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PIC Implementation of Carbon Monoxide Alarm for Indoor Parking Car

Charathip Chunkul, Khanchai Tunlasakun, and Ratchadawan Nimnual

Faculty of Industrial Education and Technology,
King Mongkut's University of Technology Thonburi
Bangmod, Thungkru, Bangkok, Thailand
(Tel : +662-470-8540; E-mail: khanchai.tun@kmutt.ac.th)

Abstract: The purpose of this paper is design and construct of a PIC implementation of carbon monoxide alarm for indoor parking car. The prototype of this paper was designed on a single PIC16F877 microcontroller that performed the acquisition, processing and display of carbon monoxide (CO) data from MiCS-5132 automotive pollution gas sensor and displayed the CO data on 7 segment displays. The system was tested using carbon monoxide from car exhaust fumes and it worked satisfactory.

Keywords: PIC, microcontroller, CO

1. INTRODUCTION

One of the unsuspected sources of CO is automobile exhaust, which produces CO as the main emission compound, depends on many factors such as gasoline formulation, air to fuel ratio, ignition timing, compression ratio, engine speed and load, engine condition, and coolant temperature. With increasing number of vehicles in metropolitan areas, the CO level has also increased in the city atmosphere especially at locations where traffic is heavy. As far as the effects of CO on humans are concerned [1]. When CO is inhaled, it inhibits the delivery of oxygen throughout the body, and the victim is asphyxiated. The CO combines with hemoglobin (the oxygen carriers in red blood cells) to form carboxyhemoglobin (COHb). CO is particularly dangerous because hemoglobin's affinity to CO is much greater than its affinity to oxygen. When the COHb level is about 15%, the victim experiences slight headaches and dizziness. At 25%, the victim has severe headaches and nausea. Between 30% and 40% the victim vomits and may collapse. Exposure beyond 40% COHb causes permanent brain damage, coma, and eventually death [2] (see figure 1.). The developed of a PIC implementation of carbon monoxide alarm for indoor parking car is based on PIC16F877 microcontroller from Microchip Technology Inc. for detected carbon monoxide level from the vehicles in indoor parking area and alarm when the carbon monoxide level greater than the dangerous point.

2. CO SENSOR

The MiCS-5132 manufactured by MicroChemical System is commonly used for detecting CO. The sensor requires two voltage inputs. Heater voltage (V_H) and circuit voltage (V_{cc}). The heater voltage is applied to the integrated heater in order to maintain the sensing element at a specific temperature which is optimal for sensing. Circuit voltage is applied to allow measurement of voltage (V_{RL}) across a load resistor (R_L) which is connected in series with the sensor. The sensor response to CO in air is represented in figure 2. The sensor resistance R_s is normalized to the resistance under air (R_O) [3]. Figure 3 shows the pin connection of the MiCS-5132 gas sensor. A simple circuit to measure the pollution level is proposed in figure 4. A load resistor is connected in series with R_s to convert the resistance R_s to a voltage V_s between pins 2 and 4.

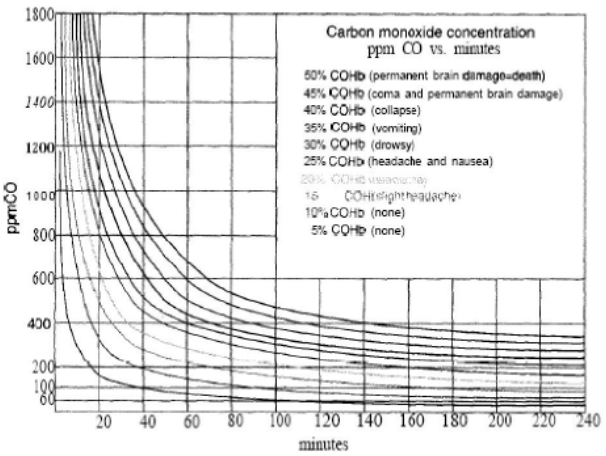


Fig. 1 Carbon monoxide concentration ppm CO vs. minutes

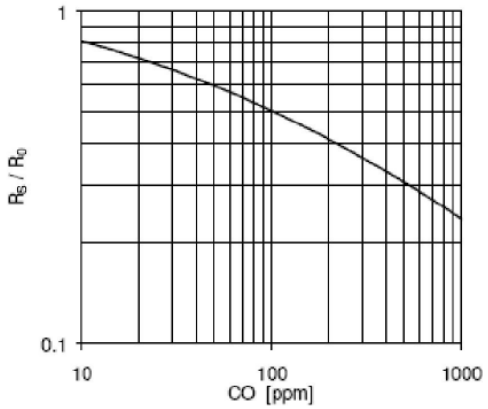
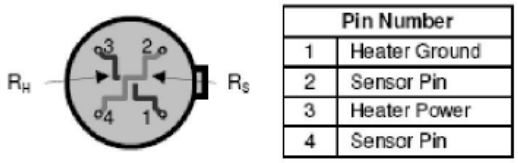


Fig. 2 R_s/R_o as a function of gas concentration at 50% RH and 25°C



Pin Number	
1	Heater Ground
2	Sensor Pin
3	Heater Power
4	Sensor Pin

Fig. 3 Equivalent circuit (top view) of MiCS-5132

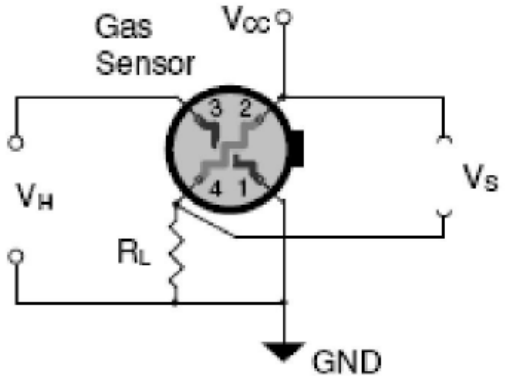


Fig. 4 Measurement circuit for pollution gas detection

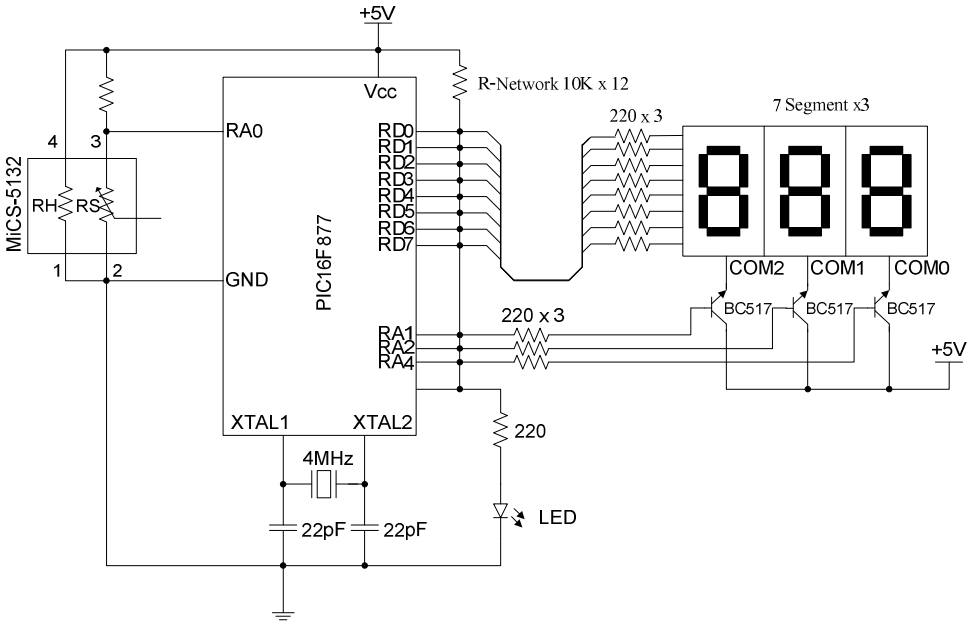


Fig. 5 Circuit diagram of a prototype

R_s can then be calculated by the following expression:

$$R_S = \frac{R_L}{(V_{CC} - V_S)V_S}$$

where

R_s = sensing resistor.
R_L = load resistor.
V_s = sensing voltage.
V_{cc} = circuit voltage.

3. EXPERIMENTAL DESIGN

The main components of a PIC implementation of carbon monoxide alarm for indoor parking car are the PIC16F877 microcontroller and the MiCS-5132 carbon monoxide sensor. The MiCS-5132 is detected the carbon monoxide level from the vehicles in indoor parking area, the circuit is converted the carbon monoxide level to voltage level and send to input of microcontroller. The microcontroller is collected the analog data about the value of voltage and process the data. Figure 5. shows hardware details of the prototype. The circuit in figure 5 consists of PIC16F877 microcontroller, MiCS-5132 carbon monoxide sensor and 3x7 segment displays.

4. EXPERIMENTAL RESULTS

The prototype of a PIC implementation of carbon monoxide alarm for indoor parking car can detect the carbon monoxide level about l0 ppm - 1000 ppm. and it easy to operate. The 3x7 segment displays and LED are provided on the front panel to measure and indicate the alarm status. The prototype can detect the carbon monoxide level in the indoor parking area and alarm when the carbon monoxide level greater than 30 ppm (dangerous point for human). The user can set the alarm point between 10 ppm – 1000 ppm when the prototype take the carbon monoxide greater than the set point, the alarm function is worked and indicated on LED. The system was tested using carbon monoxide from car exhaust fumes and it worked satisfactory.

5. CONCLUSIONS

This paper describes the design and implement of a PIC implementation of carbon monoxide alarm for indoor parking car. A simple design, small size and low cost system. This prototype based on a PIC16F877 microcontroller and can be designed to alarm when the carbon monoxide levels in the indoor parking area greater than dangerous point for save the human.

Fig. 6 The prototype of system

6. ACKNOWLEDGEMENT

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