



Automated Control System for Air Pollution Detection and Rash Driving Prevention In Vehicles

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ABSTRACT: Vehicles have become an integral part of everyone's life. As we know that a coin has two sides that have their own effects, one of the main side effects is air pollution. Every vehicle is having emission but the problem occurs when it is beyond the standardized level. This emission from vehicles cannot be completely avoided but, it definitely controlled. Now a day accidents is a common feature of deaths. The common feature of accidents will be rash driving, drunk and driving, due to minor drivers etc. Rash driving is a nature of driver which causes panic in the traffic and finally leads to accidents. These are critical things to control so we aim to develop a system that reduce rash driving. As a solution to the above problems we aim to build an automated control system for air pollution detection and rash driving prevention in vehicles. This emission of hazards gases can be control by the evolvment of semi-conductor sensor system. Sensors in the system detect the level of pollution gases along with level of ethanol in driver's breath & indicate it on the display. If the pollution level goes beyond the threshold level the microcontroller alerts the buzzer and displays pollution level on LCD. At the same time, microcontroller activates the timer that indicates vehicle will be stopped after predefined time if appropriate action is not taken by driver. When timer run-out, the vehicle will be get stop due to the fuel supply to engine get stop. For that a relay circuit is used. The GSM sends the alert SMS at registered mobile number with vehicle current location using GPS in the latitude & longitude values.

KEYWORDS: Semiconductor Sensors, Microcontroller (LPC2148) board, GSM & GPS Modules, LED'S, and LCD Display etc.

I. INTRODUCTION

Now a day's air pollution is the biggest problem to manage due to heavy increase in number of vehicles. Vehicles are the primary source of the air pollution the emission from vehicle will produce polluted air having serious impact on human health affecting the respiratory system and lungs. Similarly air pollutants contribute to environmental issues such as, green house gases, which affect the ozone layer. The main pollutants from vehicles are different oxides of carbon and nitrogen, which can be detected with the help of semiconductor gas sensors. Therefore, in this paper we proposed a system that useful in reducing the amount of pollution from vehicles. The proposed automated control system uses CO sensor & smoke sensor to measure the percentage of pollutants like carbon, nitrogen, hydrogen, & different oxides. These sensors are fixed at the end of exhaust of vehicle from where smoke is released into the environment. The CO sensor & smoke sensor detects the percentage of pollutant gases and gives it to microcontroller to check the maximum percentage of pollutants content in smoke released by vehicles. So the controller checks the percentage of different pollutants and if it is more than the threshold level which is already predefined the microcontroller triggers the buzzer to inform driver the percentage of pollutant is excides then the threshold. At the same time microcontroller trigger the timer circuit when the timer run out the fuel supply to engine cut off & vehicle comes to halt. The GSM will trigger sends the notification SMS along with vehicle location where it is stop. The same system implementation is used for rash driving prevention. Now a day's rash driving is common feature of accidents these are critical things to control for this alcohol sensor is used it measures the ethanol contain in driver breath. If it is



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more than threshold the microcontroller triggers buzzer also GSM module sends the SMS with vehicle current location using GPS.

II. RELATED WORK

The government of India made several regulations to control the pollution levels from vehicles. The Central Pollution Control Board under the Ministry of Environment & Forests set standards and timeline for implementation to control emission level. The duty of this board is air quality monitoring. The government of India created the Bharat Stage Emission Standards for air pollution control from motor vehicles. Bharat stage emission standards are emission standards that used to regulate the output of air pollutants from internal combustion engine equipment, including motor vehicles. Several emission norms were come to control the emission levels from vehicles since last two decades. There are many people who research on the air pollution detection in vehicles. In 2002, the authors K. Galatsis, W. Wlodarsla, K. Kalantar-Zadeh and A. Trinchi, has chosen the commercially available gas sensors for the toxic gases detection which are compared with the fabricated MOO3-TiO2 and MOO3- WO3 thin films [1]. In 2010, George F. Fine, Leon M. Cavanagh, Ayo Afonja and Russell Binions said that the metal oxide semiconductor gas sensors that are utilized in variety of different roles in industries. [2]. these are relatively inexpensive compared to other sensing technologies, robust, lightweight, long lasting and quick response times. In 2012, Siva Shankar Chandrasekaran, Sudharshan Muthukumar and Sabeshkumar Rajendran described an embedded system for vehicle cabin toxic Gas detection and Alerting. The system is developed using GSM and GPS modules for detecting pollutant gases with vehicle location [3]. In 2013 Anitha Kulkarni, T. Ravi Teja developed an automated control system for air pollution detection for vehicles. In this system a relay circuit is used for the control of ON and OFF position of the fuel pump. GSM and GPS system are used for sending data and locating nearest work station for vehicle servicing [4].

Road accidents claim a staggeringly high number of lives every year. From drunk driving, rash driving over speeding and over-crowding of vehicles, in majority of road accidents According to the report on "Road Accidents in India, 2011" by the Ministry of Transport and Highways, Government of India, approximately every 11th person out of 100,000 died in a road accident and further, every 37th person was injured in one. This situation makes it a necessity to target the root cause of road accidents in order to avoid them. "Road Accident Prevention Unit" is a step design to monitors the driver's state using multiple sensors and looks for triggers that can cause accidents, such as alcohol in the driver's breath and driver fatigue or distraction. When an alert situation is occurred, the system informs the driver and tries to alert him.

III. BLOCK DIAGRAM AND DESCRIPTION

The overall block diagram of system is mainly consists of following blocks shown in fig.1 here microcontroller LPC2148 is the main heart of the system followed by CO sensor, Smoke sensor, Alcohol sensor, GSM and GPS modules, LCD, Buzzer, power supply unit etc.

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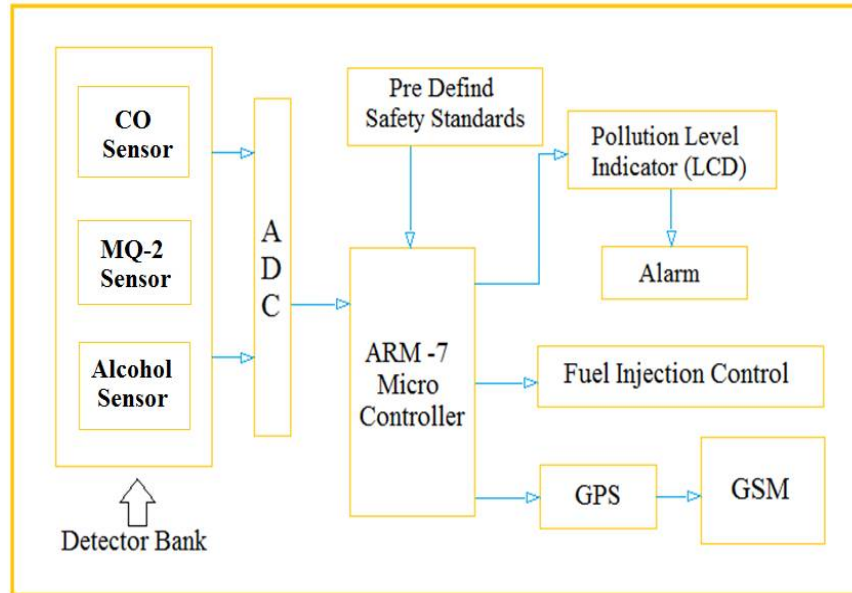


Figure 1: Block Diagram of System

1) Microcontroller (LPC2148) board:

LPC2148 is the widely used IC from ARM-7 family. It has pre-loaded many inbuilt peripherals making it more efficient & reliable. It consists of three inbuilt timer/counter which will be used for the time configuration. The microcontroller is programmed to perform three function namely_

- Comparison
- Timer
- Triggering

The microcontroller takes two I/P, one from sensors & another being from the pre-defined threshold values. When the sensors value is more than the threshold value the microcontroller triggers the timer circuit & an alarm is set off to inform the driver of the vehicle about the situation & also indicate that the vehicle will come to a halt in pre-defined time as timer runs out. Apart from timer being triggered a trigger is also given to the GPS which helps in locating location of vehicle by SMS.

2) Detector bank:

The semiconductor sensors are main component of detector bank which are located into different location in vehicle. The sensors sense the values & feeds to the microcontroller through transducer & ADC. The transducer is use to convert O/P of the sensor into an electrical signal. The analog electrical signal is then converted into a digital signal using an ADC. So it can be compared with pre-defined std. values. In this system three sensors are used these are as_

a) CO Sensor (MQ7):

The MQ-7 is suitable for sensing the pollutant gas such as carbon and its different oxides. The sensitive material of MQ-7 gas sensor is SnO₂, which with lower conductivity in clean air. MQ-7 has high sensitivity & fast response time. It can sense CO in PPM ranging 100 to 1000 PPM. It operates on 5Volts having Long life, available at low cost.



Figure 2: CO Sensor

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b) Smoke Sensor (MQ-2):

The MQ-2 gas sensor is suitable for sensing Hydrogen, Methane, Butane, & other combustible gases. It can sense Hydrogen, Butane in PPM ranging 300 to 5000 PPM, Methane 5000 to 20000 PPM. The MQ-2 has high sensitivity & fast response time, made up of SnO₂, having lower conductivity in clean air. It operates on 5Volts.



Figure 3: Smoke Sensor

c) Alcohol Sensor (MQ-3):

Alcohol detector is also called as MQ3 sensor which is made up off SnO₂. The MQ-3 gas sensor is used to detect alcohol percentage with different concentration. Initially conductivity of sensor is low. As the alcohol gas rises, the concentration of sensor also increase. MQ3 is highly sensitive to the alcohol and has good resistance to disturb of gasoline smoke and vapor. It is with low cost and suitable for different applications.



Figure 4: Alcohol Sensor

3) Fuel Injection Control:

The main function of the fuel injector is to cut the supply of fuel to the engine, when sensors values are more than threshold values. A relay circuit is used to control the ON/OFF position of the fuel pump. Here microcontroller is programmed in such way that when microcontroller sends a trigger pulse after the timer runs out relay should get back to its original position. Which cutoffs fuel supply to engine.

4) GSM Module:

Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. GSM supports voice calls and data transfer speeds of up to 9.6 kbit/s, with the transmission of SMS (Short Message Service). GSM is used for the communication between vehicle & user. If the sensors values cross the threshold values then GSM send message.

5) GPS Module:

GPS (Global Positioning System) is a satellite-based navigation system that sends and receives radio signals. GPS technology is used to find the location of any object or vehicle to monitor continuously using satellite signals. When the sensors values reach the maximum limit, a trigger pulse is given to GPS by microcontroller. The GPS module is programmed in such a way that, when it receives a trigger pulse from microcontroller, it gives the vehicle location.

6) LCD (Liquid Crystal Display):

LCD is a flat panel display, electronic visual display, based on Liquid Crystal Technology. It is a 16 character, 2-line alphanumeric LCD display, requires data in a serial format. Here LCD is basically used for displaying output which is to be measured & shows the notification of entire process.

7) Buzzer:

The buzzer module is used for audible alerts when the emission level shoots beyond the set threshold level. The buzzer or beeper is an audio based signaling device. It is mainly designed as mechanical, electromechanical, or piezoelectric.

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IV. PERFORMANCE ANALYSIS

The developed system is mainly used for controlling the air pollution from motor vehicles along with rash driving prevention when the values of sensors reach its maximum threshold value. The implementation of the developed system is shown in fig.5 and the working of the system is explained below.

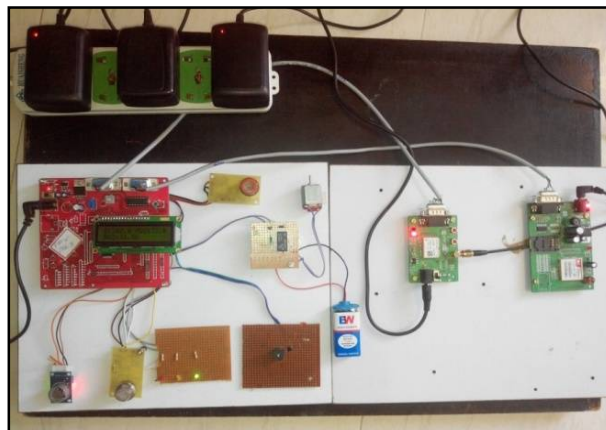


Figure 5: Photograph of developed system

The working starts with the sensing of the sensor in this system there are three sensors which are MQ7, MQ2 and MQ3. They sense carbon monoxide, methane, hydrogen, butane & alcohol (ethanol) respectively. They give analog output as per the concentration of gas present near by the environment and gives analog output to microcontroller. The microcontroller takes the analog input and converts it into digital output using ADC. After this microcontroller gives command to the liquid crystal display to print the values of sensors on it. And there is a limit specified in the program of these sensors of its concentration (standard values). If the limit of concentration of these sensors is under the specified standard values then it consider the normal condition & under this condition the vehicle is normally running indicating with ON of green LED light. If the limit of concentration of these sensors crosses the specified standard values then a buzzer sounds at the same time yellow LED light will ON indicating that level of pollution is increase. The command to buzzer is given by the microcontroller. After pre-defined time interval the vehicle comes to halt if appropriate action is not taken, indicating with ON of red LED light. Simultaneously microcontroller gives command to the GSM & GPS which is used to inform the alert text message along with vehicle location in terms of latitudinal and longitudinal values to owner of the vehicle. By this the owner gets a message on his mobile and he has to take appropriate action. Thus in this way system can maintain less pollution, avoiding road accidents and keep our surrounding safe. The following fig.6 shows the schematic of notification messages. The owner of vehicle with registered mobile number will get alert SMS along with vehicle location in latitude & longitude format when the sensors values more than the threshold values.



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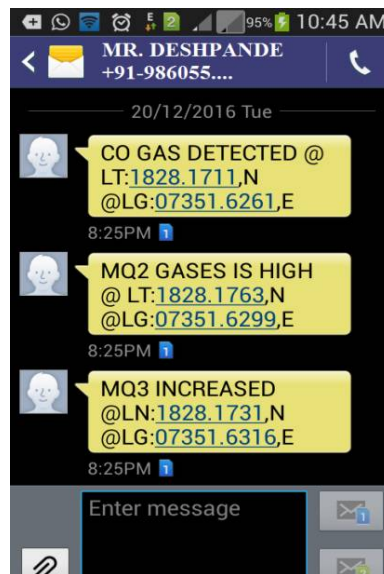


Figure 6: Schematic of Notification Messages

V. CONCLUSION

There is an increase in the level of air pollution over last couple of decades, leading to several environmental problems. Which are resulted in Ozone layer depletion leading to green house effect. Air pollution also affects the human health causing the lungs and respiratory system problems. So, the developed system will be highly beneficial in curbing this problem. The second thing is the rash driving prevention, as we know rash driving is the main reason of accident. So the system will more helpful to provide more public safety. The system helps to keep the environment free from vehicular emission. Also this system is just add-on, it does not need to change configuration of engine, will makes easier to employ this system in existing vehicles.

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