UNIVERSITI TEKNIKAL MALAYSIA MELAKA

IMPROVEMENT OF VEHICLE CABIN VENTILATION DETECTED BY ALCOHOL DETECTOR DEVICE

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Automotive) with Honours.

by

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DECLARATION

I hereby, declared this report entitled IMPROVEMENT OF VEHICLE CABIN VENTILATION DETECTED BY ALCOHOL DETECTOR DEVICE (VAD) is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Automotive) with Honours. The member of the supervisory is as follow:

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ABSTRACT

Recently, cases of fatal traffic accidents involving inebriated drivers have been often reported in the news. This issue has not only endangered the safety of drivers but also other road users. In a state of drunk, human beings are not ready to work, think rationally and evaluate things accurately. A study conducted by the World Health Organization (WHO) in 2018, between 2010 and 2018 showed that there were 2364 drunk driving-related accidents resulting in 1196 deaths. On average, each year, a total of 132 people are killed and the ratio of drunk driver-related accidents is one person killed for every three days. According to the WHO report, Malaysia is one of the 35 countries that contribute to the high rate of accidents involving drunk driving. Drunk driving has been listed as one of the leading factors in fatal car accidents. To overcome this problem, drunk driving detectors have the potential to be explored to reduce the rate of road accidents. Many studies have been done to create vehicle driver alcohol limit detectors. However, there are still many shortcomings that need to be fixed. In this study, a drunk driving detection device was introduced using a microcontroller embedded into the vehicle start system. Alcohol sensors were used in this study to detect alcohol levels in human breath. The device will initially detect the level of alcohol in the breath and when the alcohol concentration is detected in excess of 50 milligrams per 100 millimeters of blood, the car's starting system is stopped so that the car cannot be started. Next, the driver's window will slide down automatically by 20mm for the purpose of ventilation in the vehicle cabin. With the use of this system, road accidents caused by drunk drivers can be reduced. In addition, a driver who is intoxicated can rest in the car cabin until he is awake from the state of intoxication without drowning in the car cabin.

ABSTRAK

Akhir-akhir ini kes kemalangan jalan raya yang melibatkan pemandu mabuk sehingga ada yang melibatkan kematian sering terpapar di dada akhbar. Isu ini bukan sahaja telah membahayakan keselamatan pemandu malah pengguna jalan raya yang lain. Dalam keadaan mabuk, manusia tidak bersedia untuk bekerja, berfikir dengan waras dan menilai sesuatu dengan tepat. Kajian yang dilakukan oleh World Health Organization (WHO) pada tahun 2018, antara tahun 2010 dan 2018 menunjukkan bahawa terdapat 2364 kemalangan yang berkaitan dengan pemanduan mabuk yang menyebabkan 1196 kematian. Secara puratanya, setiap tahun, seramai 132 orang terbunuh dan daripada jumlah ini nisbah kemalangan yang berkaitan pemandu mabuk adalah satu orang terbunuh untuk setiap tiga hari. Menurut laporan WHO, Malaysia merupakan salah sebuah negara dari 35 negara yang menyumbangkan kadar kemalangan melibatkan pemanduan mabuk yang tinggi. Pemanduan mabuk telah dicatatkan sebagai salah satu faktor utama kemalangan kereta yang membawa maut. Bagi mengatasi masalah ini, pengesan pemanduan dalam keadaan mabuk berpotensi untuk diterokai bagi mengurangkan kadar kemalangan jalan raya. Banyak kajian telah dilakukan untuk mencipta pengesan had alkohol pemandu kenderaan. Namun, masih banyak kekurangan yang perlu diperbaiki. Dalam kajian ini, peranti pengesan pemanduan dalam keadaan mabuk telah diperkenalkan dengan menggunakan pengawal mikro yang ditanam ke dalam sistem permulaan kenderaan. Sensor alkohol telah digunakan dalam kajian ini untuk mengesan tahap alkohol dalam nafas manusia. Peranti ini pada awalnya akan mengesan tahap alkohol dalam nafas dan apabila kepekatan alkohol dikesan melebihi 50 miligram per 100 milimeter darah, sistem permulaan kereta dihentikan supaya kereta tidak dapat dihidupkan. Seterusnya, tingkap pemandu akan meluncur turun secara automatik sebanyak 20mm untuk tujuan pengudaraan di dalam kabin kenderaan. Dengan penggunaan sistem ini, kemalangan jalan raya yang disebabkan oleh pemandu mabuk dapat dikurangkan. Selain itu, pemandu yang sedang mabuk boleh berehat di dalam kabin kereta sehingga sedar dari keadaan mabuk tanpa lemas di dalam kabin kereta.

DEDICATION

This dissertation is dedicated to my beloved parents Musa bin Atan and Zaiton bt. Mat Zin, my family, and my friends whose unyielding love, support, and encouragement have enhanced my soul and inspired me to pursue and complete this project during COVID-19 pandemic.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF SYMBOLS AND ABBREVIATIONS

Cases

ABV : Alcohol by Volume 11, 12

AC : Alternate Current 47

AUD : Alcohol Use Disorder 18, 20

BAC : Blood Alcohol Concentration ..... passim

BrAC : Breath Alcohol Concentration 24, 52

dB : Decibel 52

DC : Direct Current 47, 56

DUI : Driving Under the Influence 2, 3

DWI : Driving While Intoxicated 2

FAS : Fetal Alcohol Syndrome 20

Hz : Hertz 52

kb : kilobyte 48

LCD : Liquid Crystal Display 5, 6, 7, 44

LED : Light-Emitting Diode 6, 44, 50

mA : Mili Ampere 48

MHz : Mega Hertz 48

MIROS : Malaysian Institute of Road Safety Research 2

mm : milimetre 52

MOS : Metal Oxide Conductor 49

NHTSA : National Highway Traffic Safety Administration 2, 3, 36

NIAA : National Institute of Alcohol Abuse and Alcoholism 9, 10, 18

CHAPTER 1

INTRODUCTION

1.1 Overview

According to Cambridge Dictionary, drunk *(adjective*) means unable to speak or act in the usual way because of having had too much alcohol. Besides, in the noun perspective stated that drunk is a person who drinks large amounts of alcohol very often and is unable to stop. Drinking alcohol may cause you to get intoxicated, which is related with sluggish and bad judgement, loss of concentration, slower respiratory and heart rate, visual difficulties, sleepiness, and disorientation. The more alcoholic beverages you drink, the more strong the effects of alcohol on the body become. "In the United States, a Blood Alcohol Concentration (BAC) of 0.08 is indeed the threshold for drunkenness" (Abdul et al., 2021). "If a person is detected driving with a BAC above this level, they can be arrested" (Abdul et al., 2021).

On the other hand, "driving means the controlled operation and movement of a vehicle, including cars, vans, lorry, trucks, and buses" (Yasin et al., 2021). "Driving skills have also developed since the 15th century, with physical, mental, and safety capabilities required" (Eboli et al., 2017). Driving entails more than simply understanding how to operate the car but also entails understanding how to apply the laws of the road in order to ensure safe and efficient sharing with other road users (Eboli et al., 2017). An effective driver also understands the fundamentals of vehicle handling and can drive properly. In certain countries, a driving test is used to check both practical and theoretical knowledge of traffic rules, and those who pass are awarded a driving licence (Harper, 2019).

Then, “the drunk driving is operating a vehicle with a blood alcohol content (BAC) level of at least 0.08 percent” (Crombag et al., 2020). “Drinking and driving is sometimes called driving under the influence (DUI) or driving while intoxicated (DWI), even a small amount of alcohol can lead to harmful situations” (Harper, 2019). Some car drivers may not even express signs of drunkenness, but that doesn't make it any less dangerous (Rehm et al., 2020). It is significant to bear in mind that any sort of alcohol consumed while driving is prohibited and could result in severe penalties (Abdul et al., 2021). Any level of alcohol in your bloodstream can impair your ability to drive (Yadav & Velaga, 2020). Alcohol abuse has a wide range of effects, placing you at danger of causing accidents or injuries. “Driving safely necessitates the ability to concentrate, make sound decisions, and react quickly to changing circumstances” (Harper, 2019). However, drinking weakens these abilities, placing you and others in risk.

The most common cause of traffic accidents is drunk driving. Drunken drivers are in a state of irrationality, so driving is inconvenient, and it also causes harm to properties and the lives of drunken drivers, as well as other road users. Ones revealed that “a drunk driver is 13 times more prone to cause an accident, compared to a sober person” (*MIROS*, 2012). “The latest data from the World Health Organization (WHO) even marked Malaysia as one of 35 nations with a high rate of drink driving accidents. Statistics between 2010 and 2018 showed that there were 2,364 accidents related to drink driving, with 1,196 people killed” (NHTSA, 2017). In 2019, 919 people were caught for driving in the drunk state, whereas 862 were arrested in 2018 (Rusli et al., n.d.). These figures indicate that the problem is becoming serious problem.

1.1.1 Statistics of accidents involving DUI in Malaysia

Malaysia currently possesses the third worst road crashes fatality rate in Asia. This unpleasant situation is increasing more common, and the society is urging the authorities to strengthen the legislation on this infringement. Figures from the Royal Malaysia Police (RMP) have indicated that deaths related to drunk-driving registered a meagre 0.85 percent from total statistics nationally. In 2018, there were 191 drivers and motorcyclists convicted guilty for driving and biking under the influence of alcoholic beverage resulting in 54 deaths. Vehicle drivers led the ranking for DUI associated accidents at 74. In 2017, there were 58 fatalities or 0.86 percent out of total traffic accidents.

A record of 212 drivers and bikers who were engaged in traffic accidents were found to have consumed alcoholic beverages. "Road wrecks information collected in the past decade have already shown that the greatest percentage of deaths from the total fatalities due to DUI was 3.41 percent or 229 deaths documented" (Fadilah et al., 2012). A year later, 237 people died on the roads, accounting for 3.31 percent of all traffic deaths nationwide (NHTSA, 2017). However, records show that the number of drivers/bikers engaged in DUI-related crashes fluctuates from year to year. In 2014, for example, a total of 266 cases were reported. The number of drunk-driving crashes grew to 420 the following year, and the upward trend continued in 2016 with 461 cases. The figures drop to 212 a year later. The percentage of death from total crashes from 2010 to 2018 is shown in **Table 1.1** and also the statistics of drunk driving accidents in Malaysia published by Royal Malaysia Police in 2019 is shown in **Figure 1.1.**

Table 1. 1: Percentage of death from total crashes 2010-2018 (Tamrin, 2019).

Year	Percentage of death from total road fatalities (%)
2010	0.71
2011	0.48
2012	1.97
2013	2.99
2014	2.89
2015	3.41
2016	3.31
2017	0.86
2018	0.85

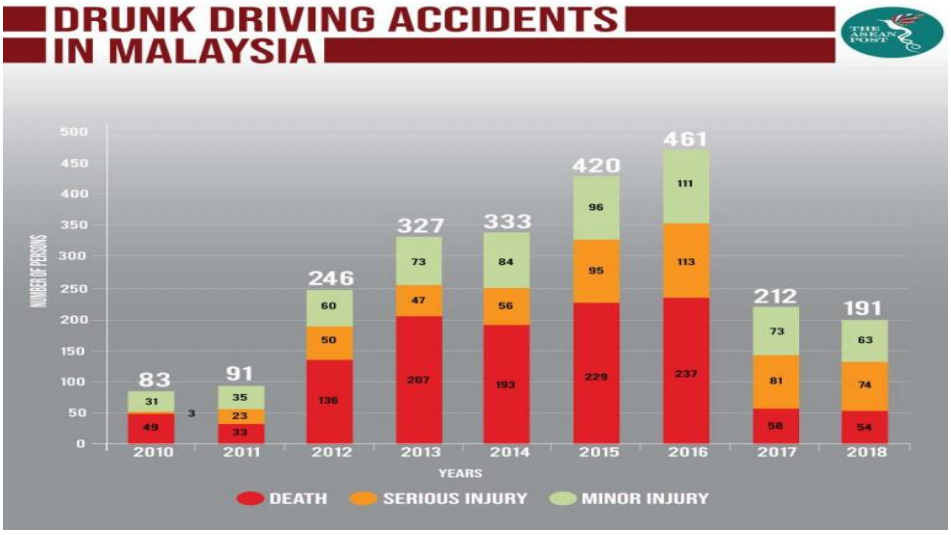

Figure 1. 1: Statistics of drunk-driving crashes in Malaysia (*RMP*, 2019)

1.2 Problem Statement

"Following a spate of tragic road incidents involving drivers suspected of driving while drunk with alcohol, drunk-driving has recently been a controversial issue in Malaysia" (Zhao et al., 2014). From the Transport Ministry (2018), "during eight years from 2011 to 2018, a record of 1,147 individuals died in influence of alcohol incidents in Malaysia". The Malaysian government has agreed to enact tougher restrictions with harsher penalties, including measures such as limiting the number of places where alcohol may be sold, suspending sales, and eventually closing down the country's alcohol business.

"Malaysia is also one of the world's most lenient nations in terms of the allowable blood alcohol concentration (BAC)" (OMS (Organización Mundial de la Salud), 2011). Malaysia's blood alcohol content (BAC) is 0.08, while nations such as Taiwan and Japan have significantly lower BACs, which are 0.05 and 0.03, correspondingly. As per research, having a higher blood alcohol content (BAC) lowers one's attention and responsiveness on the road, particularly after consuming alcohol (Zhao et al., 2014).

Based on existing alcohol detection technology, they just detects the alcohol concentration and gives a result display on the LCD display. Some of the advanced existing project, they have locked the engine system or the starting system so that the vehicle will not start to prevent from drunk-driving. Though, the shortage here is when the vehicle engine system not operating, the whole vehicle system is also will not functioning. In this situation, the drunk driver will fed up and fell asleep with no proper ventilation in the vehicle cabin. This could lead to causing drivers to drown in their own vehicles. In order to fill the gaps in existing technology, the VAD project is introduced to avoid drivers from drowning while half-consious in the vehicle cabin. When the driver can rest in safe condition until they sober, the accident involving drunk drivers can be reduce and drivers' safety also guaranteed.

1.3 Aim and Objectives

1.3.1 Aim

The aim of our paper is to overcome accident rate due to the drunk and drive while make sure the drivers' safety at first hand. Driving under the influence of alcohol has affected and killed countless of people's lives. In this context, drunk driver always put themselves in risk along with other road users too. So we are here proposing an innovative and enhanced system to reduce the accidents due to the drunk driving in a safe manners. According to the proposed system the vehicle will not start, driver can't drive car after drinking. We are making use of alcohol sensor (MQ-3), microcontroller (Arduino Due), LED and buzzer that will be embedded in vehicle starting and power window system. The system is trying to make sure safety of people inside the vehicle and surrounding people.

1.3.2 Objectives

The objectives of the present research are as follows:

1. To develop the vehicle alcohol sensing system integrated with vehicle starting system.
2. To improve the vehicle cabin ventilation system.

1.4 Scope of Study

Recently, the cases of traffic accident caused by drunk driving have increased rapidly. Society have understood that drunk-driving is extremely dangerous to public safety. It's about time to create a system that effectively prevents drunk-driving. Because this type of technology is not widely used yet, we are working to improve it because it have a accidents preventative effect and safety to the drivers the first place. For the system, the project covers;

1. The alcohol level content is based on alcohol available in market only
2. Driver alcohol content is developed based on alcohol level equation
3. The alcohol level equation is embedded in microcontroller
4. The vehicle starting system is integrated with microcontroller
5. Power window system is integrated with starting system
6. The cabin ventilation improvement is due to driver window opening

1.5 Expected result

In this VAD project, we are building a system that will disable the vehicle's starting system if the driver is under the influence of alcohol. The system receives data in the form of the detected concentration of alcohol in the driver's breath , which is generated by an alcohol sensor that is connected to the microcontroller. The alcohol sensor will be located close to the driver, so it will be able to identify the level of alcohol by analyzing the driver's breath. Any amount of alcohol discovered above 22µg (legal limit) causes the system to flash an alcohol detection notice on the LCD screen, sound an emergency alarm by using piezo buzzer, and shut down the vehicle system's start-up operation altogether. Next, the integrated window system continuing to lower down the driver's window by 20mm. This project proposes a method of preventing intoxicated driving accidents, therefore reducing the likelihood of any incidents occurring.