An IoT Based Vehicular Pollution Monitoring System Using Arduino

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Abstract— *Importance of this project is to introduce vehicular pollution monitoring system using Internet of Things (IoT) and also with GSM which is capable of detecting vehicles causing pollution on the city roads and measure amount of pollutants liberated in air. This project also reports the status of air quality whenever needed to the environmental agencies. The proposed system also assures the existence of wireless sensors for vehicle pollution system that specialize in a straight forward accessibility of real time data through internet using IoT. The measured data is also shared to vehicle owner, RTO office and some other agencies. This system is a low cost and provides good results in controlling the air pollution especially in the urban areas. Condition of vehicle can be noticed.*

Keywords— vehicle pollution monitoring system, GSM, Internet of Things, arduino.

I. INTRODUCTION

The impossible measurements in typical ways have currently become attainable using the wireless technology. In this technology, the measurement of air quality is one of the difficult areas for the researchers.

The most common source of atmosphere pollution happens due to vehicles. The humongous inflow of vehicles in urban areas causing more air pollution and decreasing air quality that leads to severe health diseases.

Increase in use of vehicles in cities results in vital increase in the emission load of various toxins into air. As a result increase in environmental problems which will affect the human health in urban places. This project deals with indicating the driver or owner of respective vehicle, if their vehicle ransom more than certain level of harmful chemicals into the environment, it sends message to the owner of the vehicle about how rate his vehicle expels out the harmful gases to environment. The measure of harmful gases is done by gas sensor. If the vehicle crosses the 2 certain threshold pollution level message alerting the vehicle will be displayed. But for the 3rd time engine will be turned off and fine will be instantly generated to the respective vehicle driver through his registered mobile number. This system connected to individual vehicle when exceeds the pollution limit it's number plate address sent through GSM. Government office like RTO's can monitor the IoT continuously and take actions on reducing pollution. In IoT they will be posted regularly.

II. LITERATURE SURVEY

This Section deals with how was the previous model was implemented. It used an IoT to address the vehicles polluting and level. To perform this it uses RFID reader, RFID tag, gas sensors, Arduino board, IoT and mobile.

How the process works is, at a side on road there will be a Gag sensor, RFID reader connected to Arduino board. And each vehicle is having its own RFID tag [8] which is helpful in identifying the vehicle which helps in identification of a vehicle. Whenever vehicle crosses the kit, the gas sensor calculates the amount of harmful gases released by an individual vehicle continuously. Meanwhile the RFID reader reads the vehicle RFID tag. In Microcontroller program was written for maximum level of gases it allows, posts data in IoT if goes beyond it. The sensed data is continuously verified with the maximum level in microcontroller. If gases released exceeds a prescribed or maximum level given in microcontroller. Then Arduino sends an alert message to the vehicle owner, the data is displayed on the Liquid Crystal Display (LCD) about which and how level CO2 and SOx released by the vehicle Same data along with vehicle id and time and date of vehicle when it pollutes gets posted in server so that authorized agencies can access the data and take further steps on vehicles that pollutes more. Along with alert message it imposes fine message to owner of car.

In [9], Authors proposed method is capable to measure the value of pollutants emitted by the vehicle continuously and display it on 16x2 alphanumeric LCD display. Also if the pollutant level exceeds the prescribed value, then a SMS will be sent to the respective authority.

In [10], authors proposed a method to monitor air pollution on roads and track vehicles which cause pollution over a specified limit. Increasing number of automobiles is a serious problem that has been around for a very long time. This paper proposes use of IoT to address this problem. Here, combination of Wireless Sensor Network and Electrochemical Toxic Gas Sensors and the use of a Radio Frequency Identification (RFID) tagging system to monitor car pollution records anytime anywhere. In this paper , the pollution data is printed on arduino terminal not on the internet server.

In [11], authors presented a vehicle pollution monitoring method to monitor and control the pollution at the traffic signaling lights. A simple wireless embedded chip is inserted in the personal vehicles to control the ignition on and off remotely. The pollution is monitored by the traffic monitor station remotely by placing a series of CO sensors connected to a WIFI based control system at the traffic signaling. Depend upon the pollution level measured from sensors at the traffic

signaling, the operator will send a command to the wireless traffic pollution control system. This control system will broad cast the message to all vehicles to turn off the ignition automatically at the time of red light ON.

III. PRPOSED METHOD

The present section deals with the modifications done to previous method and to make sensing of gases by individual vehicle a little bit of accurate. In this method we remove RFID readers and tags connected to respective vehicle. We introduce our system to each and every vehicle so that sensing a vehicle that pollutes becomes easier. The gas sensor connected to silencer of vehicle which makes detection of pollutant gases released by vehicle could be calculated accurately. Our method follows the same passion of previous method. In the program given to the microcontroller we set 3 threshold pollution values. The first value is 50ppm whenever pollutants level reaches it, the owner will get an alert message which can be displayed by Liquid Crystal Display (LCD) connected to Arduino. The second value is 150ppm whenever the pollutant gases reaches it driver gets one more alert message which will be displayed on LCD screen. The last value is 230ppm when reached to such level motor of vehicle gets turned off. This action is done with help of a relay.

The gas sensor senses the gases emitted thoroughly when emitted gases reaches 1st threshold level given in the microcontroller an alert message will be displayed on LCD display and buzzer continues to buzz until gas density goes beyond 1st level. When vehicle come across 2nd threshold level the same alert message will be displayed on LCD buzzer starts buzzing until it goes beyond 1st threshold level. Finally approaches the 3rd threshold level microcontroller sends a message to the owner of the vehicle about level of pollution and imposes fine for exceeding limit and also sends message to the officer number in RTO Office about pollutant level along with vehicle number. Meanwhile the motor of the vehicle turns off. All the gases released by vehicles all the time will be registered in IOT always. RTO officers monitor the authorized site to get information about each vehicle and notes down vehicle number for collecting fine. Since it's not possible to have wifi in each vehicle a message to officer in RTO office will be sent.
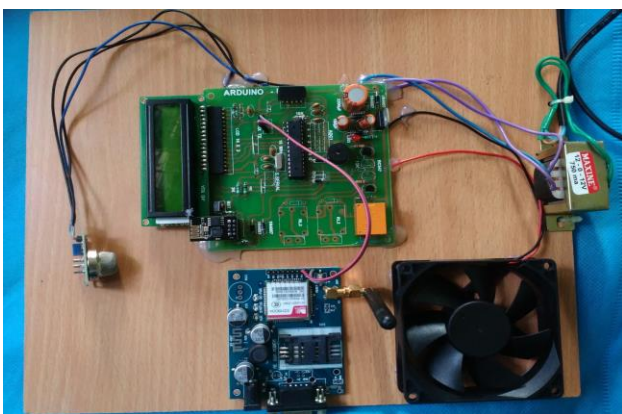

Fig. 1. Integration of Arduino module with GSM module and MQ135 gas sensor

IV. IMPLEMENTATION DETAILS

The block diagram of this experiment setup of proposed system is divided to 2 categories:
i. Hardware setup
ii. Software program

(i) Hardware Setup:

It consists of Arduino board, ATmega328 microcontroller, MQ Gas sensors, GSM module, Wifi modem. The developed system is represented in Fig.2

(ii) Software implementation: The software implementation is demonstrated by flowchart in Fig.3. the implementation details are desgned as algorithmic steps which are are represented in the flow chart .
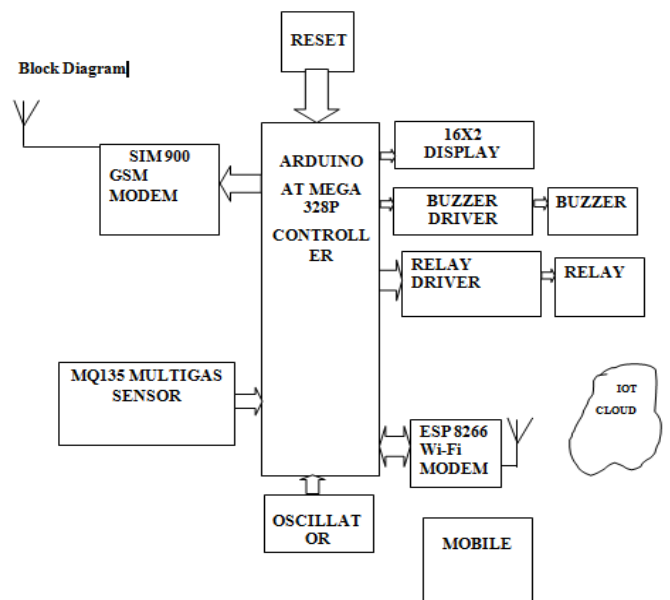

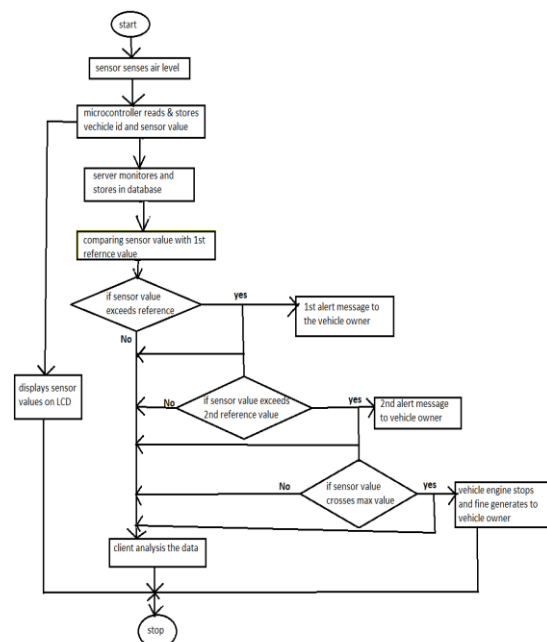Fig. 2. Proposed model for vehicle pollution monitoring using IoT.

Fig. 3. Implentation flowcart for the proposed model

V. RESULTS AND ANAYSIS

IoT based pollution monitoring system is developed and the performance of the developed system is verified successfully for various vehicles. The monitoring system displays the value which crosses 1st threshold pollutant level of the vehicle on LCD as shown in Fig 5.

Fig. 5. 1st alert message displayed on LCD screen

The monitoring system displays the value which crosses 2nd pollutant level of the vehicle on LCD as shown in Fig 6.

Fig. 6. Alerting message after reaching 2nd level.

After reaching third level that is 230ppm message displays on LCD screen and a message as in Fig. 7.
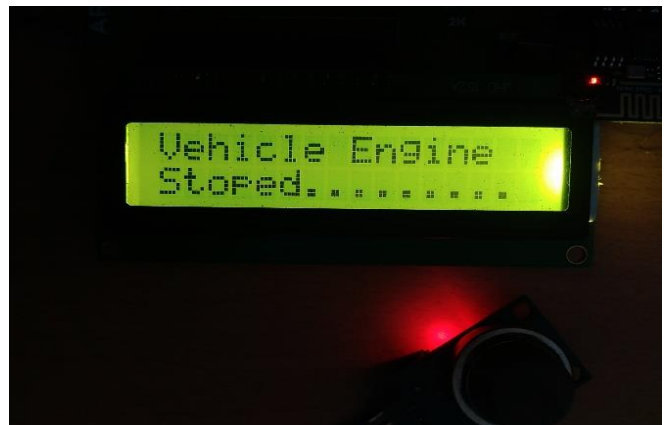

Fig 7. First a message called sending to vehicle owner by next about condition of vehicle motor.

After reaching third reference level a message with fine will be received by respective vehicle owner and it is shown in fig 8.

The client receives pollutant values from the server using IoT and client analyses the pollutant levels in speficied area. The client window with the pollutant levels and vehicle registration number as shown in fig 9.
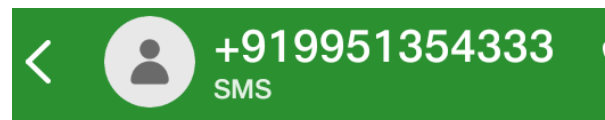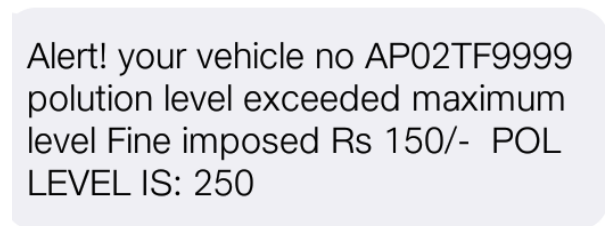

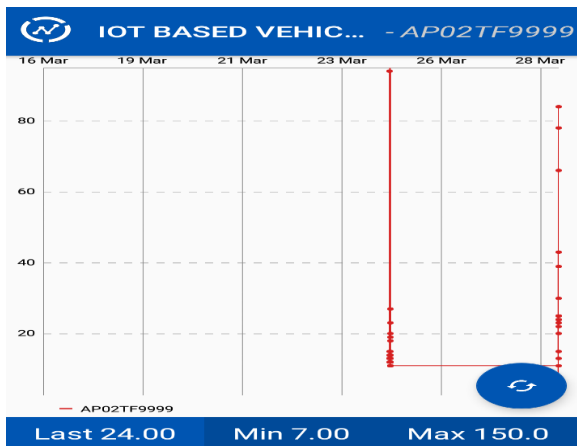Fig. 8. Message to mobile of vehicle owner

Fig. 9. . Data displayed at the server side

VI.   CONCLUSION

The hardware setup and software flow graph are discussed in length. The performance of the system is also verified using IoT technology. This smart intelligent environmental system monitors the pollutants liberated by the vehicles and also warns the vehicle owner to control the pollution and stops the vehicle engine on over extricate. It also sends the pollutant level data to the server for future analysis. This developed system is a low cost, simple to operate.

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