Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF CARBON MONOXIDE DETECTION FOR VEHICLE USING IOT SYSTEM

MUHAMAD HILMI BIN HASNAN

Bachelor of Electrical Engineering Technology with Honours

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DEVELOPMENT OF CARBON MONOXIDE DETECTION FOR VEHICLE USING IOT SYSTEM

MUHAMAD HILMI BIN HASNAN

A project report submitted
in partial fulfillment of the requirements for the degree of
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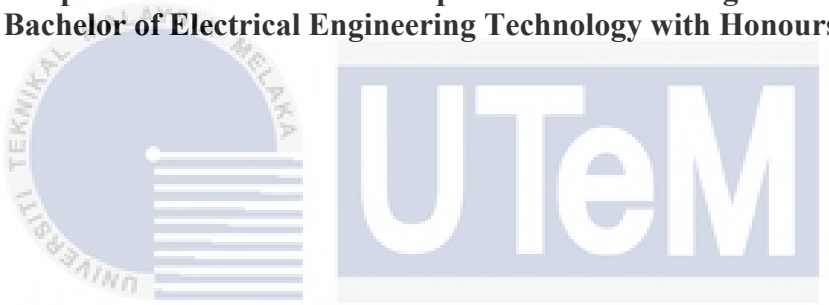

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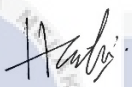
Signature : 

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APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electrical Engineering Technology with Honours.

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DEDICATION

This is dedicated to my beloved mother, Nor Jahan binti Ali Ahmad, father, Hasnan bin Daud and my siblings, Nurin Shairah, Mohd Shakir, Muhammad Hasif, Muhamad Haziq, Muhamad Hazim, Hariz Hamka and Muhammad Hamza. Praise be to Allah SWT, that I am part of this supportive family. Thank you for your advice and best wishes towards me.

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ABSTRACT

Carbon monoxide (CO) gas leakage in vehicles has become more common in recent years. The leaking of a vehicle's exhaust system poses a significant risk to humans. The human respiratory and circulatory systems, for example, can be affected by hazardous gas, and a shortage of oxygen in the bloodstream can injure the driver and passengers' brains. Hazardous gas primarily affects drivers who have been driving and are on a long trip in a vehicle. The driver is supposed to take a break and nap in their car after along drive. During the hot season, the air conditioner (AC) will be typically turned on, ensuring that the engine is frequently turned on, allowing CO gas leakage into the car. This project is designed at an affordable prices to solve this problem by using the MQ-7 sensor to detect CO gas. To improve the efficiency of this system, an Arduino UNO is utilised as a microcontroller to control both the input and output processes. The CO gas concentration in the car is displayed as a ppm value on the LCD display. Alarms are activated by the use of LEDs and buzzers. ESP8266 is used to send an alert message through WhatsApp application to an authorised person and GPS technology are utilised as tracking device, which functioned to track the location on longitude and latitude. Furthermore, this system is equipped with a power window motor that automatically rolls down the window when the CO gas concentration is dangerously high. As a result, the concentration of CO gas in the car can be controlled, preventing CO gas poisoning and death.

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ABSTRAK

Kebocoran gas karbon monoksida dalam kenderaan semakin meningkat saban tahun. Kebocoran sistem ekzos telah memberi risiko kepada pengguna. Sistem pernafasan dan peredaran darah antara dua contoh yang boleh terkesan akibat daripada terhidu gas yang merbahaya dan kekurangan oksigen dalam saluran darah juga boleh mencederakan bahagian otak pemandu dan penumpang yang terhidu gas tersebut. Antara golongan yang paling terkesan adalah pemandu yang telah memandu pada jarak yang jauh. Kebiasaannya, pada musim panas, pemandu akan mengambil masa untuk berehat dan tidur seketika setelah memandu pada jarak jauh dengan tidak akan mematikan enjin kenderaan dan akan menghidupkan sistem penghawa dingin. Hal ini demikian boleh mengakibatkan kebocoran gas karbon monoksida dan memasuki ke dalam kenderaan melalui penghawa dingin. Projek ini diciptakan dengan harga yang berpatutan untuk menyelesaikan masalah ini dengan menggunakan sensor MQ-7 untuk mengesan kehadiran gas dalam kenderaan. Bagi menambah baik keberkesanan sistem ini, Arduino UNO digunakan sebagai mikrokontroler untuk mengawal kedua-dua proses input dan output. Kepekatan gas dalam kereta akan dipaparkan pada paparan LCD dalam nilai PPM. Selain itu, penggera keselamatan akan diaktifkan oleh lampu-lampu LED dan penggera bunyi. Seterusnya, ESP8266 pula digunakan untuk menghantar mesej peringatan kepada pengguna melalui aplikasi WhatsApp dan GPS pula digunakan sebagai peralatan untuk mengesan lokasi kenderaan dalam koordinat longitud dan latitud. Tambahan pula, sistem ini juga dilengkapi dengan sistem motor motor tingkap kuasa yang akan menurunkan tingkap secara automatic apabila kepekatan gas karbon monoksida berada dalam keadaan tinggi dan merbahaya. Sebagai keputusan, kepekatan gas karbon monoksida boleh dikawal untuk mengelak keracunan gas yang boleh mengakibatkan kematian.

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LIST OF ABBREVIATIONS

V	-	Voltage
CO	-	Carbon Monoxide
GPS	-	Global Positioning Syatem
LCD	-	Liquid Crystal Display
LED	-	Light-Emitting Diode
$MQ-7$	-	Carbon Monoxide (CO) gas sensor
IDE	-	Intergrated Development Environment
RAM	-	Randon Access Memory
I/O	-	Input/Output
Hb	-	Haemoglobin
A	-	Ampere

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CHAPTER 1

INTRODUCTION

1.1 Background

These days, vehicles have been an important part in our daily lives. Living in this era, mostly people use vehicles as their life routine including as working purpose. Besides that, safety issue regarding the safety of the vehicles is getting crucial lately, especially the leakage gas issue that can cause death. Carbon monoxide (CO) can kill people in silent because it is colorless and odorless. CO can be founded in car fumes that is produced when people start the car engine.. There are several symptoms of CO poisoning like headache, weakness, dizziness, chest pain and confusion. In addition, a lot of inhalations can make people pass out or kill people. Even worse, people who are sleeping can die from CO poisoning without having any symptoms.

Arduino UNO is a major part for this project as it is functioning as a microcontroller to monitor all the inputs and outputs for the system. As for the carbon monoxide (CO) detector, this system uses MQ7 semiconductor sensor to sensing the CO gas leakage. WhatsApp application is used as an output where the warning signal will be sent when the MQ7 detects the CO gas, whether it is at a normal or dangerous level. Besides that, this system also implements an automatic motor power window which works to roll down the window when the concentration of CO gas is at the dangerous level. LEDs and buzzer also will be operated as warning signals.

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Carbon monoxide (CO) leakage normally happens because of one of two events. First case, the system of air conditioning in car usually operates by filtering air from the outside before it is being used. Nevertheless, it is very recommended to not turn on the air conditioning system while the engine inoperative. Car air conditioner may gather CO gas while the engine inoperative. So, possibly for the gas leakage to happen. Second, CO leakage also can be happened due to the original exhaust has been altered for some reason. Commonly, a normal car has a long exhaust system but modified exhaust system is a little bit shorter. Due to this, carbon monoxide (CO) manages to seep into the car's inner chamber through the modified exhaust system way more easily compared to standard exhaust system.

The most dangerous situation is when the driver is sleeping, they may not have any poisoning symptoms. So, the driver tends to not be able to roll down the window when the CO is at the dangerous level inside the car.

1.2 Problem Statement

A long drive usually makes the car drivers a little bit tired and they might take a break for a short nap. In this case, the drivers usually will lock the car from the inside for the safety reasons. They will also keep the engine and the air conditioning running. However, the drivers might not be awared off the presence of carbon monoxide (CO) producing by the running engine because of the characteristic itself, which is colorless.

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1.3 Project Objective

There are three following objectives for this project as follows:

a) To design a carbon monoxide gas detection system for vehicle with automatic roll down motor window by using Arduino microcontroller.

b) To develop a warning signal and monitoring system for the Carbon Monoxide (CO) gas detection and using ESP8266 to send an alert message through WhatsApp application with the location of the vehicle.

c) To analyse the effectiveness of carbon monoxide detection system and warning signal system to the user and the authorized person.

1.4 Scope of Project

This system contains a combination of both hardware and software. Arduino UNO is used as a microcontroller to control the whole system. In order to achieve the first objective, ESP-8266 is used to send a warning signal via WhatsApp application whenever the MQ7, Carbon Monoxide (CO) gas sensor detects the CO gas concentration whether in normal or dangerous level.

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Besides, in order to achieve the second objective, the components used are MQ7, Carbon Monoxide (CO) gas sensor as an input and buzzer, LCD display, LEDs and motor for automatic roll down power window as an output. The MQ7 sensor functioned as sensor to detect the existence of CO gas. The green LED will turn ON as a warning when the CO gas is at the normal level but when the concentration of CO gas is at the dangerous level, the buzzer will trigger and red LED will turn ON as a safety alert. The automatic roll down power window will automatically roll down to decrease the concentration of CO gas. Arduino Integrated Development Environment (IDE) is used for the software part of the program section of the application

1.5 Project Outline

Basically, this report covers five chapters. All these 5 chapters are covered on the implementation of the project operation. Chapter 1 contains of explanation of this project scope, together with the background of the project, problem statement, objectives, project scope and project outline.

Meanwhile, chapter 2 consists of a literature review. This chapter discusses the related previous studies domeby some researchers. Details on materials, devices and technologies that have been used and implemented by researchers will be examined.

As for the chapter 3, this chapter presents the methodology used to implement this project. The technique and method as a reference have to be developed with a consistent flow of this study. In addition, the block diagram will display the complete purpose of this project scope. Besides, the flowchart will also be used as the method to explain this project throughout the chapters.

Chapter 4 focuses on the preliminary results of the project.

Finally, as for the last chapter, chapter 5 contains the conclusions of the project.

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter discusses the related part studies by other researchers, the effects of carbon monoxide (CO) gas to the human body and also the source of CO gas from the vehicle. In addition, this chapter also explains the overview of existing devices, microcontroller in general and CO gas sensor technologies. In comparison, this chapter also will discuss about a variety of previous related articles, works, and journals related with this project.

2.1.1 Effect of Carbon Monoxide (CO) on Human Body System

Carbon monoxide (CO) is a toxic gas that can affected generally through human body system. One of the effects of CO on human body system is Hypoxia. Basically, hypoxia is the lack of oxygen in vital or non-vital organs. Carbon Monoxide hinders the blood's ability to carry oxygen to body tissues including vital organs such as kidneys, heart, kidneys. When human body receives CO through inhalation, it combines with the oxygen carrying hemoglobin of the blood and carboxyhemoglobin (COHb) will form. When it combines, the hemoglobin is no longer available to carry oxygen together.

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Another effect of Carbon Monoxide is it can cause an inflammation to human body. Inflammation can be happened due to many reasons and as for this study, it can happen due to the lack of oxygen on human body system. CO poisoning may increase the risk of neurologic defects, diabetes, cardiac injury and also death [1].

There are several symptoms vary widely based on exposure level duration and the general health and age on an individual as shown on Table 2.1 below [2].

Table 2.1 This is a sample caption for table. Please push tab once after the table number before you type the caption.

Concentration of CO gas	Time of exposed	Symptoms
0 ppm	-	Fresh air.
9 ppm	-	Maximum indoor air quality level.
10-35 ppm	8 hours	Headache, dizziness and nausea.
100 ppm	2-3 hours	Slight headache.
200ppm	2-3 hours	Mild headache, dizziness, fatigue and nausea.
400 ppm	1-2 hours	Loss of judgement, serious headache, sweating.
800 ppm	45 minutes	Unconscious within 2 hours. Dizziness, nausea and convulsions. Death within 2-3 hours.
1,600 ppm	20 minutes	Headache, tachycardia, dizziness and nausea. Death within 1 hour.
3,200 ppm	5-10 minutes	Headache, dizziness and nausea. Death within 30 minutes.
6,400 ppm	1-2 minutes	Headache, dizziness and nausea. Death less than 20 minutes.
12,800 ppm	1-3 minutes	Unconsciousness. Death within 3 minutes.

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2.1.2 Source of Carbon Monoxide (CO) Gas

Carbon Monoxide (CO) formation is usually because of incomplete combustion of carbon compounds; common sources include fire, engine exhaust, and faulty furnaces. As for the vehicles, CO gas emissions could be produced from through the waste product from exhaust pipe system of vehicles and unfinished combustion process from any carbon-based gasoline [3].

System of exhaust piping of vehicle discharges fumes that contains CO gas that are sucked into the cabin through air conditioner when vehicle is in idle condition. High concentration of CO gas can build up to dangerous condition. This usually happens when fuel-burning devices are not rightly operated, vented and well-maintained [4].

When the car was in idle mode such as in heavy traffic, the level of CO gas could rise from 25 ppm to 70 ppm which is will put it in a dangerous level that can causes the passenger inside the car to suffer any kind of symptoms like dizziness, migraine and nausea. The concentration of the CO gas could be getting higher when the car engine was not running [3]

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2.2 Overview of Existing Project System

This section will analyze some previous existing project implementation that has been applied related with this project system. Some great researchers have done their research in developing the best methods of improving the use of the carbon monoxide (CO) gas detector.