust. [8]. A mobile information accessing unit and a permanent connection established cellular network for pollution monitoring backend-server make up the proposed system. A microcontroller, air pollution sensors, a GPRS modem, and a GPS module are all included in the Mob-DAQ machine. The Pollution-Server is connected to a database server that stores the pollutants levels. Users may see real-time pollution levels and locations in major cities thanks to a link between the Pollution-Server and Google Maps. This system is available seven days a week, 24 hours a day. [9]. This proposed system aims to create a cost-efficient Internet of Things approach to lookout and interpret traffic flow and suggest solutions to reduce air pollution. A system of cost-efficient internet monitor have been created and built to accommodate such a proposal, and it is based on a distributed multilayer model. A data mining gathering model is mounted for continuous survey to get information about traffic on roadways. The technology can suggest extrapolations, reducing traffic congestion, fuel waste, and air pollution [10].

## III.PROPOSED WORK

The work was completed in the following manner: Basic understanding of all system components (Arduino UNO, MQ-135 CO gas sensor, GSM module, nRF24L01). MQ-135 sensor to Arduino UNO interface. Calculation of pollutant threshold values in vehicle emissions. Creating code to sense the data from the MQ-135 sensor to the Arduino UNO. The Stored data in Arduino 1 is fetched to transfer by the help of nRF24L01 module. Whenever the crossover near tollgates or poles is carried out, the data from Arduino1's flash memory will be transferred to Arduino 1's nRF24L01 to Arduino 2. Using an Arduino UNO to interface with a GSM module. Creating code for a GSM module that would deliver warning and intimation messages to users. For authorities, cloud (using IOT technology) is used to deliver fine. The numerous blocks/components employed in the design of this project have unique and distinct roles that are thoroughly investigated. The various blocks are Arduino UNO, MQ-135 gas sensor, GSM module, nRF24l01. Here in this section the detailed description of every individual block about its working, purpose in the project, and their technical specifications are explained. Gas sensor is used here is MQ-135, to detect the $CO_2$ gas released from the vehicle. The detected gas is continuously compared with the predefined threshold levels. Arduino controller is used to compare the sensed value and threshold value, if the sensed value is exceeding the threshold value, then an alert is given to the user (GSM Module) and authorities (IOT Technology) with the help of nRF24L01 trans-receiver. The overall operation is depicted in the Fig 2.

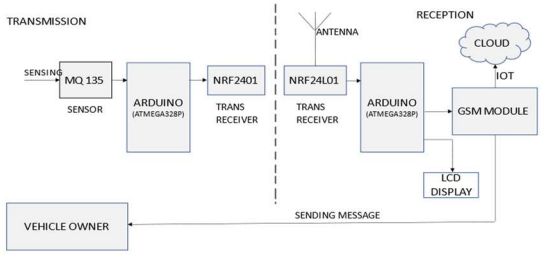



Fig. 2. Block Diagram

The Overall Working is categorized into two sections: One is Transmission Part, and the other is receiving part. The Transmitting Part consists of Arduino UNO, MQ-135 Sensor, nRF24L01 transmitter. The Receiving Part consists of Arduino UNO, LCD Display, GSM and nRF24L01 receiver. The Outline of the system can be explained in detail using the flow chart depicted in Fig 3.

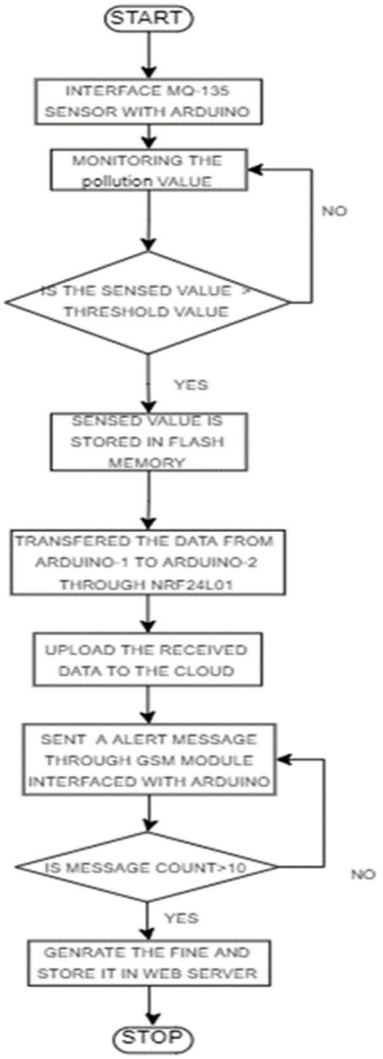



Fig. 3 Flow Chart of Proposed System

## IV. WORKING OF PROPOSED SYSTEM

This system can be installed in any automobiles that contributes to air pollution in the social environment. Our model installation is as follows: The MQ-135 sensor is connected to the Arduino. The Arduino is then interfaced with nRF24L01 which acts as a transmitter. A Code should be uploaded to the Arduino to create a communication of nRF24L01.The Header files for the sensor, memory and nRF module is set up and the pins are initialized. The Transmission memory address is fixed, to create a handshake with receiver. The nRF24L01 pins are initialized and the Arduino is set to test whether the RF module is initialized or not. The Variable for sensing is initialized to zero. The Values will be sensed by the sensor and stored in last and current variables. If the current value exceeds last stored value, the last stored value will be updated. This process runs continuously and the nRF transmitter module will look for the receiving module. This is explained in Fig. 4.1

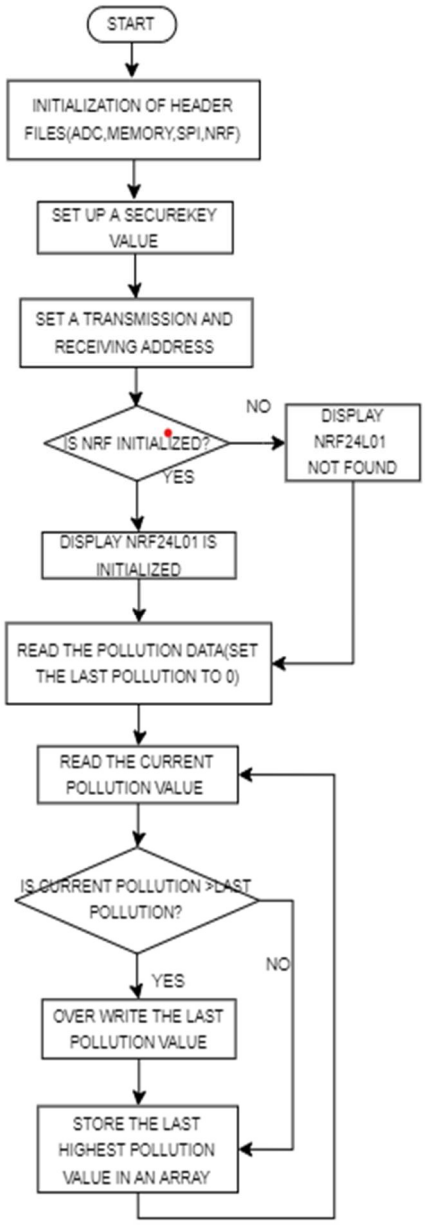
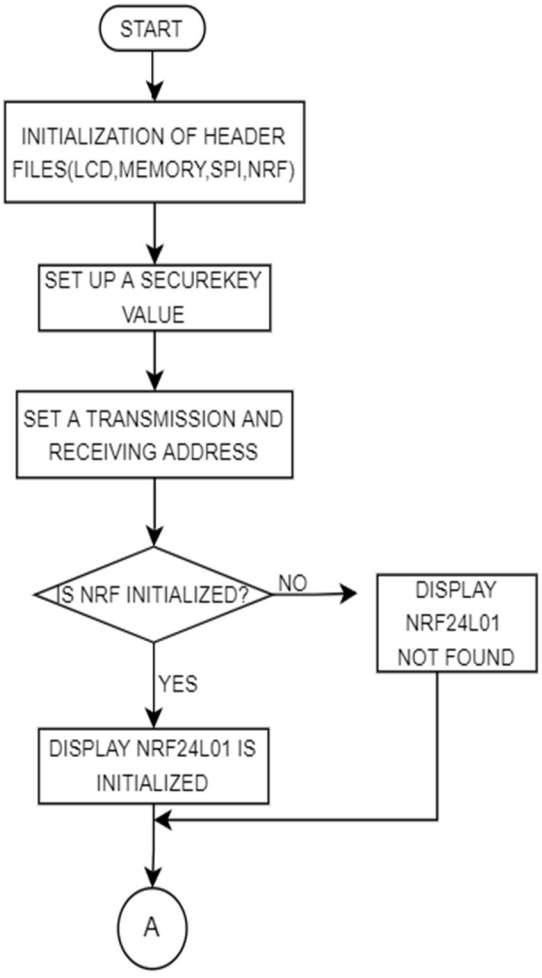



Fig. 4.1 Flow Chart of Transmission Part

When the transmitter is ready, it will be transmitting the data continuously. On the other hand, another Arduino is interfaced with nRF receiver and LCD Display. Whenever the transmission side nRF module comes in communication range of the receiving side nRF module, the data will be transmitted from transmitter to receiver. The Communication between two

nRF module is done using GFSK Modulation. In GFSK (Gaussian Frequency Shift Keying modulation) where, baseband pulses (consists of -1 and 1) are made to pass through the gaussian filter before the modulation. This Gaussian filter makes pulses smooth and hence limit the width of the spectrum which is known as pulse shaping. After the data is received, the information is sent through GSM Module. GSM (Global System for Mobile Communication) is a digital mobile network that is widely used by mobile phone users throughout the world. GSM was designed to be a safe wireless system. It has considered user authentication via a pre-shared key and challenge-response, as well as over-the-air encryption. Using GSM, we can able to send a message to the respective user if the pollution level exceeds the threshold. To upload the data to the cloud, instead of using Wi-Fi module, we can use GSM Module. In this project we use GSM sim800l to upload data to cloud because SIM800L supports General Packet Radio Service (GPRS) for internet access via HTTP. AT commands can be used to access the module's built-in TCP/IP stack. This can be very useful for long-term data logging on low-bandwidth networks. The Data is sent to the cloud and the overall work on receiving side is shown in Fig 4.2



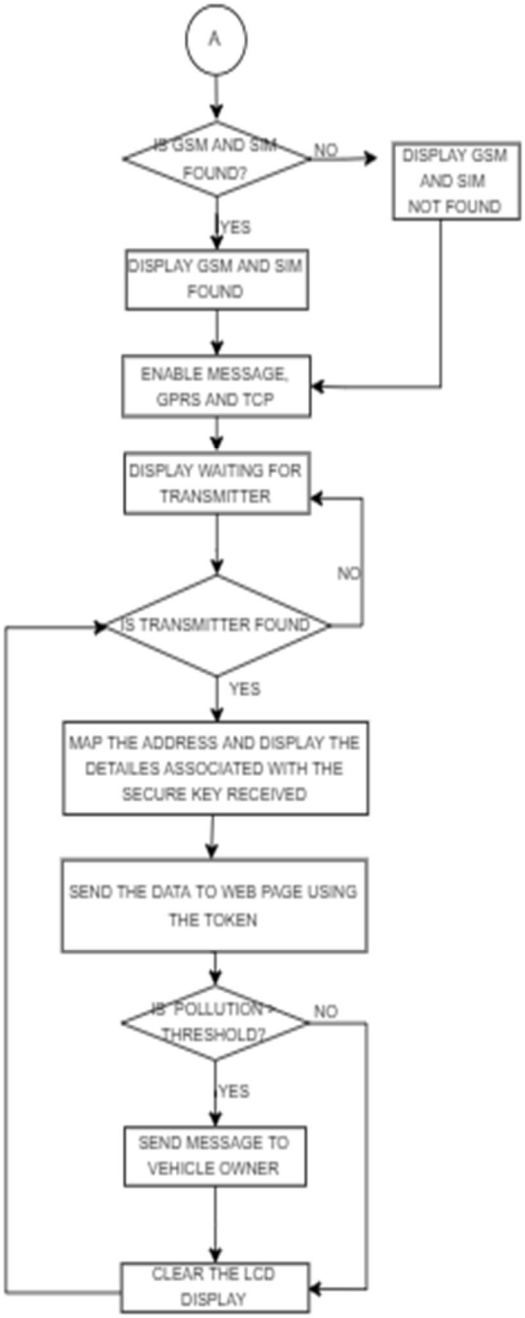




Fig. 4.2 Flow Chart of Receiving Part

## V. EXPERIMENTAL RESULTS

The Proposed Project was tested. The Proposed System measures the real time pollution level of various automobiles. The Overall proposed prototype is shown in Fig 5.1

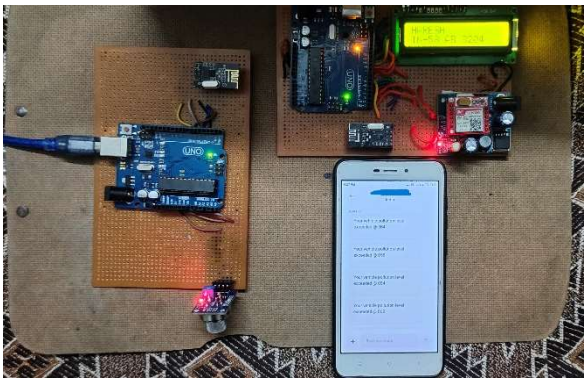


Fig. 5.1 Project Setup

The Data in general is uploaded to the cloud whenever there is a handshake between transmission and receiving part. In the Webpage, the location is indicated to denote the place at which the vehicle crosses the receiver setup Here two data are used to display the pollution level of the vehicle. The First one is the vehicle which remains stationary and the second is the vehicle which starts and emits pollution. For a vehicle which remains stationary, the webpage is displayed with a green widget and data is stored in the database. This is shown in Fig 5.2

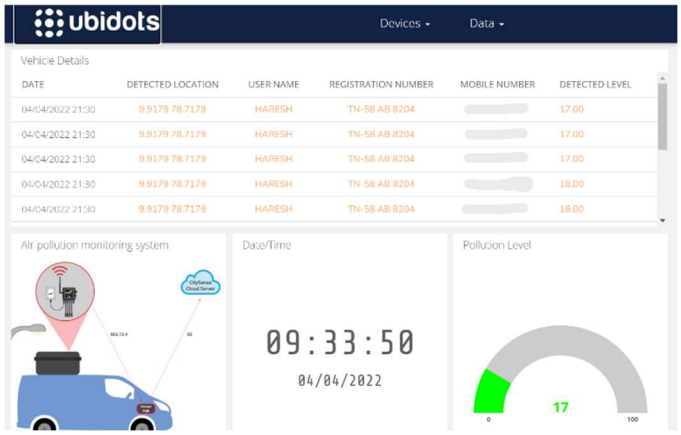



Fig. 5.2 Display of vehicle data when the vehicle is stationary

The Threshold is set at 50 ppm. When the vehicle starts, it displays 50% and above level in the webpage because for testing we usually take initial value of CO, which is 50 ppm. The Webpage is displayed with a red widget and the pollution level which is caused by the vehicle is sent to the respective user with the help of GSM SIM800L Module which is shown in Fig 5.3.

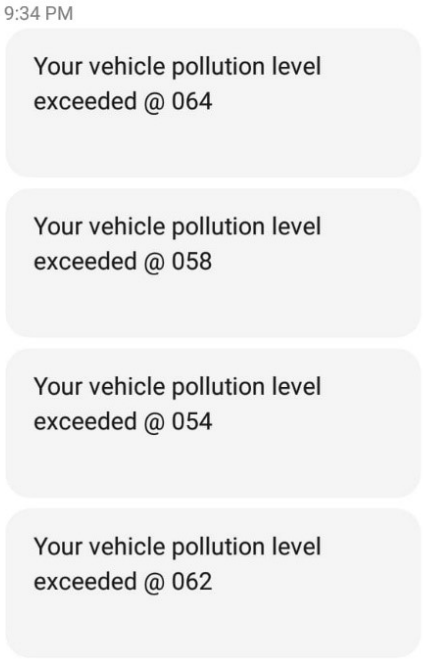



Fig. 5.3 Indication of vehicle owner about the pollution level

The data is stored in the database. This is shown in Fig 5.4

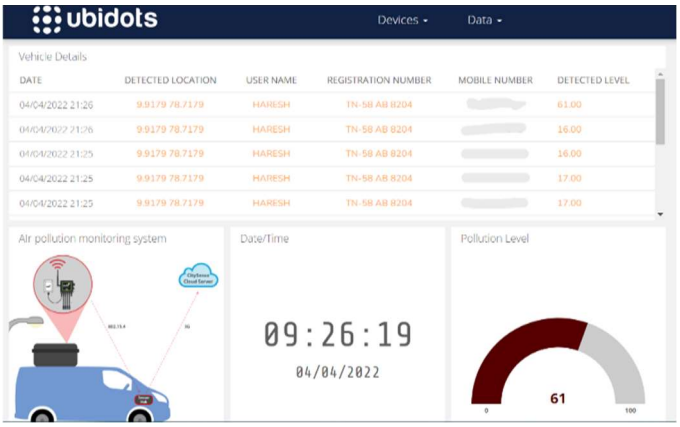



Fig. 5.4 Display of vehicle data when the vehicle is started

The Experimental results are tabulated as shown in Fig 5.5

| S.No | Name of the Vehicle Owner | Pollution Level |
|---|---|---|
| 1 | Raju | 50 |
| 2 | Joel | 55 |
| 3 | Vishnu | 51 |
| 4 | Naveen | 60 |

Fig. 5.5 Real-Time Results

## VI. CONCLUSION

The paper addresses the design, development, and testing of a vehicle pollution monitoring and control system based on the Internet of Things. The proposed technology can assist in keeping gas levels within predetermined limits. When a vehicle passes through a toll gate, the usage of two nRFmodules is advantageous for sending and receiving information. The study reveals that the system meets the sensor's requirements, and that the message is conveyed to the vehicle owner via GSM module. The technology is simple to install in any automobile that contributes to air pollution. The created web page is used to remotely check the level of gas from anywhere on the globe where the internet is available. The results show that the entire system has been thoroughly tested and implemented.

## VII. REFERENCES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