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Vehicle Health Monitoring using Multiple Sensors

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ABSTRACT

Every vehicle has its own emission of gases, but the problem occurs when the emission is beyond the standardized values. The primary reason for this breach of emission level being the incomplete combustion of fuel supplied to the engine which is due to the improper maintenance of vehicles. This emission from vehicles cannot be completely avoided, but it definitely can be controlled. The aim of the project is to monitor and control the pollutants in the vehicle by using the pollution control circuit. This pollution control circuit consists of various sensors like smoke sensor, temperature sensor and GSM, GPS kind of devices, and all of them are integrated and connected to a Controller. It is a real time work where a demo application has been made in which ARM 7 processor is used and a controller board is made where all these devices get integrated and work accordingly. The vehicle is controlled by this circuit. When a vehicle attains certain threshold pollution level then the engine gets automatically switched off and an SMS is generated and sent to the pre-defined number stored in the memory through the GSM module. The GPS module is used to locate the vehicle position where it is halted. This paper demonstrates an effective utilization of technology by which we save our environment by controlling the pollution of vehicles.

Key Words: ***Sensors, GSM, GPS and Controller.***

INTRODUCTION

The incomplete combustion in the engine of a vehicle leads to emission of different gases contributing to increase in the pollution and adversely affecting the environment. Detection and control of these gases is an important area of work [1-2]. This emission from vehicles cannot be completely avoided but, it definitely can be controlled. Now a day's accidents are common reason for deaths. These are critical things to control so here we come up with a concept to reduce pollution and detect the location of accident using GPS. As a solution to the above problems we aim to build an automated control system for emission level control of vehicle and accident place detection. Smoke detector is used to detect the carbon percentage in the smoke released by the vehicle due to combustion of fuel in it [3-4]. Smoke detector is fixed at the end of the exhaust of vehicle from where smoke is released into the environment. The smoke detector detects carbon and gives it to the Microcontroller to check the maximum percentage of carbon content in the smoke released by vehicles. Temperature sensor can be used to sense the temperature in the vehicle. So the controller checks the percentage of carbon and temperature, if it exceeds the threshold level the system gets triggered and the engine comes to hault state and then it sends SMS [5-6] about this to the nearby pollution control office through GSM.

LITERATURE SURVEY

Over the years, there have been several regulations made by the Government to control the emission from vehicles; most of them being unsuccessful at the same. The standards and the timeline for implementation are set by the Central Pollution Control Board under the Ministry of Environment & Forests. Bharat stage emission standards are emissionstandards instituted by

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the Government of India to regulate the output of air Pollutants from internal combustion engine equipment, including motor vehicles. The first emission norms were introduced in India in 1991 for petrol and 1992 for diesel vehicles [7]. These were followed by making the Catalytic converter mandatory for petrol vehicles and the introduction of unleaded petrol in the market. On April 29, 1999 the Supreme Court of India ruled that all vehicles in India have to meet Euro I or India 2000 norms by June 1, 1999 and Euro II will be mandatory in the NCR by April 2000. Car makers were not prepared for this transition and in a subsequent judgment the implementation date for Euro II was not enforced. The standards, based on European regulations were first introduced in 2000 [8-9]. Progressively stringent norms have been rolled out since then. All new vehicles manufactured after the implementation of the norms have to be compliant with the regulations. Since October 2010, Bharat stage III norms have been enforced across the country. In 13 major cities, Bharat stage IV emission norms are in place since April 2010. In this paper, the semiconductor sensors have been used to detect the pollutant level of the vehicles. This Paper concentrates mainly on three blocks; smoke detector, microcontroller and fuel injector. The smoke detector detects the pollutants (CO, NOx, etc.) continuously. The microcontroller compares the level of pollutants with the stipulated level allowed by the government [10-11]. When the pollutant level exceeds the standardized limit, it sends a signal to the fuel injector. On receiving a signal from the controller, the fuel injector stops the fuel supply to the engine after a particular period of time.

PROPOSED SYSTEM

The overall block diagram of the proposed system is given in figure 1

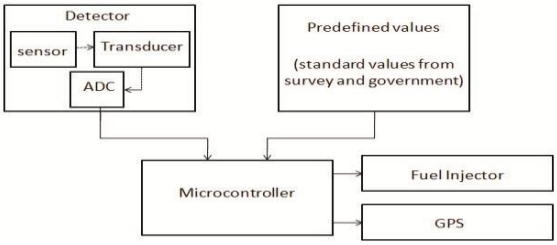

Figure.1 Block diagram

A. Detector

The detector consists of three sub-blocks namely smoke sensor, transducer and ADC. The smoke sensor is the main component of the detector block which is embedded onto the exhaust of the vehicle. The sensor senses the amount of emission from the vehicle and feeds the data to the microcontroller through the transducer and the analog to digital converter at regular intervals of time. The transducer is used to convert the output of the sensor into an electrical signal. The analog electrical signal is then converted into a digital signal using an ADC, so that, it can be compared with the predefined values, in the microcontroller.

In this paper, carbon monoxide sensor (MQ-7) which can measure CO concentrations ranging from 10 to 10,000 ppm is considered. This sensor, basically finds usage in sensing carbon monoxide concentrations (ppm), in the exhaust of cars as shown in figure.3.3 and gives an analog output. The MQ-7 gas sensor is mainly made up of SnO2, whose conductivity varies with the cleanliness of air i.e. it has a lower conductivity in clean air and viceversa. A simple circuit as shown in figure.2, is used to map the changes in conductivity to the corresponding output signal of the gas concentration [12-13]. The main advantage of the MQ-7 gas sensor is that it has high sensitivity to Carbon Monoxide. Additionally, it has a very long life time and is available at a low cost. Also it can be used for a wide range of applications.

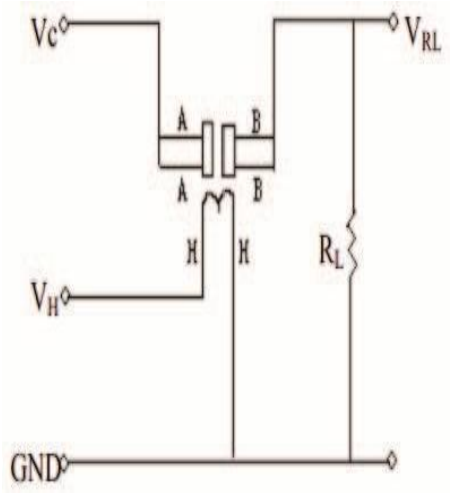

Figure 2 Equivalent Circuit of MQ-7

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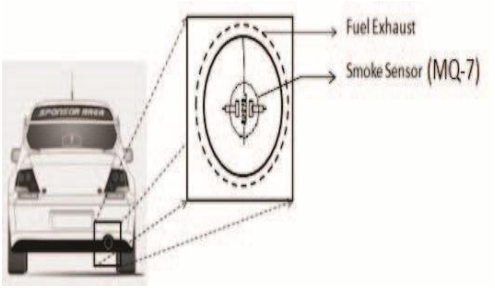

Figure.3 Smoke sensor

B. Microcontroller

In this paper, ATMEL 89S52 is used, which is an 8bit micro controller. It consists of three inbuilt timer/counter which will be used for the timer configuration.

The microcontroller is programmed to do three functions namely comparison, timer and triggering circuit [14-15]. The microcontroller takes in two inputs; one from the smoke sensor's output and another being the pre-defined threshold value specified by the government. When the smoke sensor output is more than the threshold value, the microcontroller triggers the timer circuit and an alarm is set off to inform the driver of the vehicle, about the same and also indicate that the vehicle will come to a halt as soon as the timer runs out [16-17]. Apart from the timer being triggered, a trigger is also given to the GPS, which helps in locating the nearest service station. Once the timer runs out, a trigger pulse is generated by the microcontroller which is fed to the fuel injector, which in turn stops the flow of fuel to the engine, as a result of which, the vehicle comes to a halt.

C. Fuel Injector

The main function of the fuel injector is to cut the supply of fuel to the engine, when the pollution limit is breached.

The relay circuit shown in the figure.4 is used to control the on and off position of the fuel pump[18-19]. In this paper, the engine control unit is programmed in such a way that, when the microcontroller sends a trigger pulse after the timer runs out, relay should get back to its original position, that is the fuel cut off switch, is on. Then the fuel supply from the pump will be stopped.

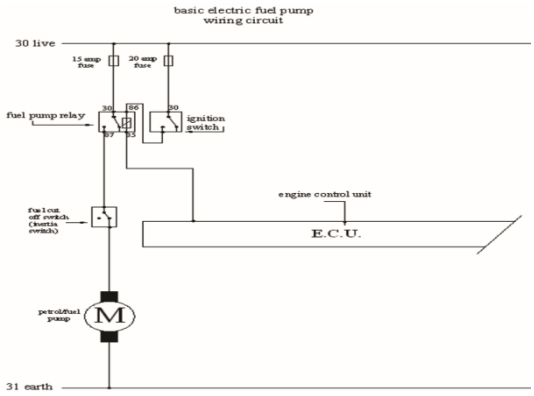

Figure.4 Fuel pump wiring circuit

D. Global Positioning System (GPS)

When the pollution level reaches the maximum limit, a trigger pulse 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 service stations where the vehicle can be taken for maintenance.

RESULT AND DISCUSSION

The signals acquired from the smoke sensor are compared with the user defined set point crossing the threshold limit the pollution level gets displayed in the LCD and when it exceeds the set point it gives a buzzer indication following the motor gets off.

The table below shows the sample of results obtained from the system:

Pollution levels	Output voltage	Motor condition
300ppm	0V	ON
350ppm	0.5V	ON
400ppm	0.95V	ON
450ppm	1.35V	ON
500ppm	1.79V	ON
550ppm	2.30V	ON
600ppm	3.0V	ON
650ppm	3.45V	ON
700ppm	3.88V	ON
750ppm	4.4V	ON
800ppm	4.98V	OFF
850ppm	5.38V	OFF
900ppm	5.98V	OFF
950ppm	6.45V	OFF
1000ppm	7.0V	OFF

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CONCLUSION

The concept of detecting the level of Pollution and indicating it to the driver is implemented. There is an increase in the level of Pollution over the last couple of decades, leading to several Environmental problems. There will be a huge population, who do not take care of the pollution from their vehicles seriously, which has already resulted in several environmental problems such as Ozone layer depletion and so on. Hence this system will be highly beneficial in curbing this problem.

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