DESIGN OF A SYSTEM TO DETECT HAZARDOUS GASES IN VEHICLES AND ALERTING A USER

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Abstract

In this modern era, the technology is dynamically improving for the safety of human beings and vehicles have become the main source of transportation. These vehicles produce poisonous gases (such as CO and CO2) due to incomplete combustion of fuel because of improper maintenance. These toxic gases are harmful for humans causing headache, dizziness and nausea. Poor cabin air quality commonly exists within vehicles. The filters are provided to ensure that no unwanted particles such as pollen, bacteria, dust and exhaust gases enter into the vehicle cabin. A vehicle cabin air quality monitor using carbon monoxide and oxygen sensors has been designed. This project mainly focuses on designing an embedded system for a vehicle which senses these poisonous gases, monitors them and display their content. If the level of CO and CO2 increases than the normal level(30ppm) or the level of O2 decreases than the normal level(19%) then it is displayed on the LCD automatically[1]. A warning message SMS is sent to the user via GSM module and ventilation is provided. This automated detection and alerting system is advantageous over the manual method as it offers quick response time and accurate detection of an emergency[3].

Keywords: LCD display, GSM Module, Ventilation.

I. INTRODUCTION

Cabin air quality in automobiles, planes and other confined spaces has gained much interest. The adverse health effects caused by high carbon monoxide, nitrogen dioxide and discomfort caused by suspended particulate matter such as dusts, fumes, mists, and smokes has instigated innovative automobile features, such as vehicle cabin air quality control integrated to the Heating, Ventilation and Air Conditioning (HV AC) system [4].

However, not only are exhaust emissions a health hazard but so too is our natural breathing process in a confined environment. In the course of breathing, we exhale carbon dioxide which in an indoor environment such as a vehicle cabin, can displace oxygen, leaving the environment oxygen deficient.

Adverse human health effects may manifest due to the high carbon dioxide and low oxygen concentrations, the situation being exaggerated when vehicle occupants choose to operate the HV AC system in the "recycle" mode aiming to prevent outdoor-polluted air entering. A study on fatal single vehicle crashes highlights it is more likely to have windows closed, the heater on, and less likely to have fresh air and less and air conditioning fitted.

Many deaths are also attributed to fatal unintentional carbon monoxide poisoning in and around motor vehicles. A study of U.S. deaths found that 57% of unintentional CO poisoning deaths occurred in automobiles. By incorporating a system with CO and O2 gas sensors it is believed that the safety of vehicles can be dramatically increased, and deaths caused by carbon monoxide poisoning prevented.[4]

This paper designs an embedded system for toxic gas CO detection inside the vehicle cabin and to develop a sensing system using a sensor array and microcontroller. If the detection unit detects that toxic gas reaches the maximum allowable level then, an alarm is generated immediately and the ventilation will be provided automatically. And then an SMS is

send to the authorized user via the GSM module and ventilation is provided.

II. METHODOLOGY

The gas sensors are used to detect the gas emissions inside the vehicles. From the sensors the signals are given to the analog to digital converter which converts the analog input to digital output and gives the output to the Arduino. If the read values are above threshold level necessary actions are initiated.
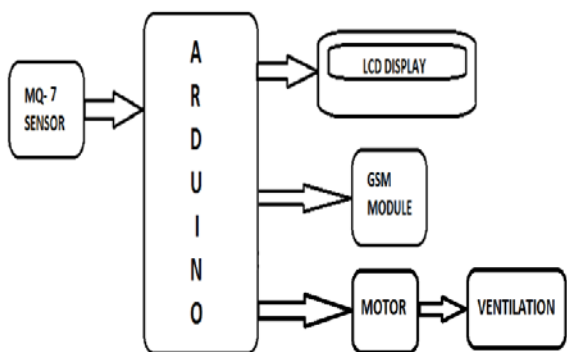
III. BLOCK DIAGRAM

Fig.1 Block diagram

A. SYSTEM COMPONENTS:

ARDUINO MICROCONTROLLER:
The Arduino is the key component in this project. The Arduino Uno can be powered via the USB connection or with an external power supply. The board can operate on an external supply of 6 to 20 volts and output from the board is 5 volts.

Fig.2 Arduino

GAS SENSOR:
A carbon monoxide sensor is a device that detects the presence of the CO gas in order to prevent carbon monoxide poisoning. In this project MQ7 sensor is used which has high sensitivity to carbon monoxide. It operates on heating voltage of 5V and heating resistance of 33 ohm. The standard temperature of working condition is $-20°$ C $\pm$ $2°$ C and relative humidity of 65% $\pm$ 5%.

Fig.3 MQ7 Sensor

LCD DISPLAY:
16X2 Character LCD display is used which consist of 5X8 dots with curser and built-in controller. It operates on +5V power supply having duty cycle of 1/16.
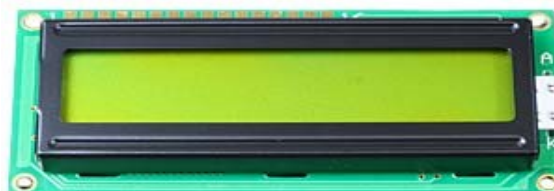

Fig.4 LCD Display

A/D CONVERTER:
The ADC0809 data acquisition component consist monolithic CMOS device with an 8-bit analog-to-digital converter, 8-channel multiplexer and microprocessor compatible control logic. It consists of an analog signal multiplexer, an 8-bit successive-approximation converter, and related control and output circuitry.
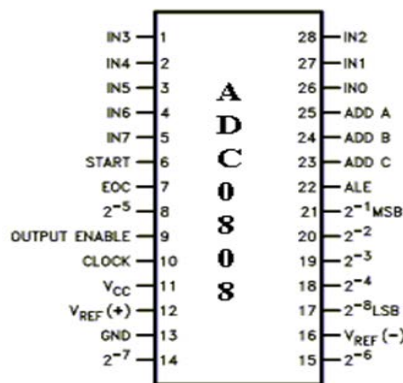

Fig.5 ADC Converter

GSM MODULE:
SIM900 is a quad-band GSM/GPRS module that works on frequencies GSM 850MHz, EGSM 900MHz, DCS 1800MHz and PCS 1900MHz.


Fig.6 GSM Modem

DC MOTOR

A DC motor of rated speed 6 to 10rpm is used to lower the window of the vehicle in order to provide ventilation.

IV. WORKING

The gas sensors to detect the hazardous gas in vehicles is placed inside the vehicle. The sensors keep on monitoring the level of gases inside the vehicles. Once the level of gas reaches beyond the threshold level the alert is given to the user. The level of gas is displayed using the LCD Display to the user. In case the user is away from the vehicle then the alert message is sent to the user phone with the help of GSM module. Also if the user is unable to reach out for help then immediate ventilation is provided for the people inside the car by lowering the windows automatically. In this way safety precautions is taken in order to protect the people against the hazardous gases present inside the vehicle.

FLOWCHART:
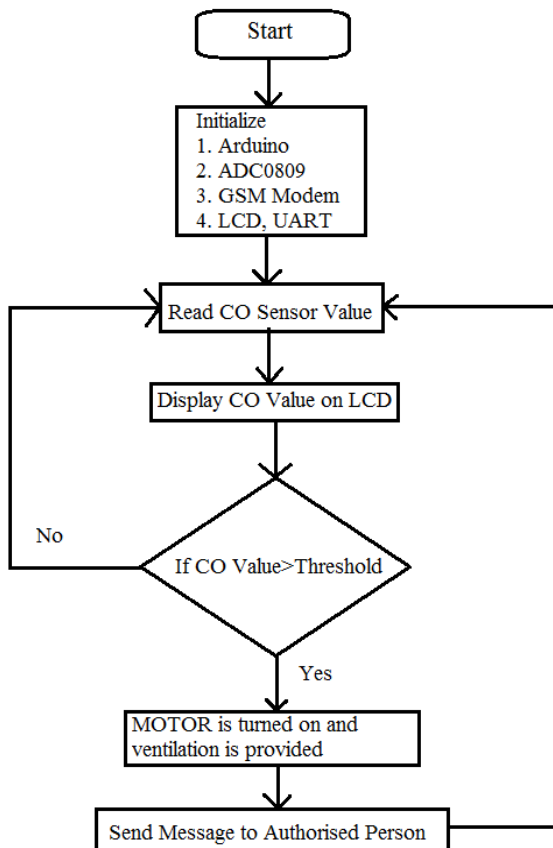
CONCLUSION

Sensors are identified as per requirement and the circuit is built to take the input from the sensor. The program for displaying the data on LCD and to send the SMS alert to the user via GSM is coded. The necessary safety precautions are taken by providing immediate ventilation.

REFERENCES

[1] "CO and CO_2 Pollution Monitoring Based on Wireless Sensor Network" *M. Udin Harun Al Rasyid, IsbatUzzinNadhori.*

[2] "Car Indoor Gas Detection System" *Pejman Panahi, Cuneyt bayilmis.*

[3] "Monitoring and Controlling Of Hazardous Gases Inside Vehicle and Alerting Using GSM Technology For the Safety Of People Inside the Vehicle" *Sandip S.Pati, Prof.Jaykaran*

[4] "Vehicle Cabin Air Quality Monitor using Gas Sensors For Improved Safety" *K. Galatsis, W. Wlodarski, Y.x. Li and K. Kalantar-zadeh* 2000 Proceedings of the Society of Automotive Engineers Exposition, March 2000, Detroit , USA