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DESIGN AND IMPLEMENTATION FOR DETECTING ENVIRONMENTAL HAZARDOUS GASES FROM AUTOMOBILE SYSTEM

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Abstract

There are number of hazardous gases in environment, this gases damage the nature. It is big problem for every point of view. Hence, the exhaust gas analyzer (PUC machine) has developed for detecting hazardous gases from automobile system but it is more expensive and bigger in size. Our project reduces this issue. We have decided to make a small, compact electronics circuit same as gas analyzer which is implemented in car, motorbike, and other vehicle engines. With the help of our project every person will know the level of exhaust gases and take action immediately.

Index Terms: Gas sensors (CO, CO₂, NO_x), PIC18F887 Microcontroller, TRI-BAND GSM Module, 16X2 LCD Module, BUZZER, and Regulated power supply.

1. INTRODUCTION

Millions of vehicles on roads in the India and around the world may be operating without properly certified on-road emission controls as a result of test manipulation. An automobile is a self propelled vehicle that travels on land. It consists an internal combustion engine which provides the power to the vehicle and the vehicle runs on the road. But when the engine provides power to vehicle it releases hazardous gases which is harmful for people, plants, and animals. Following parameter and gases as shown.

1.1 CO (carbon monoxide)

A colorless, odorless gas, carbon monoxide is produced by incomplete combustion of fuels. Because it interferes with the blood's ability to deliver oxygen to the body, very high levels of carbon monoxide can cause death. It is estimated that 1,000 people each year die of carbon monoxide poisoning while thousands of other suffer non-fatal poisoning. When carbon containing fuels –such as coal, wood, natural gas, and fuel oil are incompletely burned, carbon monoxide is emitted. The carbon monoxide enters the air from the combustion source

that may not be properly installed or maintained or not adequately ventilated, such as:

- Unvented heaters (kerosene or gas space heaters)
- Furnaces
- Woodstoves
- Gas stoves
- Fireplaces
- Gas water heaters
- Automobile exhaust from attached garages

1.2 CO₂ (carbon dioxide)

Carbon dioxide (CO₂) is released into Earth's atmosphere mostly by the burning of carbon containing fuels and the decay of wood and other plant matter. Under all conditions found naturally on Earth, CO₂ is an invisible, odorless gas. It is removed from the atmosphere mostly by plants, which extract carbon from CO₂ to build their tissues, and by the oceans, in which CO₂ dissolves. Carbon dioxide emissions impact human health by displacing oxygen in the atmosphere.

Breathing becomes more difficult as carbon dioxide levels rise. In closed areas, high levels of carbon dioxide can lead to health complaints such as headaches, insomnia.

1.3 NO_x (Nitrogen oxide)

Nitrogen dioxide is an irritant gas, which at high concentration causes inflammation of the airways. When nitrogen is released during fuel combustion it combines with oxygen atoms to create nitric oxide (NO). This further combines with oxygen to create nitrogen dioxide (NO₂). Nitrogen dioxide and nitric oxide are referred to together as oxides of nitrogen (NO_x). NO_x gases react to form smog and acid rain as well as being central to the formation of fine particles (PM) and ground level ozone, both of which are associated with adverse health effects. NO_x can decrease the lungs functioning, increase the risk of respiratory conditions and increases the response to allergens. High levels of NO_x can have a negative effect on vegetation, including leaf damage and reduced growth. NO_x also reacts with other pollutants in the presence of sunlight to form ozone which is damage vegetation at high concentrations.

1.4 Hydrocarbon

Hydrocarbon emissions are composed of unburned fuels as a result of insufficient temperature which occurs near the cylinder wall. At this point, the air-fuel mixture temperature is significantly less than the center of the cylinder. Hydrocarbons consist of thousands of species, such as alkanes, alkenes, and aromatics. They are normally stated in terms of equivalent CH₄ content. In Diesel engines, the fuel type, engine adjustment, and design affect the content of hydrocarbons. Besides, HC emissions in the exhaust gas depend on irregular operating conditions. High levels of instantaneous change in engine speed, untidy injection, excessive nozzle cavity volumes, and injector needle bounce can cause significant quantities of unburned fuel to pass into the exhaust. Hydrocarbons have harmful effects on environment and human health. With other pollutant emissions, they play a significant role in the formation of ground-level ozone. Vehicles are responsible for about 50 % of the emissions that form ozone. Hydrocarbons are toxic with the potential to respiratory tract irritation and cause cancer.

2. HARDWARE DESCRIPTION

2.1 Carbon monoxide detector (CO detector)

A carbon monoxide detector or CO detector is a device that detects the presence of the carbon monoxide (CO) gas to prevent carbon monoxide poisoning.



Fig.(a) CO detector

2.2 Carbon dioxide detector (CO₂ detector)

A carbon dioxide detector or CO₂ detector is an instrument for the measurement of carbon dioxide gas.



Fig.(b) CO2 detector

2.3 Nitrogen oxide detector (NO_x detector)

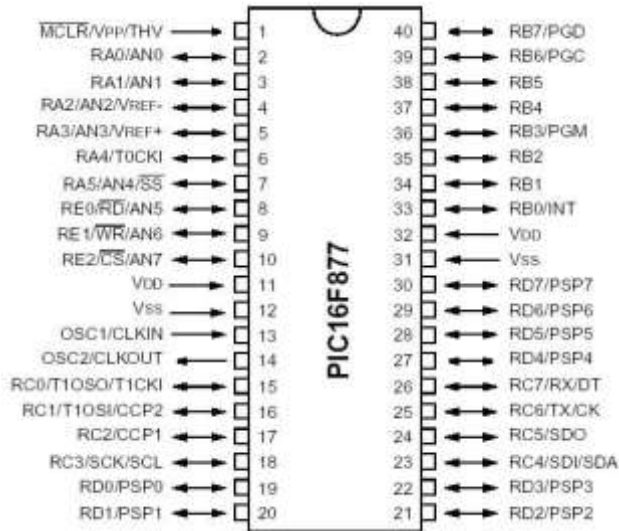
A nitrogen oxide detector or NO_x detector is typically a high-temperature device built to detect nitrogen oxides in combustion environments such as an automobile, truck and tailpipe or smokestack.



Fig.(c) NOx detector

2.4 PIC16F887 Microcontroller

PIC16F887 is a 40-pin PIC microcontroller and is used mostly in embedded projects and application. Few of its features are as follows: It has five ports on it starting from Port A to Port E. It has three timers in it, two of which are 8 bit Timers while 1 is 16 Bits.



3. BLOCK DIAGRAM

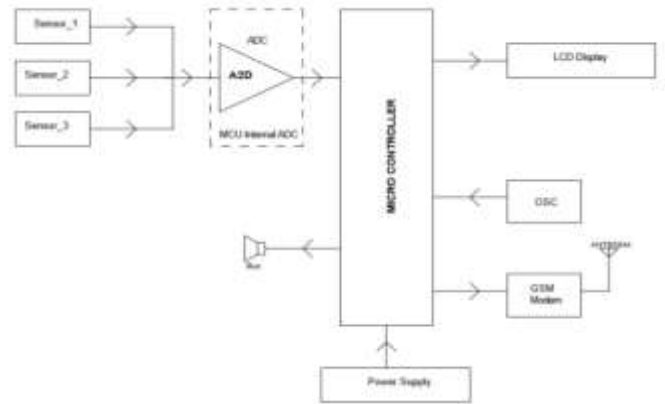


Fig. Block diagram of sensing circuit

2.5 TRI BAND GSM Module (SIM 900a)

The SIM900A is a complete Dual-Band GSM/GPRS solution in a SMT module which can be embedded in the customer applications. Featuring an industry-standard interface, the SIM900A delivers GSM/GPRS 900/1800 MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption.



Fig shows the block diagram of sensing circuit which consists of gas sensors, PIC controller, GSM module, 16x2 LCD display, buzzer and regulated power supply. Input gases come from automobile system such as carbon monoxide (CO), carbon dioxide (CO₂), and nitrogen oxide (NO_x) is detected by the gas sensors in which CO detector detects CO gas, CO₂ detector detects CO₂ gas and NO_x detector detects NO_x gas. This detected gases are given to PIC controller which converts the gases from analog signal to digital signal automatically because ADC is internally connected to microcontroller. After that microcontroller process the digital bits when regulated power supply is given. Now in figure there is output peripherals that is LCD, Buzzer and GSM module. When the gas sensors sense the amount of gas after threshold value that is mentioned in program then microcontroller sends sms bits to display the message to LCD, to blow the sound to buzzer and to send SMS to vehicle rider at same time.

4. WORKING

The Indian government has mandated the Pollution Under Control (PUC) certificate under the Central Motor Vehicle Rule, 1989. The PUC test assesses the emission of a vehicle and checks if it follows the standard pollution regulation. Now, PUC test procedure by government of India for vehicle user, In case of diesel vehicles, the acceleration is fully pressed and the reading of pollution levels are observed. This is repeated five times and the average constitutes the final reading. For petrol vehicles, the car is kept idling without pressing the acceleration. Only one reading is taken and this constitutes the final reading. PUC testing can be done at any authorized petrol pumps or independent testing centers, but the above PUC system is all about manually we have to do that in which people makes the fake PUC certificate and cheat to environment.

2.6 16x2 LCD Module

An LCD is an electronic display module which uses liquid crystal to produce a visible image. The 16x2 LCD means it can display 16 characters per line in 2 such lines. In this LCD each character is displayed in a 5x7 pixel matrix.



Hence, working of our project design system is automatically and implemented in vehicle. When rider or driver starts the vehicle, vehicle engine releases the gases which is detected by gas detector, this gas detector is implemented in vehicle due to

this, process is automatically done after starting the vehicle. The sensing circuit sense all the gases after detecting and process through microprocessor and output of microprocessor is given to ADC. The analog signal is converted into digital bits by using ADC. The amount of gases in percentage (%) is displayed on LCD display. We are going to fix a threshold value of gases for individual CO, CO₂, NO_x gases. For example there is fix or threshold value of CO gas is 4.5%. In this system we will indicate gas level after threshold value by using red signal and buzzer can also be used for sound indication.

THIS SMS(1),SEND BY GAS Sen-
sor SYS >> CO Is High Detected //
CO= 64 CO₂=85 Nz=13

THIS SMS(1),SEND BY GAS
Sensor SYS >> CO₂ Is High
Detected // CO= 42 CO₂=93
Nz=17

5. RESULT

When all sensors detects gases.



When level of gases are increased.



SMS has been sent by GSM module to rider.

6. CONCLUSION:

7. ADVANTAGE AND APPLICATION

The advantage of this system is small and compact in size as compare to PUC machine. The biggest advantage of this system is less expensive and easy to implement in vehicle. This system also reduces the complexity of gas analyzer circuit. The application of this system is very helpful for environment and RTO can easily check PUC level of vehicle because this system is implemented in vehicle. Future application of this system is every automobile industry can implement the system in vehicle because now a day pollution is not consider as a joke, and PUC certificate is required to every vehicle customer.

8. REFERENCES

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The input gases from automobile system are detected by sensing circuit and output is displayed on LCD display also sms is sent to rider with the help of our project. We have mentioned the threshold value of gases, after the threshold value red led signal will be indicated. This will help RTO officer to take action on vehicle owner or rider. Our project is also helpful for environment and every person will know the present condition and PUC level of vehicle to take immediate action.