



# Vehicular Pollution Monitoring System and Detection of Vehicles Causing Global Warming

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## Abstract:

This paper is to develop a compact system to detect the pollutants in the vehicle which could be assembled in the vehicle itself. Tremendous innovations have been made in the technology and manufacturing of cars as well as in the pollution control department but still nothing significant achieved of it. This idea employs an MQ-7 sensor and temperature and humidity sensor which is economical and capable of detecting Carbon Monoxide gas and temperature and humidity emitted from the exhaust gases of the vehicle. An initial warning is given to the driver regarding the amount of CO gas with the help of LCD display and later the same information is transferred to the Police Control Room in case of negligence. This is done with the help of Arduino Controller that is incorporated in the vehicle. The Arduino Controller is used to transfer the information to the different applications from the MQ7 sensor.

**Keywords:** MQ-7 sensor, DHT-11 sensor, LCD display

## I. INTRODUCTION

The imperfect (incomplete) combustion in the engine of a vehicle leads to emission of different harmful gases leading to increase in the pollution and unfavorably affecting the environment. Detection and control of these gases emission source in the environment is an important area of work. Emission of these gases from vehicles cannot be completely avoided but, it definitely can be controlled. As a solution to the above problems, the system is proposed for emission level control of vehicle. The system is provided with the sensors, data from the sensors is used to make check the pollution level and accordingly the control action is carried out to control the pollution of the vehicle.

The monitoring system of harmful gas inside special vehicle has many advantages such as advance performance, high reliability, etc. The detection unit reaches the maximum threshold level, at the same detects the toxic gas, carbon monoxide it send an SMS using internet. User can send SMS and receive SMS through internet, based on that User can control some appliances in host section. The system measures CO, temperature & humidity concentration using sensors. The acquired information about air pollution in surroundings is then stored on central on-line repository system periodically. It uses the internet connection for transferring data to a central computer. These stored data is used to take appropriate action on the vehicle owner.

## II. LITERATURE SURVEY

Chi-Man Vong[1] uses a pollution control system consists of RFID which is connected to the lambda sensors. 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. ChunxiaoLI[2] author presents a vehicle's CO<sub>2</sub> emission reduction scheme by an ETC- Electronic Toll Collection (ETC) devices is used at each traffic junction and 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. NishigandhaAthare, Prof. P.R.Badadapure[3] Human safety and air pollution detection in vehicles. KwangSooYo[4] demonstrates gas Sensors sensing properties for Monitoring Air Pollution and different gases causing air pollution.

Khedo et al [5] proposes deployment of Wireless Sensor Networks (WSN) for air pollution monitoring. The proposed system, namely Wireless Sensor Network Air Pollution Monitoring System (WAPMS) will monitor air pollution in Mauritius through the use of wireless sensors deployed in huge numbers around the island. It will implement new data aggregation algorithm to merge data to eliminate duplicates, filter out invalid readings.

In [7], it is proposed that RFID technology can be effectively used to solve transport related problems such as accident risk management, environment alert, traffic rule violation control, vehicle theft identification and traffic signal management etc. One RFID Tag is placed on each vehicle to send vehicle identification to traffic information database. RFID reader is placed with embedded controller at Toll Gates, Parking areas and also in traffic signal areas.

## III. EXISTING SYSTEM

### 1. PUC (Pollution Under Control)

The PUC test the non-polluting certification test that takes place for all vehicles every three months. If the vehicle crosses

limit of emission, then the vehicle owner has to pay the fine. If the vehicle is not emitting more polluted gases then the non-polluting vehicle certificate will be issued to the vehicle owner. Here, the emission test is done every 3 months. To overcome this problem, our proposed system has an inbuilt system inside the vehicle that checks the continuous emission values.

#### IV. PROPOSED SYSTEM

The proposed system is based on two units. It has two implementation parts: First, we monitor the emission level using an Arduino controller. This is called as vehicle unit. Second, we maintain the database for taking action on the vehicle owner. This is called as server unit. To reduce the complexity of multiple units, these two methods are used.

##### 1. VEHICLE UNIT

The Vehicle unit consists of sensors, Arduino controller, Buzzer and LCD display. In this unit, the sensor is used to collect the data of pollution due to the vehicle. This data that contains the level of pollutants is afterward fed to the Arduino controller. When the pollution level exceeds the threshold value then an alarm is generated and the pollution level is displayed on the LCD display. The Arduino controller in each vehicle contains the internet connection which is used to send the message to the vehicle owner to make him aware about his vehicle conditions. In this unit, by using internet SMS is sent to vehicle owner by analyzing the data from the application for the user.

##### 2. SERVER UNIT

The Server side unit consists of the database at the server. This database consists of data regarding pollution levels, temperature and humidity values and vehicle owner identity. The database is stored with the help of MySQL. The server will get the data from the vehicle when it crosses the threshold value of the pollution level. Then the owner has to tune the engine on the same day. If he fails to tune the engine, next day also the pollution level data will be sent to the police control room. Then, the corrective action will be taken on the vehicle owner.

#### V. ARCHITECTURAL DESIGN

Architectural Design is the process of defining a collection of hardware and software components and their interfaces to establish the framework for the development of a computer system.

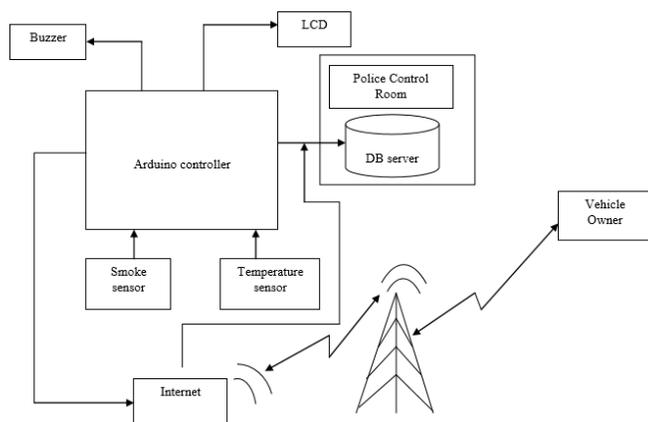


Fig. 4.1 Architectural diagram

The above figure shows the architectural design for the vehicular pollution monitoring system.

- **Smoke sensor:** The smoke sensor continuously senses the smoke released. The smoke sensor is connected to the exhaust pipe. The values from this sensor are sent to the arduino board to compare with the threshold value.
- **Temperature sensor:** The temperature sensor continuously senses the temperature of the exhaust gases. The values from this sensor are sent to the arduino board to compare with the threshold value.
- **Arduino controller:** The arduino controller checks the values from the above two sensors. If the values cross the threshold value a warning message is sent to the vehicle owner via internet.
- **LCD display:** The LCD display is fixed near the steering so that the driver will see the sensor values.
- **Buzzer:** The buzzer raises the alarm when the threshold value of the sensor is crossed.
- **Police control room:** The police receive the message send from the GSM and he takes the corrective action on the owner of that vehicle.
- **Database Server:** The Database server is used here to maintain the list of abnormal sensor values from a particular vehicle. These values are used by the police to put the penalty on them.

#### VI. SYSTEM REQUIREMENTS

##### 1. Hardware Requirements

- Arduinomicrocontroller development board
- MQ7 Gas sensor
- DHT-11 sensor
- sensor
- LCD display
- Buzzer

##### 2. Software Requirements

- Language : Embedded C
- Backend : MySQL Server
- IDE : Arduinouno, Visual St

#### VII. Implementation

In this section, implementation of the framework is discussed. Despite the fact that Internet of Things is a relatively new concept, there are already a few open platforms available which are able to perform remote and seamless management and experimentation with sensor data.

The proposed system consists of the five basic modules that performs processing of the data and interface to different applications that makes the system user-friendly. These are

- Sensor Module(temperature and CO)
- Display Module
- Alarm Module
- SMS Module
- Server Module

### 1. Sensor Module

Sensor module includes two sensors that are Carbon-monoxide sensor and temperature and humidity sensor for the purpose of sensing of the exhaust gases liberated from the vehicle. These sensed values are fed to the arduino controller for processing of the sensed data, where comparison is made between the sensed values and the defined threshold values the threshold, if sensed values are beyond the threshold value then the system makes the owner alert through alarm.

### 2. Display Module

The display module is developed to provide the user interface, where the users of the system are capable of interacting with the system either through LCD display or through different applications for the vehicle owner and for the police control room.

The LCD display displays the amount of pollution level of different polluting factors that are Carbon-monoxide, temperature and humidity. The sensed data of these factors is continuously displayed on the LCD display, which is kept inside the vehicle and in front of the driver. One application is developed for the user, which displays all pollutants information; in addition to this it will also displays the status of sending SMS to ensure that the message is sent successfully. One more application is developed at the police control room that retrieves data from the database and displays only one record for a day which indicates that one day of time is given to the vehicle owner for making the tuning of the engine.

### 3. Alarm Module

This module requires an output device called buzzer, which generates an alarm only when the condition is satisfied with respect to the threshold value. That is, the pollution is beyond the threshold value.

### 4. SMS Module

This module involves informing the vehicle owner about his vehicle conditions by sending an SMS to inform him that the tuning of vehicle engine is required at that particular time, because the vehicle owner is unaware of his vehicle conditions. So providing such facilities makes vehicle owner to know the status of pollution increase through his vehicle.

### 5. Server Module

It is the database maintaining module, which stores the information regarding the vehicle conditions by including the concentration of Carbon-monoxide, temperature and humidity. Along with this the vehicle id is also included in the database which acts as the primary key for the table; that can be uniquely identified. This key will also help to retrieve the data from the police application to take the necessary action. This database is capable of holding only those entries that do not exist for the same day; which indicates that for each day only one set of values for concentration of carbon-monoxide, temperature and humidity are stored for the vehicle of a particular vehicle id.

## VIII. ADVANTAGES

- The designed smart intelligent environmental system monitors the pollutants produced by the vehicles.
- Warn the vehicle owners to control the pollution.

- The air pollution agencies can able to analyze the data and also detect the vehicle registration numbers that causes more pollution in the atmosphere.
- Low cost, simple to operate and is easily inserted in any locations.

## IX. DISADVANTAGES

- Internet connectivity is must for sending the SMS to vehicle owner.
- Short period of one day time is given to the vehicle owner for making tuning of the engine.

## X. EXPERIMENTAL RESULTS

In our proposed system, the MQ-7 sensor is used to sense the CO gas concentration in the gas emitted from the vehicle. The DHT11 sensor is used to sense the temperature and humidity of the released gas. Both the sensors are placed facing the exhaust pipe. The arduino controller is inbuilt in the vehicle and the LCD display is placed in front of the driver near the steering. Both the sensors continuously sense the values and the values are sent to the arduino controller. The arduino controller then compares the CO concentration level with the threshold value set in the arduino. If the sensed value is greater than the threshold value then a message is sent to the owner of the vehicle and at the same time the vehicle id, threshold crossed sensor values along with date and time is sent to the database server maintained in the police control room. The owner is allowed to tune up the engine. Every day a warning message is sent to the vehicle owner and the database entry is made in the police control room until the owner tunes up his vehicle's engine. So, the corrective action can be taken on the vehicle's owner if he delays to tune up the engine.

In the below figure 9.1 we can see the temperature and humidity value and the CO sensor value displayed on the LCD display.



Fig. 9.1 Output displayed on LCD display

In the fig. 9.1 we can see the picture of the LCD display. Here, T represents the temperature of the released gases, H represents the humidity of the released gases relative to temperature and CO represents the CO concentration in the released gases from the particular vehicle.

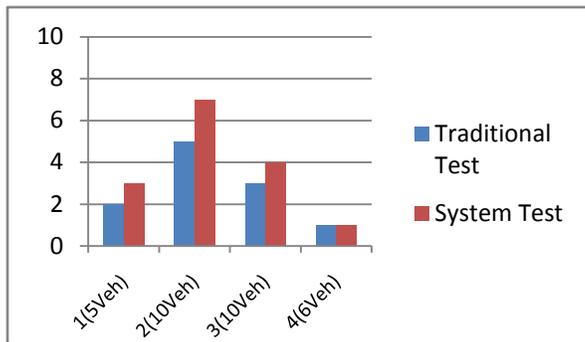


Fig 9.2 Result analysis by testing the system

- X-axis → Test Cases (no. of vehicles tested).
- Y-axis → no. of vehicles crossed CO release limits.

In the above Fig 9.2 we can see the result analysis chart obtained by testing our system for different vehicles. By considering all the four cases, the proposed system is giving satisfactory results.

The threshold of CO value is fixed as 409 (analog value) because, the permissible CO content from the car is 2V which is equal to 409 (analog value).

The calculations required to convert from analog to volt are as shown in the following-

- To convert analog to volts =  $\{5 \times \text{analog value from the sensor}\} / 1023$

## CONCLUSION

IoT is an emerging networking concept within the pervasive or ambient things or objects are connected to provide a smart or intelligent service to make human life easier and happier. Using the IoT we have proposed a system which monitors the vehicular pollution. By monitoring the emissions data, the engine health can be easily inspected and examined. The vehicle owner also becomes aware of his vehicle's condition and makes the engine tune-up. Experimental results show that the proposed system is effective and reliable for vehicle emissions inspection. As we all know that global warming is taking place due to environmental pollution. Vehicular pollution is the main cause for the environmental pollution. By using the proposed system, the global warming can be reduced to some extent.

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