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Low Cost Vehicle Pollution Monitoring System

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ABSTRACT: In many countries the percentage of people having diseases like asthma, heart disease, chronic obstructive pulmonary disease, diabetes increasing rapidly due to vehicle exhaust. This problem is largely occurring in metro cities like Mumbai, Delhi and Pune etc. Because number of vehicle are more in this cities compare to small cities. So a system requires which will monitor vehicle exhaust without wasting time of vehicle owner. There are various projects on the pollution monitoring in various countries but due to the technological, economical differences of developed countries and developing countries these projects cannot be implemented in developing countries. Another aspect of system is cost, the cost of system should be low this can be achieve by using low cost component. In this paper a cost effective system to monitor vehicle pollution is discussed. The problems regarding multi tagging, efficiency of on board device can be overcome by proposed system. This system provides traffic management without adding further cost.

KEYWORDS: PUC, AVR, CO, MY-SQL, PHP.

I. INTRODUCTION

Day by day pollution level increasing that not only affecting human health but also affecting to nature. Global warming is the biggest challenge in front of world. CO_2 increases day by day which is called green house gas causes green house effect. Diseases like asthma, heart disease, chronic obstructive pulmonary disease, diabetes increasing rapidly in peoples. The main sources of pollution in cities are vehicles. Presently the credibility of the PUC Centres is not very high and many of them are prone to various levels of malpractices. There needs to be a very strong system which will equivalent to PUC. The system designed to monitor the vehicle exhaust. The exhaust detection and controlling system is discussed in this paper where a real time detection of exhaust and its comparison with standards takes place. The cost effective system is designed with the help of ZIGBEE Tags and AVR controller. System uses sensors like MQ7, MQ5. The vehicle exhaust data is collected from sensor which is part of on board unit transfer to road side unit. Road side unit collects data from all OBUs and then transmit it to server side unit. Server side unit store all the data in database using PHP and MY-SQL for further use.

II. RELATED WORK

Recently, different pollution control systems discussed in literatures. In 2014 "Application of RFID Technology and the Maximum Spanning Tree Algorithm for Solving Vehicle Emissions in Cities on Internet of Things" presented by chi-man vong in this paper a pollution control system for developed countries is discussed the system consist of RFID tag to which the lambda sensor is connected through analog to digital converter. The lambda sensor mounted on exhaust pipe to measure air ratio when air ratio is less than one carbon monoxide and hydrocarbon emission will increased and when air ratio greater than one more nitrogen oxide will be produced. This value is read by RFID reader. This RFID tag transfer data to another RFID unit. This module is connected to the 3G card through which data is send to the database server where all the data with date is available. The standards and received data from the vehicles are compared if the standards does not match with the data then message is generated and send to the vehicle owner. In this paper for mounting of the RFID tag efficiently by using maximum spanning tree algorithm is also discussed which help us to mount RFID tag on minimum traffic junctions and covers large traffic [2]. The second paper Automated System for Air Pollution Detection and Control in Vehicles presented by Anita kulkarni, T. Ravi Teja. In this paper on board

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pollution control system discussed. If pollution through vehicles crosses predefined standards then this system stops vehicle and message generated and sent to specific number which is stored in GSM module problem [3]. Another paper presented called etc assisted traffic light control scheme for reducing vehicles co2 emissions [4] by chunxiao li and shigeru shimamoto. In this paper author presents a system to reduce vehicle's CO2 emission by using an ETC-assisted real-time traffic light control scheme in vehicular networks. Using Electronic Toll Collection (ETC) devices traffic at each junction can be find out. ETC devices communicate with signals at each junction. With the help of this communication traffic at each junction is obtained [4].

Table1.1: Test limits

Sr.No.	Vehicle Type	CO%	HC (ppm)
1	2&3—Wheeler (2/4-stroke) (Manufactured on and before 31st March 2000)	4.5	9000
2	2&3—Wheeler (2-stroke) (Manufactured after 31st March 2000)	3.5	6000
3	2&3 – Wheeler (4-stroke) (Manufactured after 31st March 2000)	3.5	4500
4	4-wheelers manufactured as per Pre Bharat Stage-II norms	3	1500
5	4-Wheelers manufactured as per Bharat Stage-II, Bharat Stage-III or subsequent norms [5]	0.5	750

Table shows the test limits for vehicles. If pollution level of vehicle is more than this limits then the vehicle is unfit for using.

III. PROPOSED SYSTEM

A. *Design Considerations:*

- Low system cost.
- Reduce CO_2 exhaust by managing traffic.
- Easily maintainable.
- At server side unit highly secure.
- Maximum coverage area.
- Increasing tagging percentage.

B. *Description of the Proposed System:* The pollution control and traffic management system has low cost, efficient and also reduce CO_2 emission through vehicles by reducing stand by time.

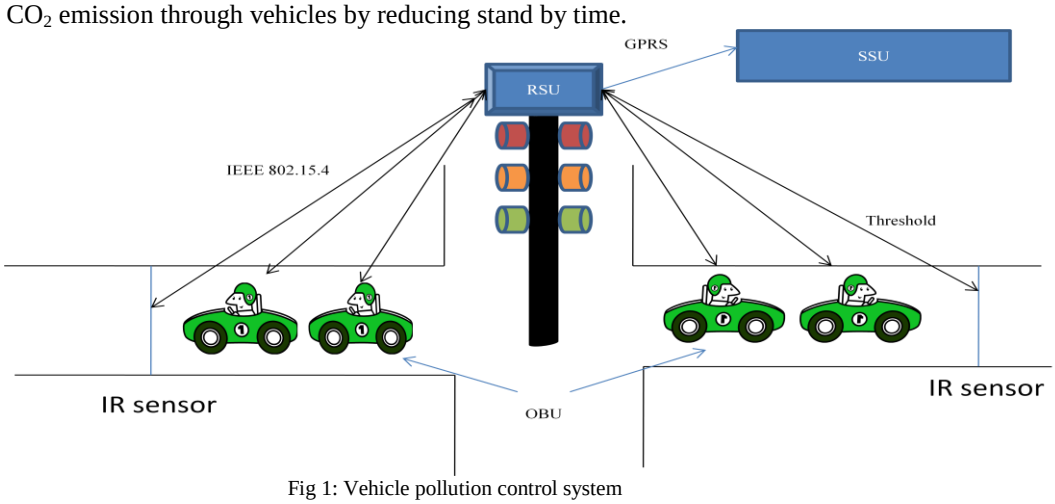

Fig 1: Vehicle pollution control system

Fig shows vehicle pollution monitoring system. This system divided into three subsystems.

1. On board unit (OBU)
2. Road side unit (RSU)

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3. Server side unit (SSU)

On vehicle on board system (OBU) is installed which is used to collect exhaust data from vehicle and send it to road side unit (RSU) which is installed on traffic signal point. Received data along with traffic threshold send to server side unit (SSU).

1. On board unit:

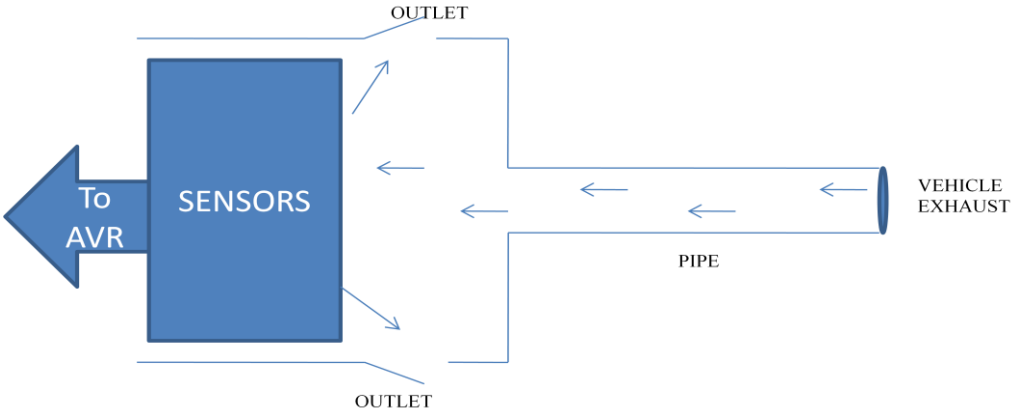

Fig 2: Pipe and sensor arrangement in OBU.

Figure show arrangement of pipe and sensor. Pipe inserted into exhaust pipe of vehicle not more than 300 mm. exhaust from pipe bombarded on sensors. Air after reflecting from sensors comes out through outlet. It is designed to increase accuracy and increase life time of sensor. The Sensitive Material Sno2 is used in MQ-7 gas sensor which has very low conductivity in clean air. As gas concentration increases sensor conductivity increases. At high temperature (heated by 5.0V), it cleans the other gases adsorbed under low temperature. The sensor could be used to detect other gases that contain CO; it is available in low cost and suitable for various applications. It can be use at temperature from -10 to 50 C and consumes less than 150 mA at 5V [6]. Sensitivity characteristic curve of MQ7 is shown below.

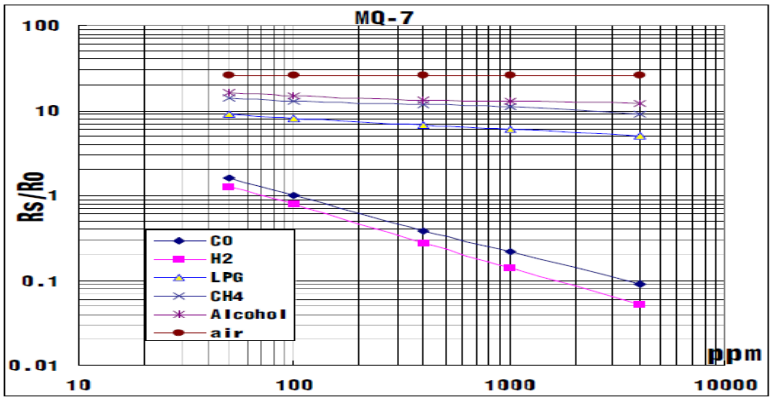

Fig 3: Sensitivity characteristic curve of MQ7.

Figure shows sensitivity curve of MQ7 sensor. Where Ro: sensor resistance at 100ppm CO in the clean air. Rs: sensor resistance at various concentrations of gases. The output of sensors is given to ATmega 328p controller it contains inbuilt ADC so MQ7 sensor can directly connected to it and UART so we can connect it to the ZIGBEE. ZIGBEE uses 2.4 GHz ISM band to connect with other ZIGBEE. We have used XBee pro model which uses star topology with range of 90m. Send data 250 Kbps.

2. Road side unit: this part contains three components first ZIGBEE which receives data from on board unit and give it to ATmega 328p controller. Advantage of ATmega 328p is we can connect it to GPRS 900 module. This GPRS Shield

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works on 800,900,1800MHz so can work on any GSM network in the world. This module contains TCP/UDP stack by using that data can uploaded on server. Here we use baud rate of 9600 bps. With the help of GPRS 900 module data send to a web page using AT commands.

3. Server side unit: this unit consist of website, database and server. First part is designing web page. For designing webpage HTML and PHP language is used. Second part is to create database. Third part is to update database through web page and with authentication. The database of vehicles is updated as shown in fig below.

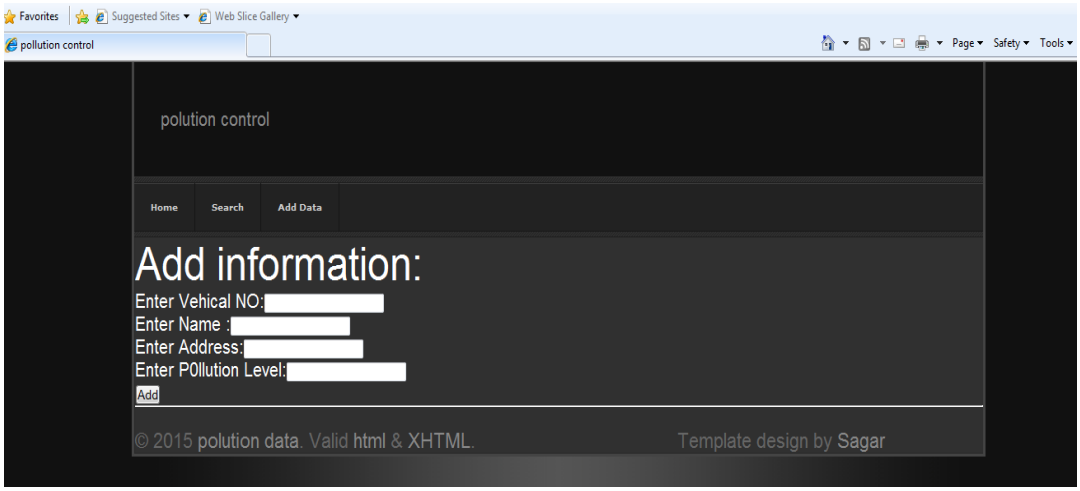

Fig 4: Template to update data.

Figure shows web page to create and update database. By entering vehicle number, name, address new database is created. This link is also helps to update pollution level when only vehicle number and pollution level entered. The second process is done by using post method. Authorized person can only access the information of pollution through vehicles by using login id and password.

IV. SYSTEM ANALYSIS

The CO sensor calibrated with Gas analyser which is used in PUC. Readings are taken out on two wheeler and four wheeler and full acceleration and less acceleration reading is given below.

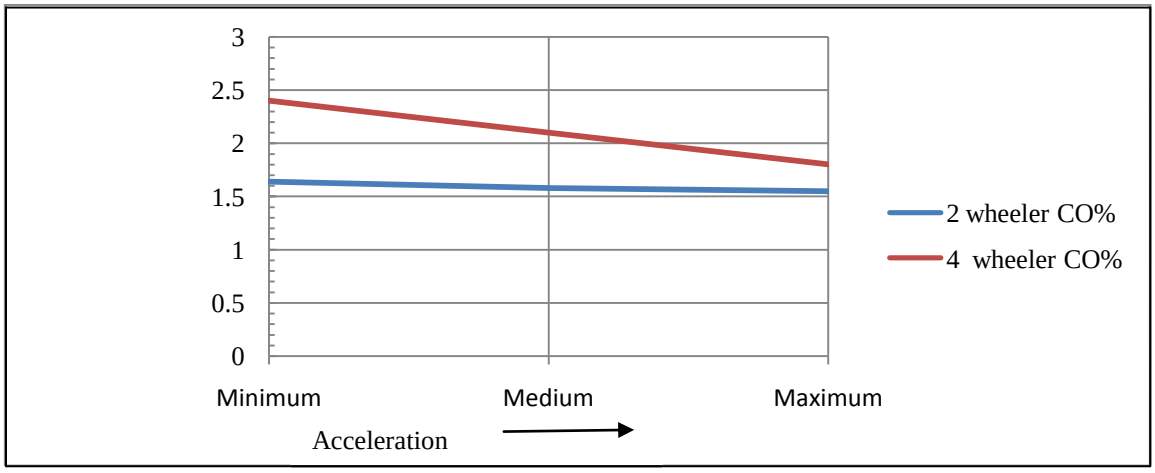

Fig 5: CO exhausts comparison.

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Figure shows reading of co exhaust in two wheeler and four wheeler vehicle. The acceleration changes from minimum to maximum and reading are taken out. Co exhaust is max at minimum acceleration i.e. 1.64% for two wheeler vehicle and it reduces as acceleration increases and become 1.56%. Four wheelers vehicle co exhaust is max at minimum acceleration i.e. 2.4% and reduces as acceleration increases and become 1.98%. From above discussion it is concluded that the co exhaust is maximum when vehicle is stand by position (i.e. low acceleration) this situation mostly occurs at traffic signal point. So traffic signal points are sources of pollution in cities. Traffic control is done by obtaining traffic threshold to reduce co%. Traffic threshold obtained by IR sensors mounted on road at each traffic signal point as shown in figure one.

V. CONCLUSION AND FUTURE WORK

This system is cost effective solution for vehicle emission problem and can be used for other application once it mounted on vehicle. From analysis discussion we concluded that co exhaust can be reduced by using this system. Security at server side is maintained as only authorized person can only know the information of pollution through vehicles. As the system requires database of vehicle owner so to implement the system willingness of government required. The future scope is to increase number of vehicle tagging at a time to server side unit vie road side unit.

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