

Smart Internal Combustion Engine Exhaust Monitoring & Control System

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Abstract-Control over urban air pollution turns out to be an enormous challenge due to not only the rising numbers of total vehicles but also the increased toxic risk of diesel cars. Every vehicle will have emission but the air pollution occurs when it crosses the standardized values. The main reason for this breach of emission level being the incomplete combustion of fuel supplied to engine, which is due to the improper protection of vehicles. This emission from vehicles can be controlled but cannot be completely avoided. The pollution level can be minimized by the use of innovative and technical methods. This paper aims at using semi-conductor gas sensor at the exhaust of vehicles which detects the level of pollutants. When the emission level goes beyond the already set threshold level, by using GSM, a message will be sent on the driver's mobile number also there will be a buzzer in the vehicle to indicate that the limit has been crossed and the vehicle will stop after a certain period of time a cushion time given to the driver for parking vehicle. During this time period, the GPS starts locating the nearest service stations. After the counter of timer runs out, the fuel supplied to the engine of vehicle will be cut-off by using fuel injector circuit and the vehicle has to be towed to the mechanic or to the nearest service station. A microcontroller monitors and controls the synchronization and execution of the entire process.. This project, will benefit the society and help in reducing the air pollution. when implemented as a real time project.

Keywords- Air Pollution, Sensors, GPS, GSM, Micro Controller.

I. INTRODUCTION

By the time the issue of air pollution is increasing day by day. Use of fuel based vehicles is the biggest reason of the problem. So such pollution is very harmful for environment as well as human life. It may cause very serious effects on the global environment if it is not controlled.. Air pollutants cause serious impact on human health. Vehicles are one of the major contributors to air pollution apart from industries. The incomplete combustion of fuel in the engine of a vehicle leads to emission of diverse gases causing increase in the pollution and harmfully affecting the environment. The main pollutants from vehicles are nitrogen oxide, carbon monoxide, hydrocarbons, which can be easily detected with the help of semiconductor gas sensors. Therefore in this paper a scheme is suggested which will reduce the amount of pollution from vehicles. In this system smoke detector is used to detect percentage of the carbon monoxide in smoke released by vehicles due to combustion of fuel in it. Smoke detector is set at the end of exhaust of vehicle from where smoke is released into the surroundings. The smoke detector detects carbon monoxide and gives it to microcontroller to check the maximum percentage of carbon monoxide content in smoke released by vehicles and if it is more than the threshold level of carbon, the system module sends SMS about this to the driver through GSM and it also sends location of vehicle through GPS system. The rest of the paper is organized as part II gives the literature review and a brief note about the various research activities, on gas sensors and monitoring systems. Part III discusses about the various blocks of the proposed

system. Part IV concludes the paper with an idea to implement the same as a real time project.

II. LITERATURE REVIEW

The standards and the timeline for implementation are set by the Central Pollution Control Board under the organization of Environment & Forests. Over the years, there have been several convention made by the Government to control the emission from vehicles; most of them being unsuccessful at the time. Bharat stage emission standards are emission standards instituted by the Government of India to normalize the output of air pollutants from internal combustion engine equipment, including motor vehicles.

The first emission norms were introduced in India for petrol in 1991 and 1992 for diesel vehicles. On April 29, 1999 the Supreme Court of India made rule that all vehicles in India have to meet Euro I or India 2000 norms in June 1, 1999 and Euro II will be mandatory in the NCR in April 2000. The standards, in 2000 based on European regulations were first introduced. All new vehicles manufactured after the implementation of the norms have to be acquiescent with the regulations. As October 2010, Bharat stage III norms have been obligatory across the country. In 13 cities, Bharat stage IV emission norms are in rules since April 2010. The standardized values for the emission levels are referred as given in [1]. The sensing of the emitted gases is done using various sensors and devices. In the past years, there has seen several research activities that have been taking place to develop semiconductor gas sensors [2]. In the paper [3], the

quality of air in the car cabin was analyzed using MOS gas sensors. In the paper [6], station a system is proposed to detect the excessive emission of CO from vehicles and then there was a GPS which will locate the service station, but there were no facility to send text SMS on the mobile number of driver. In the paper [7], author proposed an air pollution detection system for the detection of CO they have used mq-2 gas sensor. In the paper [8], author developed an embedded system for hazardous gas detection in homes and offices. LPG and propane gas can be detected by using mq-6 gas sensor. In paper [10], a pollution detection system was developed by sensing carbon monoxide gas using mq-4 sensor, but no controlling mechanism was provided. In the paper [11], a pollution detection system was developed in which they have used LPC 1343 microcontroller.

In this paper, LPC 2148 microcontroller which is a reliable and fast response machine is used. The semiconductor sensor MQ-7 has been used to detect the pollutant level of the vehicles. This paper focuses mainly on three parts; microcontroller, smoke detector and fuel injector. The smoke detector detects the pollutant gas (CO) continuously. The level of pollutants is compared by the microcontroller with the standardized level allowed by the government. When the pollutant level crosses the standardized limit, it sends a trigger signal to the fuel injector. On getting a signal from the controller, the fuel supply to the engine will be stopped after a certain period of time.

III. PROPOSED SYSTEM

The overall block diagram of the proposed system is given in figure 3.1.

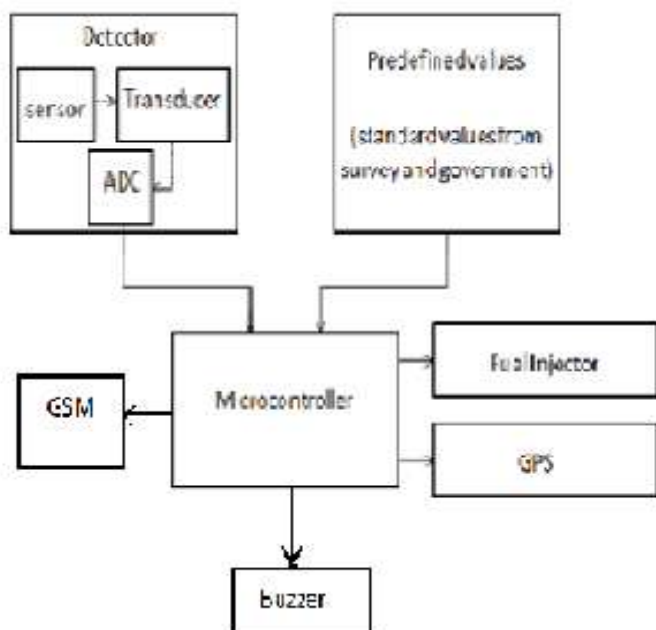


Figure 3.1 Block diagram

A. Detector

The detector contains three sub-blocks namely smoke sensor, ADC and transducer. The smoke sensor is the key component of the detector block which is placed onto the exhaust of the vehicle. The sensor senses the amount of carbon monoxide which is emitted from the vehicle and gives the data to the microcontroller through the analog to digital converter and transducer at regular intervals of time. The transducer is able to convert the output of the sensor into an electrical signal. Using an ADC the analog signal is converted into a digital signal, so that, it can be compared with the already defined values, in the microcontroller.

In this paper, carbon monoxide detecting sensor (MQ-7) is used as shown in figure 3.2 that can measure carbon monoxide concentrations ranging from 10 to 10,000 ppm is used. This sensor mostly used in sensing carbon monoxide concentrations in ppm at the exhaust of vehicle as shown in figure.3.3 and gives an analog output. The MQ-7 gas sensor is mainly made up of Tin Dioxide (SnO₂), with the cleanliness of air its conductivity changes. The advantage of the MQ-7 gas sensor is that it has high sensitivity to Carbon Monoxide. Also, it has a long life time and is available at a low cost.



Figure 3.2 Carbon monoxide sensor

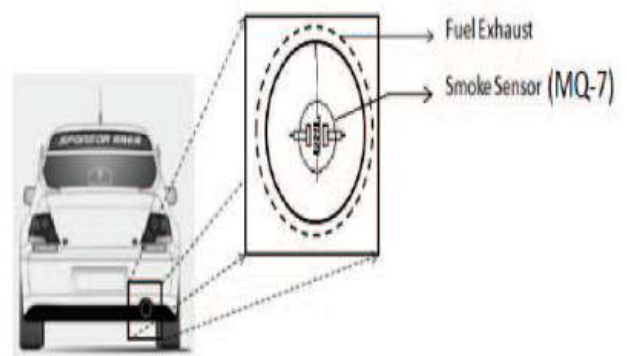


Figure 3.3 Smoke sensors

B. Microcontroller

In this paper, LPC2148 is used which is an 16/32 bit micro controller, To make pollution detection faster, system should be used with advanced microcontroller to decrease computational complexity. It does not have an operating system and simply runs the program in its memory when it is

turned on. This microcontroller deals with a keil programming code. Microcontroller operates at +3.3V which can be regulated using the voltage regulator (L7805). +5V input power is converted to 3.3V using 1117 IC. Crystal oscillator is used to execute the programming code.

The microcontroller does three functions that are comparison, timer and triggering. The microcontroller has given two inputs; one is from pre-defined threshold value predefined by the government and another is the smoke detectors output. When the smoke detector output is greater than the threshold level, the microcontroller triggers the timer circuit and a buzzer, to inform the driver of the vehicle, that the emission of carbon monoxide gas has been breached and also indicate that the vehicle will stop as soon as the timer runs out. Microcontroller also triggers the GPS, which locates the nearest service station in the latitude and longitude form. Once the timer runs out, a trigger is send by the microcontroller to the fuel injector, which stops the flow of fuel to the engine of the vehicle consequently the vehicle comes to a halt.

C. Fuel Injector

The fuel injector is an electromechanical device, which is fed by a 12 volt supply from either the fuel injection relay or the ECM. A fuel injector must spray fuel as a mist because it's easier for vehicle's engine to burn the fuel. When you step on your gas pedal, your vehicle's throttle valve (which is a valve that opens and lets air into your engine) works in conjunction with your fuel injectors.

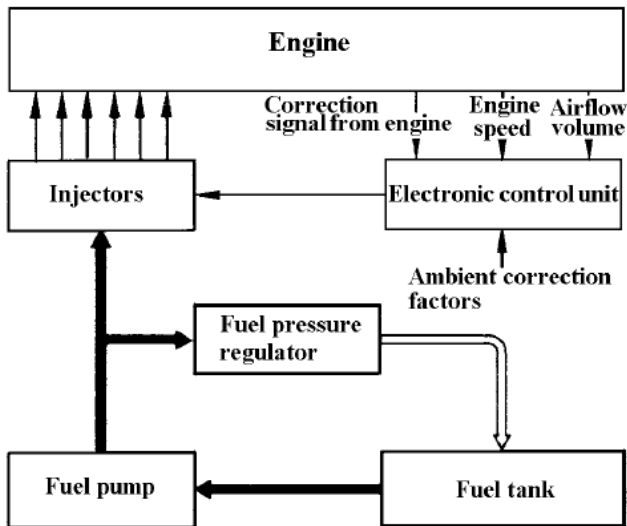


Figure 3.4 Schematic diagram of the electronic fuel injection system

The main function of the fuel injector is to cut the supply of fuel to the engine, when the pollution limit is crossed. The relay circuit shown in the figure.3.5 is used to control the on and off position of the fuel pump [4]. In this paper, the engine control unit is program in such a way that,

when the microcontroller sends a trigger after the timer runs out, relay should get back to its original position, i.e. the fuel cut off switch, is on and then the supply of fuel from fuel tank to the injector is stopped as shown in the figure 3.4. Then automatically the vehicle will be stopped.

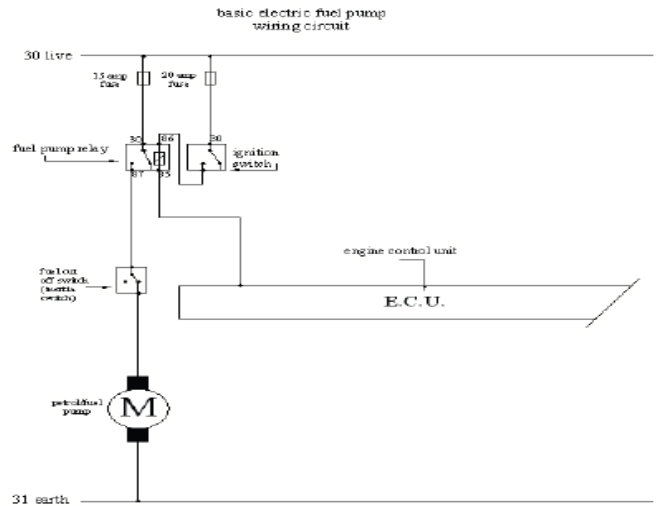


Figure 3.5 Fuel pump wiring circuit

D. Global Position System for Mobiles (GSM)

GSM is a global standard for digital cellular communication. GSM module will send the message to the drivers mobile number indicating that pollution limit has been crossed when the smoke value excides the pre-defined value.

E. Global Positioning System (GPS)

GPS is a U.S. space-based global navigation satellite system. It provides reliable positioning, navigation, and timing services to worldwide users on a continuous basis in all weather, day and night, anywhere on or near the Earth which has an unobstructed view of four or more GPS satellites. A GPS receiver calculates its position by precisely timing the signals sent by the GPS satellites high above the Earth

When standardized the pollution level is crossed, a trigger is given to GPS by the microcontroller. The GPS is programmed in such a way that, when it receives a trigger pulse, it shows the nearest vehicle service stations where the vehicle can be taken for maintenance.

IV. CONCLUSION

From the study of literature it is found that there were many pollution detection systems are developed but in those systems no controlling mechanism was provided. To overcome this problem an excellent scheme is mentioned in this paper. This whole paper entirely focuses on the concept of detecting the level of Pollution and indicating it to the driver or RTO. There is an increase in the level of Pollution over the last couple of years, causing several Environmental problems. There are many people all over the world who do not take the pollution from their vehicles seriously, which results in several

environmental problems like depletion of ozone layer and so on. So, this system will be highly beneficial in reducing this problem. Also this system will be one of the greatest improvements in technology to keep the Environment free from vehicular emission and bring vehicle to a halt if the Pollution level is more than the Standards defined by the Government. This system will not change the configuration of the engine instead will make it easier to embed this system in the existing vehicles. This paper, when augmented as a real time project, will benefit the society and help in reducing the air pollution.

REFERENCES

- [1] http://wikipedia.org/wiki/Bharat_stage_emission_standards
- [2] George F. Fine, Leon M. Cavanagh, Ayo Afonja and Russell Binions " Metal Oxide Semi-Conductor Gas Sensors in Environmental Monitoring", Sensors 2010, 10, 5469-5502;
- [3] K. Galatsis, W. Wlodarsla, K. Kalantar-Zadeh and A. Trinchi, " Investigation of gas sensors for vehicle cabin air quality monitoring," vol. 42, pp. 167-175, 2002.
- [4] "Trade of Motor Mechanic"; Module 5; Unit 2 Electronic Fuel injection; Phase 2 by FÁS Learning Innovation Unit with Martin McMahon & CDX Global; Curriculum Revision 2.2 16-01-07.
- [5] LIU Zhen-ya, WANG Zhen-dong, CHEN Rong, "Intelligent Residential Security Alarm and Remote Control System Based on Single Chip Computer," vol. 42, pp. 143-166, 2008.
- [6] Siva Shankar Chandrasekaran, Sudharshan Muthukumar and Sabeshkumar Rajendran "Automated Control System for Air Pollution Detection in Vehicles", 2013 4th International Conference on Intelligent Systems, Modelling and Simulation.
- [7] Anita kulkarni, T. Ravi Teja, "Automated System for Air Pollution Detection and Control in Vehicles", Vol. 3, Issue 9, September 2014
- [8] V.Ramya, B. Palaniappan "Embedded system for Hazardous Gas detection and Alerting International Journal of Distributed and Parallel Systems" (IJDPS) Vol.3, No.3, May 2012
- [9] Mohammad Akthar Ali1, M. Venkata Sireesha, "Automated Control System for Air Pollution Detection in Vehicles", ISSN 2319-8885 Vol.03, Issue.32 October-2014,
- [10] M. Ranga Reddy & S. Sarath Chandra "An intelligent air pollutant vehicle tracker system using gas sensor and GPS"
- [11] Channabasavaiah M S, Shrinivas Mayya D Automated Control System for Emission Level & Rash Driving Detection in Vehicles Vol. 2, Issue 2, pp: (96-99), Month: April - June 2014
- [12] Amarananth, N. V. Uma Reddy "Engine Self-Test With Air Pollution Detection And Remote Information System "eISSN: 2319-1163 | pISSN: 2321-7308
- [13] Vijay Savania, Hardik Agravata and Dhrumil Patel "Alcohol Detection and Accident Prevention of Vehicle" IJIERE Volume 2, Issue 3, 2015
- [14] Suneha D. Pawar, Prof .U. A. Rane, "Environment Monitoring and Device Control using ARM based Embedded Controlled Sensor Network", (IJETR) ISSN: 2321-0869, Volume-3, Issue-4, April 2015
- [15] V.V.R Kishore, Suman, "A Novel Approach to Implement Self-Controlled Air Pollution Detection in Vehicles using Smoke Sensor", (IJETT) – Volume 16 Number 6 – Oct 2014