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Pollution Check in Vehicles and Alerting System Using Location Identifier

Vasana Prathyusha[1], P. Bala Murali Krishna[2]
[1]PG student, Dept of ECE,Sri Mittapalli Institute of Technology for Women, Tummalapalem, Guntur, A.P, India
[2]Professor, Dept of ECE,Sri Mittapalli Institute of Technology for Women, Tummalapalem, Guntur Dist, A.P, India

Abstract--- This paper presents automated control system for air pollution detection in vehicles. As the usage of vehicles is more in these days, pollution is increasing drastically. As a solution to the above problem we aim to build an embedded system for controlling the pollution in vehicles. This emission from vehicles cannot be completely avoided but it definitely be controlled by using semiconductor sensors for detecting the various gases. This system "Pollution check in vehicles and alerting system" uses GPS and GSM Technologies. When the pollution/ emission level shoots beyond the already set threshold level, there will be a buzz in the vehicle to indicate that the limit has been breached and this information will be send to the registered mobile number using GSM. During this time period, the GPS starts locating the vehicle and GPRS display the values on the webpage. The synchronization and execution of the entire process is monitored and controlled by a micro controller.
Keywords: Microcontroller, GPS, GSM

I. INTRODUCTION

Along with health concerns, pollution is being greatly considerable in environmental matters. One of the major concerns regarding the environment is air pollution. Air pollution contributes to the green house gases, which affects the ozone layer. Air pollution [1] is not only harmful to the environment but also to all other living beings on earth. Air pollutants that are inhaled have serious impact on human health affecting the lungs and the respiratory system. Vehicles and Industries are the major sources of Environmental Pollution. Every vehicle will have emission but the problem occurs due to the improper maintenance of vehicles. This emission from vehicles cannot be completely avoided but it definitely be controlled. For that, we have designed an excellent system which controls the pollution in vehicles.

The main pollutants[2] from vehicles are the oxides of carbon and nitrogen, which can be easily detected these days with the help of semiconductor gas sensors. Therefore, in this paper we prepare a system useful in reducing the amount of pollution from vehicles.

The proposed automated control system uses GSM & GPRS. We use CO and temperature sensors[3]-[4] to detect the pollutants. GSM technology is used to send the sensed levels of pollutants to the mobile and GPRS technology is used to post the same on the webpage.

The rest of the paper is organized as follows. Section II gives the system resources, section 3 gives the design of proposed embedded system, section 4 explains about the working of proposed system and finally section 5 concludes the proposed system.

II. SYSTEM RESOURCES

In this section we describe the hardware resources that we mainly used in our proposed system.

A.LPC2148 Micro controller

LPC2148 is the widely used IC from ARM-7 family. It is manufactured by Philips (NXP) and it is pre-loaded with many inbuilt peripherals making it more efficient and a reliable option for the beginners as well as high end application developer.

In this paper, LPC2148 is used, which is a 16 bit micro controller. It consists of three inbuilt timer/counter which will be used for the timer configuration. The microcontroller[8] is programmed to do three functions namely comparison, timer and triggering circuit. The microcontroller takes in two inputs; one from the smoke sensor's output and another being the pre-defined threshold value. When the smoke sensor output is more than the threshold value, the microcontroller triggers the timer circuit and an alarm[5] is set off to inform the driver of the vehicle, about the same and also indicate that the vehicle will come to a halt in 2KM RANGE as the timer runs out. Apart from the timer being triggered, a trigger is also given to the GPS, which helps in locating the nearest service station by SMS. Once the timer runs out, a trigger pulse is generated by the microcontroller which is fed to the fuel injector,

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which in turn stops the flow of fuel to the engine, as a result of which, the vehicle comes to a halt.

B. Liquid-crystal display (LCD)

It is a flat panel display, electronic visual display that uses the light modulation properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

III. DESIGN OF PROPOSED EMBEDDED SYSTEM

The proposed system consists of following blocks shown in fig1.Here micro controller is the main heart of the system followed by CO sensor, GSM, LCD, GPRS and GPS.

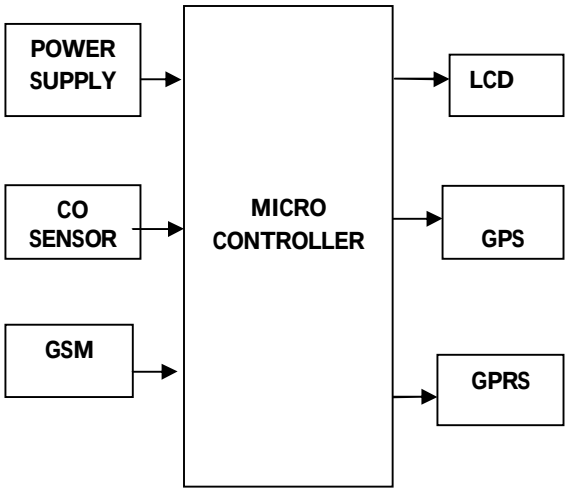


Fig1: Block diagram of proposed system

The design of the proposed system is explained as follows. The total equipment of this project is placed inside a vehicle; implemented system is shown in fig4. Here we have GPS (Global Positioning System) module by which we can get the location of the vehicle, the location values are displayed on the LCD (Liquid Crystal Display). In this project we have two sensors which are interfaced to the micro controller. Those are temperature sensor and CO sensor[6] through which we can measure the temperature[7] and amount of CO released from the vehicle. These values are also displayed on LCD. Whenever these values exceed the threshold then intimation is given to the RTA including vehicle's exact position.

The operation of the system is explained as follows. The proposed system consists of power supply, which is of single-phase 230V ac. Then it is step down to 5v dc which is sufficient to our system. In the next step all the modules get initialized. As the proposed system uses semi conductor sensors at the emission outlets of vehicles which detects the level of pollutants and also the indication of this level are displayed on LCD using GPS and GPRS.

A. CO Sensor

Carbon monoxide sensor is suitable for sensing CO concentrations in the air. This sensor has high sensitivity and fast response time. This sensor comes in a package.

The CO sensor is used in gas leakage detecting equipments in home and industry, are suitable for detecting of LPG, i-butane, propane, methane, alcohol, Hydrogen, smoke. Here we are using MQ-4[6] sensor which is shown in fig2 and the specifications are given below.

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Fig2: CO sensor

In this paper, carbon monoxide sensor (MQ-4) 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 and gives an analog output.

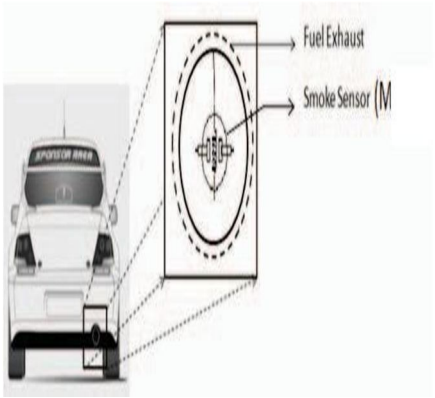


Fig 3: Smoke Sensor

The MQ-4 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 vice- versa. The main advantage of the MQ-4 gas sensor is that it has high sensitivity to Carbon Monoxide. Additionally, it has a very long life time and is available at low cost. Also it can be used for a wide range of applications.

B. Specifications

The specifications of CO sensor are given below:

1) Semiconductor Type Gas Sensor.
2) Target gas/Typical detection ranges:
3) MQ-4: Methane, Natural gas, 500 to 10000ppm.
4) MQ-5: town gases, hydrogen, 100 to 3000ppm.
5) MQ-6: propane, butane, liquefied petroleum gas, 300 to 10000ppm.
6) Standard circuit conditions:
7) Heater voltage: 5V DC/AC
8) Circuit voltage: 3~15V DC
9) Heater power consumption: 750 Mw
10) Temperature range: -20deg. C to +40 deg. C
11) Size: Diameter19mm×High17mm or Diameter17mm×High10mm.

C. Temperature Sensor

In the proposed system we are using LM35 temperature sensor which is used to measure temperature with an electrical output proportional to the temperature in ^{o}C.

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This LM35 is an Integrated Circuit Temperature Sensor shown in fig3 where we can measure temperature more accurately than using a thermistor. The sensor circuitry is sealed and not subject to oxidation, etc. The LM35[7] generates a higher output voltage than thermocouples and may not require that the output voltage be amplified.

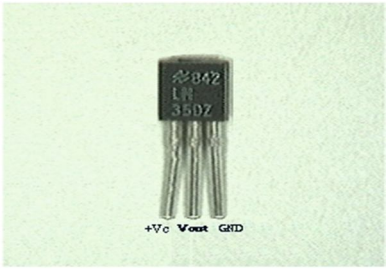


Fig3: Temperature sensor

It has an output voltage that is proportional to the Celsius temperature. The scale factor is 0.01V/ºC The LM35 does not require any external calibration or trimming and maintains an accuracy of ±0.4 ºC at room temperature and +/- 0.8 ºC over a range of 0 ºC to +100 ºC. Another important characteristic of the LM35DZ is that it draws only 60 micro amps from its supply and possesses a low self-heating capability. The sensor self-heating causes less than 0.1 ^{o}C temperature rise in still air.
In this system temperature sensor is used to measure temperature in the vehicle.

D. GSM Technology

GSM (Global System for Mobile communications) is the technology that underpins most of the world's mobile phone networks. It is a second generation cellular standard developed to cater voice services and data delivery using digital modulation. The GSM platform is a hugely successful wireless technology and an unprecedented story of global achievement and cooperation. GSM[10] has become the world's fastest growing communications technology of all time and the leading global mobile standard, spanning 218 countries. It is a set of ETSI standards specifying the infrastructure for a digital cellular service. GSM is an open, digital cellular technology used for transmitting mobile voice and data services. GSM operates in the 900MHz and 1.8GHz bands GSM supports data transfer speeds of up to 9.6 kbps, allowing the transmission of basic data services such as SMS.

E. GPS Technology

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. Three satellite signals are necessary to locate the receiver in 3D space and fourth satellite is used for time accuracy. GPS[11] will give the information of parameters like longitude, latitude and attitude. With the help of these parameters one can easily locate the position of any object. In this GPS technology, the communication takes place between GPS transceiver and GPS satellite. The GPS[14] signal allows repeating this calculation every 6 seconds. Many GPS units show derived information such as direction and speed, calculated from position changes.
In the proposed system GPS is used to get the latitudinal and longitudinal values of the vehicle where it is stopped.

F. GPRS

General Packet Radio Services (GPRS)[13] is a very widely-deployed wireless data service, available now with most GSM networks. It is a packet-based wireless communication service that promises data rates from 56kbps to 114 Kbps and continuous connection to the Internet for mobile phone and computer users. The higher data rates allow users to take part in video conferences and interact with multimedia Web sites and similar applications using mobile handheld devices as well as notebook computers. GPRS[12] is based on Global System for Mobile(GSM) communication and complements existing services such circuit-switched cellular phone connections and the Short Message Service (SMS). We can see the sensed level of pollutants and the place where the vehicle gets stopped on the webpage by using this GPRS technology.

IV. WORKING OF THE PROPOSED SYSTEM

Pollution check in vehicles and alerting system using location identifier is mainly used for controlling the pollution by stopping the vehicles when it reaches the threshold value defined by the user, based on the RTA standards. Here we use CO sensor and

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temperature sensor. Implementation of the proposed system is shown in fig4 and the working of the system is explained below.

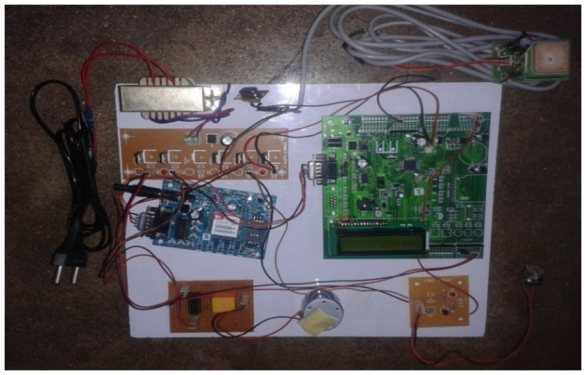


Fig4: Prototype of Proposed System

Before switch on the kit, first we switch on the GSM module. Then we switch ON the power supply block having 230V A.C supply as input to the step down transformer. After it is step down to 5V D.C which is sufficient to our system. Next all the modules get initialized, GSM, GPS and GPRS are connected . As we are using CO and Temperature sensor, the values of those sensors are displayed on the LCD. In addition to this latitudinal and longitudinal values are also displayed using the GPS, which monitor the exact position of the vehicle.

The standardized threshold limit values[3] are set. In referred to this, pollution in the vehicle increases and exceeds the threshold limit the indication is given three times. Even if the vehicle continued the same then the vehicle gets stopped in the fourth time and an SMS is sent to the mobile, displaying the sensor values along with latitudinal and longitudinal values. Along this the same sensed values are posted on the web page shown in below figures 5&6.

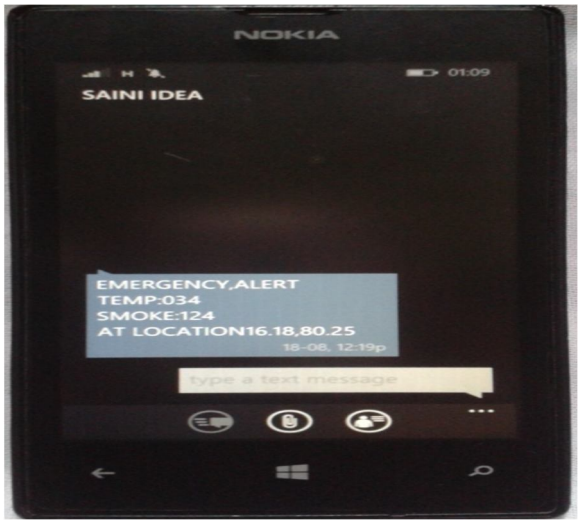


Fig5: Output values are displayed as a SMS using GSM technology

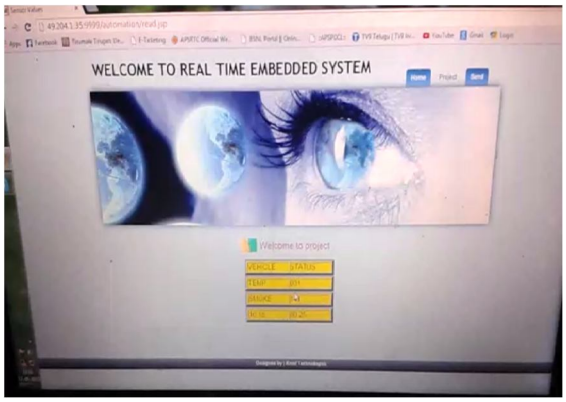


Fig6: Output values are posted in a web page using GPRS technology

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V. CONCLUSION

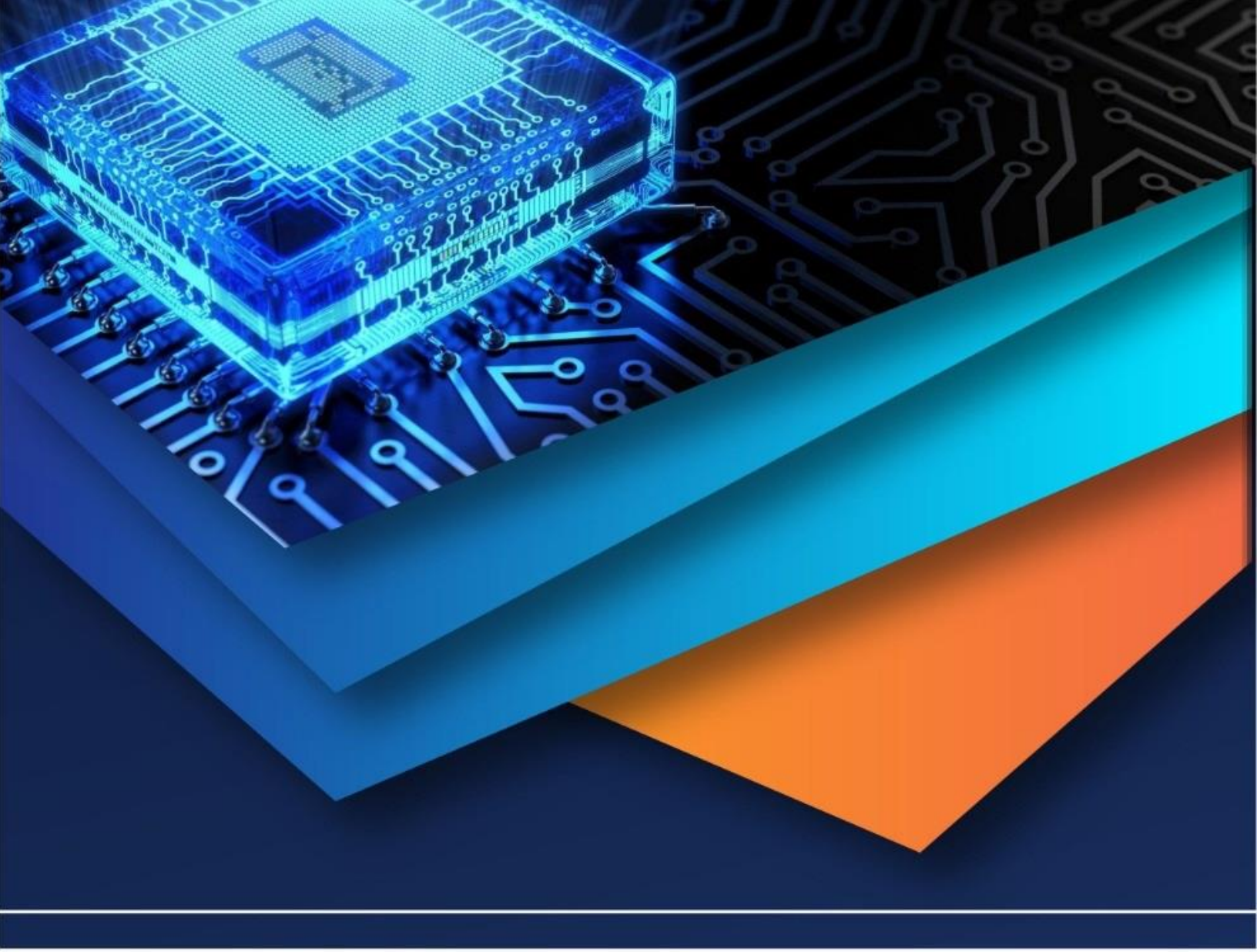
This paper mainly focuses on two operations. The first is we developed an embedded system to detect and control pollution from the vehicles. In this project we used LPC2148 micro controller, CO and temperature sensors for detecting the pollutants. The system is tested in diverse environmental condition. So our embedded system will be highly beneficial in curbing this problem. The second reason is that this system will be one of the greatest improvements in technology to keep the Environment free from vehicular emission and bring it to a halt if the Pollution level is more than the Standards mentioned by the Government. Our system will not change the configuration of the engine by any means, and it is employed in the existing vehicles.

As our system is designed with low cost and low power, yielding high accuracy, this can be extended to home, transport and industrial applications.

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