DIRECT CURRENT MOTOR CONTROLLER USING ALCOHOL SENSOR WITH IOT

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BACHELOR OF MECHANICAL ENGINEERING TECHNOLOGY (AUTOMOTIVE TECHNOLOGY) WITH HONOURS

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Faculty of Mechanical Technology and Engineering

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DEDICATION

A lot of thank you to my irreplaceable family especially my parents, Mr. Ayub Bin Amran, and Noraiyni Binti Key for giving me full support to successfully manage my final year project to this stage. My Supervisor also, Ts. Dr. Nur Rashid Bin Mat Nuri @ Md Din who giving endless guidance and knowledge. Lastly to my fellow friend and housemate, who give cooperation and guidance in sharing to complete this project.

ABSTRACT

To combat the widespread problem of drunk driving, this study integrates an alcohol sensor with a motor control system in vehicles. By automatically modifying the motor's movement in response to the driver's blood alcohol content (BAC), the goal is to improve road safety. The system measures the BAC in the car using a MQ-3 alcohol sensor. NodeMCU and Arduino UNO as a microcontroller. The motor will stop and prevent driver from running the vehicle if the BAC is higher than the set level which 0.08% following Malaysia legal restriction. A location will send to relative as soon as the alcohol level is high and also sms if the location is dont have internet coverage. The process includes configuring hardware and using the C++ programming language. The system's effectiveness in detecting alcohol levels and its potential to reduce drunk driving are demonstrated by result findings. 40% alcohol-content liquor was used for the sensor's calibration in either direct and breath. Breath and direct are measured at 435 ppm and 645 ppm. The direct reading is higher than the breath reading theoretically proves how effective the sensor functions.

ABSTRAK

Untuk memerangi masalah pemanduan mabuk yang meluas, kajian ini mengintegrasikan sensor alkohol dengan sistem kawalan motor dalam kenderaan. Dengan mengubah suai pergerakan motor secara automatik sebagai tindak balas kepada kandungan alkohol darah pemandu (BAC), matlamatnya adalah untuk meningkatkan keselamatan jalan raya. Sistem ini mengukur BAC dalam kereta menggunakan sensor alkohol MQ-3. NodeMCU dan Arduino UNO sebagai pengawal mikro. Motor akan berhenti dan menghalang pemandu daripada menjalankan kenderaan jika BAC lebih tinggi daripada paras yang ditetapkan iaitu 0.08% mengikut sekatan undang-undang Malaysia. Lokasi akan dihantar kepada saudara sebaik sahaja tahap alkohol tinggi dan juga sms jika lokasi tidak mempunyai liputan internet. Proses ini termasuk mengkonfigurasi perkakasan dan menggunakan bahasa pengaturcaraan C++. Keberkesanan sistem dalam mengesan tahap alkohol dan potensinya untuk mengurangkan pemanduan dalam keadaan mabuk ditunjukkan melalui penemuan keputusan. 40% minuman keras kandungan alkohol digunakan untuk penentukuran sensor sama ada secara langsung dan nafas. Nafas dan terus diukur pada 435 ppm dan 645 ppm. Bacaan langsung lebih tinggi daripada bacaan nafas secara teorinya membuktikan keberkesanan fungsi sensor.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS AND ABBREVIATIONS

DC	- Direct Motor
LCD	- Liquid Crystal Display
BAC	- Blood Alcohol Content
ppm	- Parts per Million
IR	- Infrared
GPS	- Geographical Positioning System
GSM	- Global System for Mobile Communication
LED	- Light Emitting Diode
SRAM	- Static Random Access Memory
EEPROM	- Electronically Erasable Programmable Read-Only Memory

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Background

Innovative technologies have been developed to detect alcohol levels and prevent those under the influence from operating vehicles in attempts to prevent this problem. One such technology is the incorporation of alcohol sensors, which can detect alcohol impairment and so help to avoid drunk driving incidents. The implementation of alcohol sensors into vehicles and other modes of transportation has huge potential to reduce the risks connected with drunk driving. These sensors measure the concentration of alcohol in a person's breath or surrounding environment, providing real-time data that can be used to establish how well someone is able to operate a vehicle. Proactive actions can be done towards avoiding accidents from occurring by implementing alcohol sensors into vehicle control systems.

The purpose of this study is to investigate at the idea of applying alcohol sensors to avoid drunk driving accidents. We can get insights into the effectiveness and potential of alcohol sensors in improving road safety by analyzing existing literature, studies, and technological developments in this area. Understanding the approach beneath these systems can also offer further insight into the design considerations, algorithms, and control mechanisms that go into integrating alcohol sensors with vehicle control systems. Drivers who have been discovered to be drunk can be prohibited from starting the car or have their driving abilities reduced by installing alcohol sensors into vehicle control systems. This proactive approach has the potential to save numerous lives, reduce injuries, and lessen the financial burden of drunk driving incidents.

The origins of this research can be traced back to the requirement for efficient methods to reduce the dangers of drunk driving. Traditional approaches, such as breathalyzers and ignition interlock devices, give some control, but their effectiveness to avoid accidents while the vehicle is in motion is limited. The technology can continually monitor the driver's alcohol levels and take proactive measures to maintain safe driving practices by embedding alcohol sensors directly into the DC motor controller.

The importance of this study originated from its ability to save lives and minimize the devastating effects of drunk driving incidents. The risk of accidents caused by intoxicated drivers can be significantly decreased by installing a reliable and sensitive system that can detect alcohol impairment in immediately. The integration of alcohol sensors with DC motor controllers allows for immediate action, such as reducing vehicle speed, controlling acceleration, or activating safety measures to avoid accidents before they happen.

Furthermore, the initiative is extremely valuable to companies where machinery safety is critical. Alcohol impairment may represent an important issue in industrial settings, threatening worker safety and leading to serious accidents. By integrating alcohol sensors with DC motor controllers, machinery and equipment can be equipped with an extra layer of safety precautions to prevent accidents caused by drunk drivers.

Overall, the project's background and relevance come from its ability to solve the critical issue of drunk driving accidents and improve safety in both the transportation and industrial sectors. This research intends to contribute to a safer and more responsible society by integrating alcohol sensors with DC motor controllers, where the hazards associated with alcohol impairment are effectively minimized and lives are protected.

1.2 Problem Statement

Accidents involving alcohol causes harm, including deaths, and have a negative effect on society as a whole. They continue to occur at a terrifying rate despite efforts to decrease their incidence. Therefore, it is essential to comprehend the root causes and create effective preventative measures.

According to data provided by the World Health Organization (WHO), harmful consumption of alcohol causes around 3 million deaths annually, or 5.3% of the total deaths worldwide [1]. Furthermore, the National Highway Traffic Safety Administration reported that alcohol-impaired driving accidents resulted in 10,511 deaths in the United States alone in 2018, accounting for 29% of all deaths involving motor vehicles. These numbers highlight the serious and widespread impact of alcohol-related accidents [2].

On the other hand, referring to the WHO’s Global Status Report on Road Safety for 2015, South Africa is one of the world's most dangerous countries for road accidents, with 25.1 deaths per 100,000 inhabitants each year. Surprisingly, alcohol drinking is responsible for approximately 6 out of every 10 traffic deaths (58 percent) in South Africa [3].

1.3 Research Objective

This research offer a few amount of objective that can be convenient for the safety of the user and other driver. The objective are:

1. To develop a device that detect alcohol level .
2. To develop a software that reveal driver location.
3. To test the effectiveness of the system

1.4 Scope of Research

The scope of this research are as follows:

• System design:

The project involves designing the overall system architecture that connects the alcohol sensor to the DC motor controller. Selecting appropriate sensor technology, determining sensor positioning for precise alcohol detection, and creating the connection and methods for communication between the sensor and the motor controller are all part of this process.

• Control Mechanisms:

The project involves developing of control systems within the DC motor controller to respond to alcohol impairment. This may entail installing safety measures such as speed restriction, acceleration limiting, or activating safety processes to avoid accidents caused by drunk driving.

• Performance Optimization:

The project scope includes improving system performance through the refinement of algorithms, calibration procedures, or control mechanisms. Identifying areas for improvement, correcting limits, and improving the system's responsiveness and efficacy in detecting and preventing alcohol-impaired operation are all part of this process..

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Excessive alcohol consumption has been identified as a main element in a driver's incapacity to effectively operate a car, increasing the chance of the said driver being involved in an accident. The risk of accidents resulting in injury or death increases when alcohol is consumed while driving. Datuk Seri Ismail Abd Muttalib, Deputy Housing and Local Government (KPKT) Minister, stated that "between 2016 and 2020, there were 771 cases of accidents caused by the influence of alcohol, resulting in 44 deaths.". According to data from The Royal Malaysia Police (PDRM), 21 incidences of drunk driving were recorded between January 2020 and May 2020, with 8 deaths. Due to this issue, the Malaysian government enacted a new legislation in the modified Road Transport Act 2020 to take forceful action against intoxicated and reckless driving [4]. Furthermore, the government would cut the prescribed limit of alcohol from 35 micrograms to 22 micrograms in 100 ml of breath.

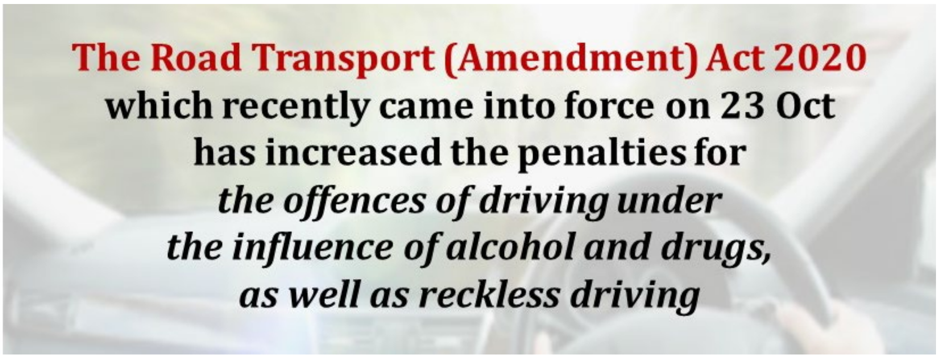


Figure 2.1 The Road Transport (Amendment) Act 2020 (Lie, 2020)

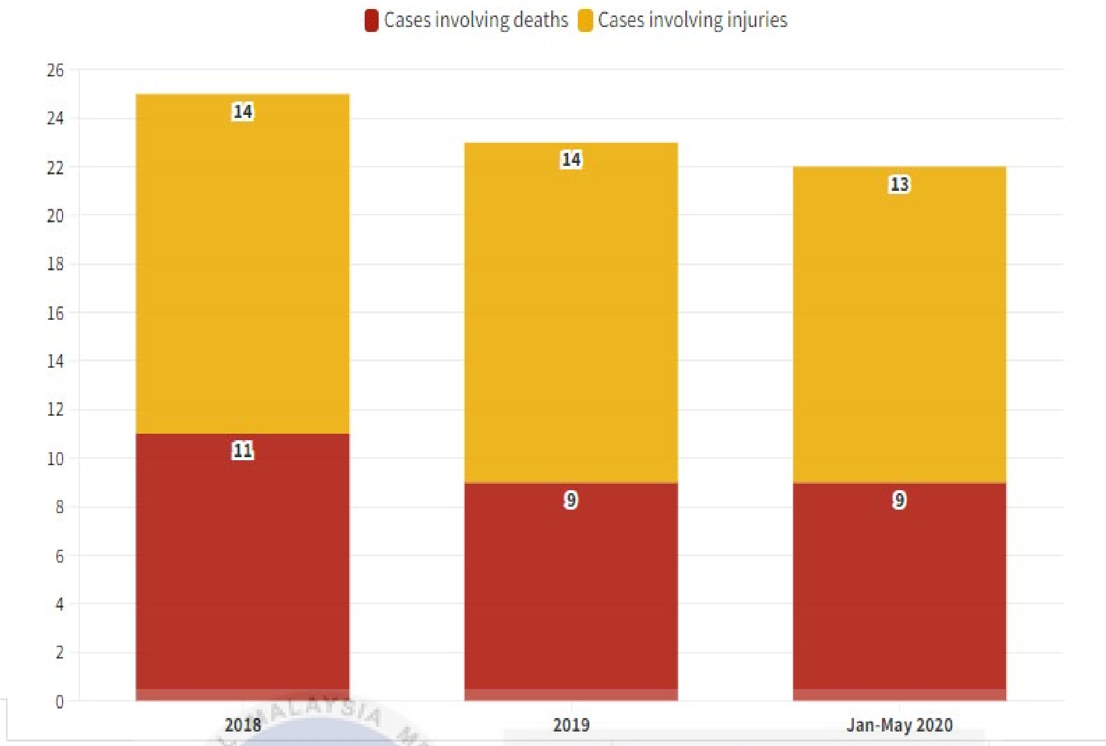


Figure 2.2 Total driving case involving deaths or injuries in Malaysia

2.2 Measurement of Alcohol Content

Blood alcohol concentration (BAC) is the amount of alcohol in the blood measured in milligrammes per litre (mg/L). The amount of alcohol taken, the drunker's weight, gender, body fat, and the meal consumed before drinking are all factors that impact blood alcohol level. Because alcohol enters the system more slowly on an empty stomach, a person is more likely to have a higher blood alcohol content. The first legal limit for blood alcohol content was 0.15. In Malaysia, the government announced a new amendment to Section 45G of the Road Transport Act 1987, which includes 22 micrograms of alcohol per 100 millimetres of breath, 80 milligrammes of alcohol per 100 millilitres of blood, and 67 milligrammes of alcohol per 100 millilitres of urine.[5]. There is a method to determine blood alcohol concentration because the specified limit for blood tests is 80 milligrammes. But first, it should be noted that there is a standard conversion factor for estimating blood alcohol concentration, which is 2100:1. This indicates that 1 mm of blood contains 2100 times the amount of alcohol as 1 millilitre of lungs' air. BAC is represented as ethanol weight, which is determined by weighing 210 litres of breath in grammes. Next, divide the 210 by 1000 to calculate the BAC percentage by multiplying by mg/L in breath. The formula for calculating the percentage of BAC is shown below:

$$\%BAC = breath\left(\frac{mg}{L}\right)\left(\frac{210}{1000}\right) \qquad Eq.\ 1$$

Malaysia's average BAC is typically reported to be 0.08%. When the breath (mg/L) for a 0.08% BAC is corresponding to 0.381 for the equivalent level of BAC, the equation can be used to determine the value of breath. The detection limit and range of the MQ-3 sensor are described on the data sheet as 10 mg/L and 1023, respectively. The numerical value of 0.381 mg/L of alcohol could be calculated in actual time using the 1023 value as a baseline. If there is 0.38 mg/L of alcohol in the breath, the alcohol content is around 39

$$\frac{0.381}{10} = \frac{x}{1023} \qquad \text{Eq. 2}$$

$x =$ 38.97 equivalent to 39.

2.3 Review of the Previous Research

There are lots of the research that can be found on the internet that are related to the sensor that sense the presence of alcohol in the car which is being applied by many people to test the alcohol level. Furthermore, even the government had changed the law, there are still got the cases that involving of the drunk issue when driving. The literature review for this study is to collect the information or research about the previous work that related to the alcohol detection system in the car. This study also will have figured out on how to improve the method of the presence of the alcohol and providing a better understanding of the research study that have been discussed and summarized, as in Table 1. From the Table 1, it shows the comparison of the previous work on the detection system of alcohol. As seen from the table, the similarity of all the study is the uses of components are quite same and the difference is the notification system by using the communication components. But there is a study where the notification is not used because of focusing more on how to ignite the engine of the car. In conclusion, some of the features can be used to the bachelor degree project to develop the detection system of alcohol.

Table 2.1 Comparison between Arduino mega vs Arduino uno

ARDUINO	UNO	MEGA
Microcontroller	ATmega328	ATmega2560
Operating Voltage	5V	5V
Input Voltage	7-12V	7-12V
Digital I/O Pins	14	54
Analog Inputs Pins	6	16
DC Current per I/O Pin	40mA	40mA
DC Current for 3.3V Pin	50mA	50mA

Flash Memory	32KB	256KB
SRAM	2KB	8KB
EEPROM	1KB	4KB
Clock Speed	16MHz	16MHz

Table 2.2 Components used by previous research

Article 1	**Article 2**	**Article 3**	**Article 4**
Power Supply	Power Supply	Power Supply	Power Supply
Atmega2560 of Arduino Mega	Atmega328 of Arduino Uno	AT89S51	PIC 16F876A
Alcohol Sensor (MQ-3)	Alcohol Sensor (MQ-3)	Alcohol Sensor (MQ-3)	Alcohol Sensor (MQ-3)
GSM Module	SIM900A module.	Comparator	Ignition System
DC Motor	DC Motor	Ignition System	Alarm
LED	LED	Relay	LCD
GPS Tracker	Ultrasonic Sensor	Buzzer	
Buzzer	LCD		
LCD			
Push Button			

2.4 Summary of Article 1

The article by S. L. A. Muthukarpan et al. (2021) investigates the problem of drunk driving accidents on Malaysian roads. The country has a high death rate from traffic accidents, with drunk driving being a major factor. Using a breathalyzer to detect alcohol in drivers is an ineffective and unworkable method. As a result, the article offers a new system that detects alcohol in the driver's breath and perspiration using alcohol sensors such as MQ-3 and IR sensors. For thorough detection and warning, the system also includes a mobile phone accelerometer, ignition lock, GPS tracker, GSM module, LED lights, and a buzzer.

The study approach includes integrating and controlling the system's multiple parts utilizing an Arduino Mega board and microcontroller. Flowcharts show the overall system process, GPS tracking, and GSM module functionality. The alcohol sensor monitors the amount of alcohol in the driver's breath and, based on the results, the system activates alerts, controls the engine, tracks the vehicle's location, and sends SMS notifications to police and relatives.

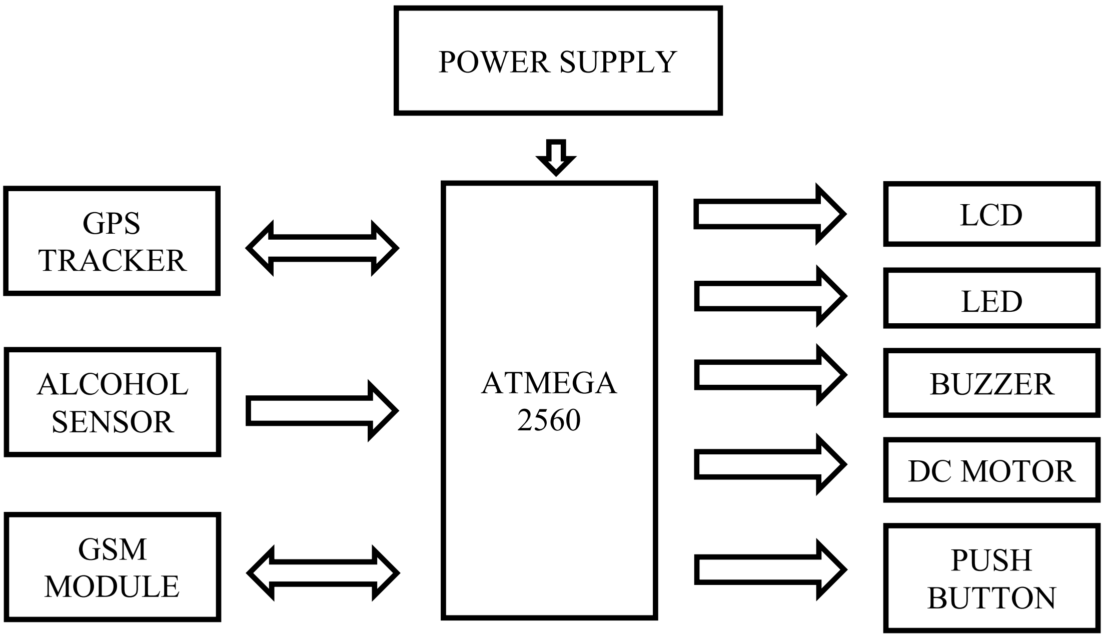


Figure 2.3 Block diagram of the system

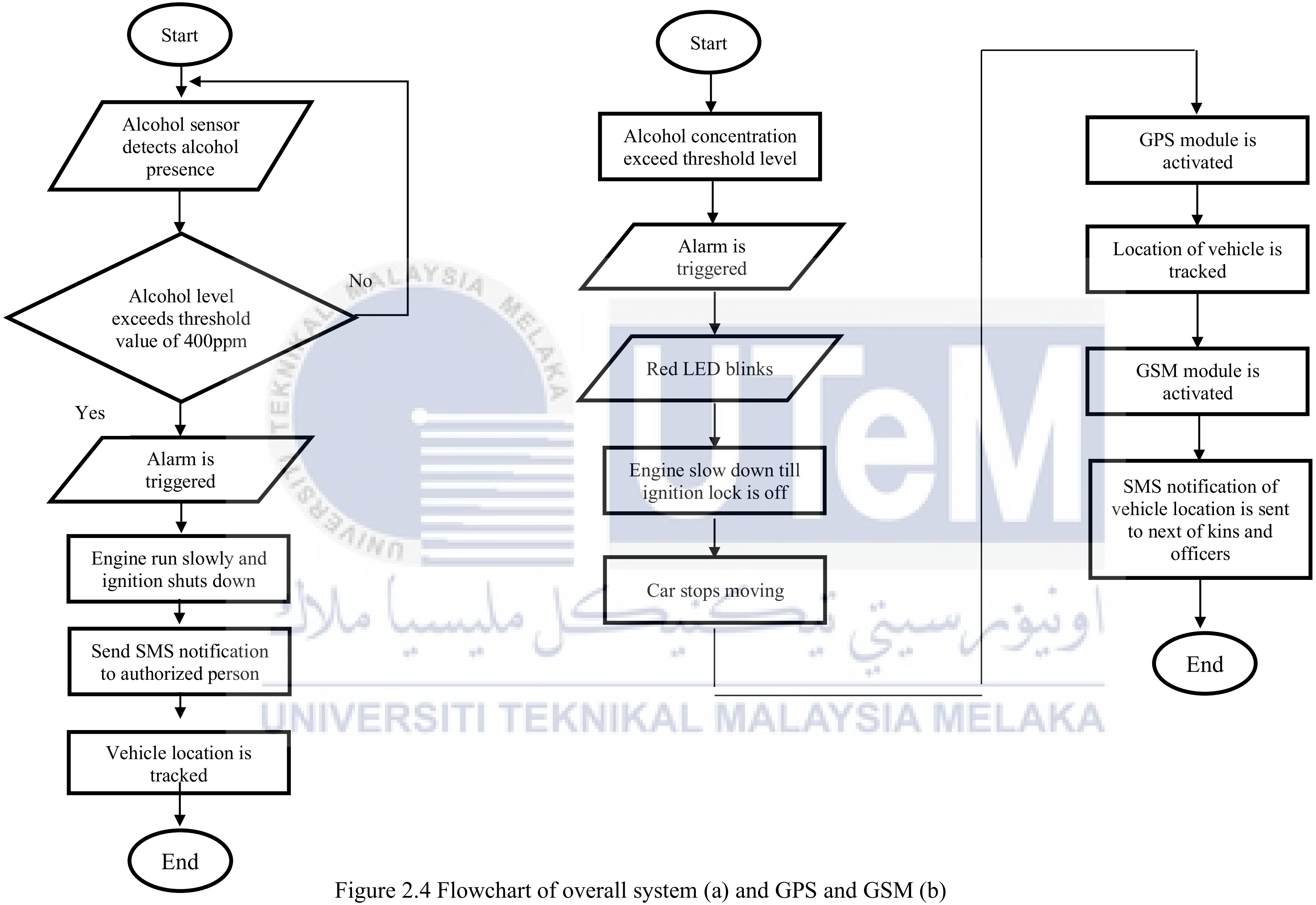


Figure 2.4 Flowchart of overall system (a) and GPS and GSM (b)

2.5 Summary of Article 2

According to Divesh Kumar et al. (2019), drunk driving is a major cause of traffic accidents, putting both the driver and other road users at danger. Due to the restricted ability of police officers to detect intoxicated drivers immediately, the enforcement of laws prohibiting drinking and driving has been difficult. This paper investigates the need for an alcohol detection system that is not limited by space or time, with the goal of lowering the number of accidents caused by drunk driving.

The research goes through the major components of the alcohol detection system. It focuses on the Arduino Uno microcontroller, which serves as the system's main development board. The ultrasonic sensor, MQ-3 sensor for alcohol detection, buzzer to indicate alcohol presence, DC motor for engine locking, SIM900A module for providing alerts, and LED for visual indication.

The literature review provides a summary of related works in the topic. It provides an overview of various research papers and the contributions they make to alcohol detection systems. The application of various sensors, such as the MQ-3 sensor, GPS module integration, helmet-based alcohol detection systems, heart rate monitoring, and image processing for avoiding crashes are all discussed.

The methodology chapter covers the alcohol detection system's detailed process. It explains how the MQ-3 sensor detects alcohol concentration and, if it exceeds a certain threshold, the Arduino Uno stops the DC motor and triggers the red LED to signal a dangerous distance. The SIM900A module oversees delivering a message to authorities informing them of the dangerous vehicle.

Chapter 5 investigates the applications and benefits of the alcohol detection system. It emphasizes its possible deployment in numerous vehicles, its role to preventing drunk driving incidents, and its utility for law enforcement. Further development possibilities are also considered, such as integrating a GPS module for location tracking. In addition, the system's code, written in the C programming language, is shown.

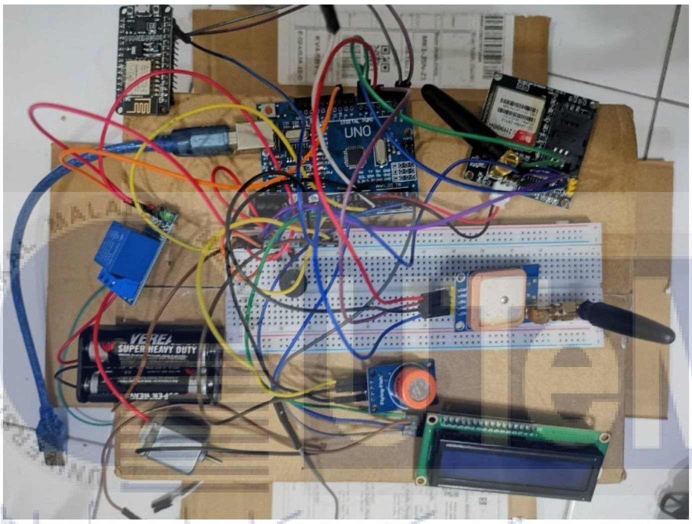


Figure 2.5 Image of the whole system

The implementation of an alcohol detection system is an effective method for reducing road accidents caused by drunk driving. The system's ability to detect alcohol concentration and respond immediately by shutting the engine and alerting authorities improves vehicle safety. GPS integration for real-time location tracking may be added in the future. Overall, this method helps to develop vehicle safety and accident prevention.

2.6 Summary of Article 3

Referring to S. V. Altaf et al. (2017). The essay points out the problem of drunk driving accidents and the importance for a mechanism to detect and prevent such instances. The authors suggest a system that detects the driver's alcohol consumption using a microcontroller and a MQ3 alcohol sensor. The device is intended to shut off the vehicle's engine if alcohol is discovered, and it also includes capabilities such as monitoring the vehicle and decreasing fuel delivery.

The paper's related work section summarises past research in this field. PIC 16876A controller, GSM and GPS technology, IR LED 894, IR sensor, and a real-time online prototype driver-fatigue monitor are among the works described. These earlier studies used sensor-based systems to detect alcohol use, monitor driver weariness, and ensure driver safety.

The suggested alcohol detection and motor locking system's architecture is given, which contains components such as the AT89S51 microprocessor, alcohol sensor (MQ3), LCD display, fuel supply blocker, and relay. The central control unit is the AT89S51 microprocessor, and the alcohol sensor monitors alcohol concentration in the driver's breath. When alcohol is discovered, the fuel supply blocker cuts off fuel delivery to the engine, and the LCD display displays signals and warning messages to the driver.

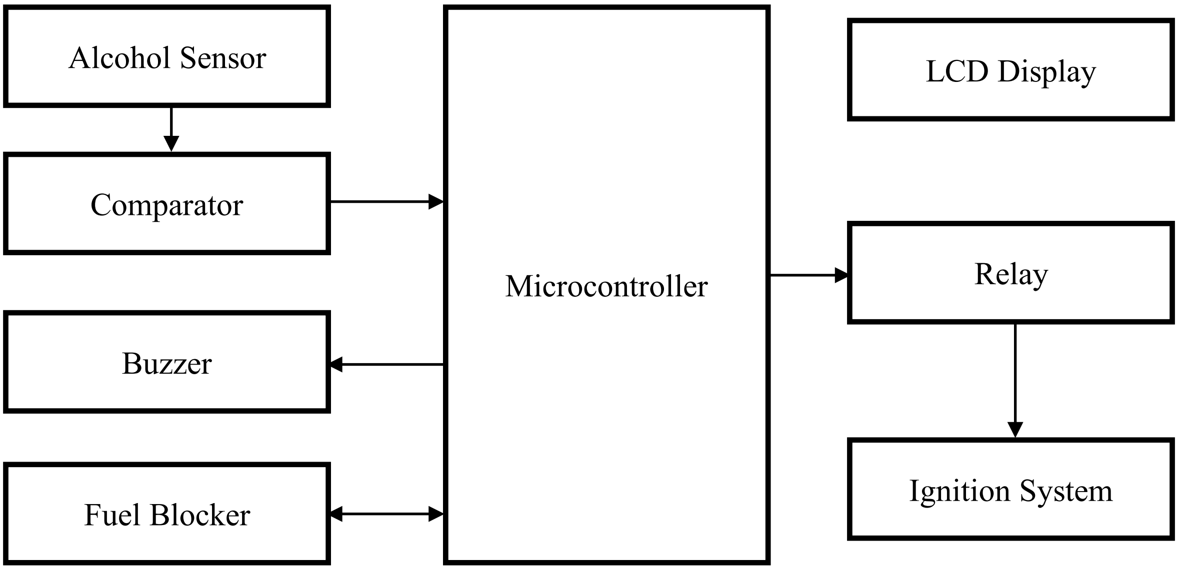


Figure 2.6 Block diagram of alcohol detection and Engine locking with fuel blocker

According to the report, installing the proposed system in automobiles can lead to safer journeys, fewer injuries during accidents, and a lower accident rate due to drunk driving. The system's capacity to detect alcohol on the driver's breath and halt the ignition or cut off fuel supply seeks to reduce drunk driving incidents.

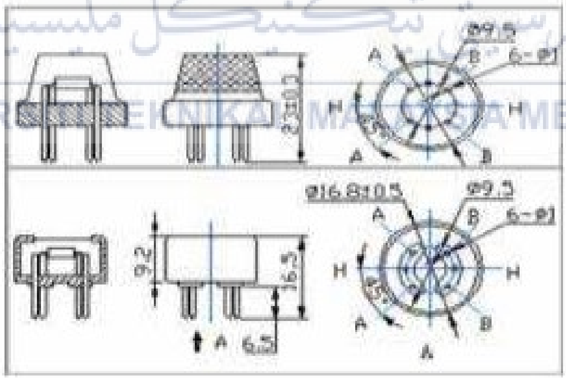


Figure 2.7 Overview of MQ-3 sensor

Although the literature review offers an overview of the suggested alcohol detection and motor locking system, it is crucial to highlight that to obtain a deeper understanding of the topic, a more extensive assessment of existing literature and research in this field should be done.

2.7 Summary of Article 4

A car accident prevention system incorporated with an alcohol detector is discussed by M.H Mohamad et al. (2013). The goal of this approach is to prevent traffic accidents related by drinking and driving. The project combines an alcohol sensor (MQ-3) with a microcontroller to detect the presence of alcohol in human breath. It also has an ignition mechanism that is controlled by the level of blood alcohol content (BAC) detected by the alcohol sensor.

The analysis emphasises the rise in traffic accidents in Malaysia as a result of variables such as population expansion and higher living standards. Driving under the influence of alcohol is a major contributor to these collisions. The review cites data from the Malaysian Institute of Road Safety Research (MIROS) that show a considerable percentage of accidents and deaths are caused by drunk drivers.

The suggested system incorporates many components to overcome this issue. The MQ-3 alcohol sensor detects alcohol in human breath and transmits the information to a microprocessor (PIC 16F876A). An LCD display reveals the driver's level of drunkenness, and an alarm system warns the driver and others close. If a particular BAC level is detected, the ignition system is designed to disable the vehicle's engine.

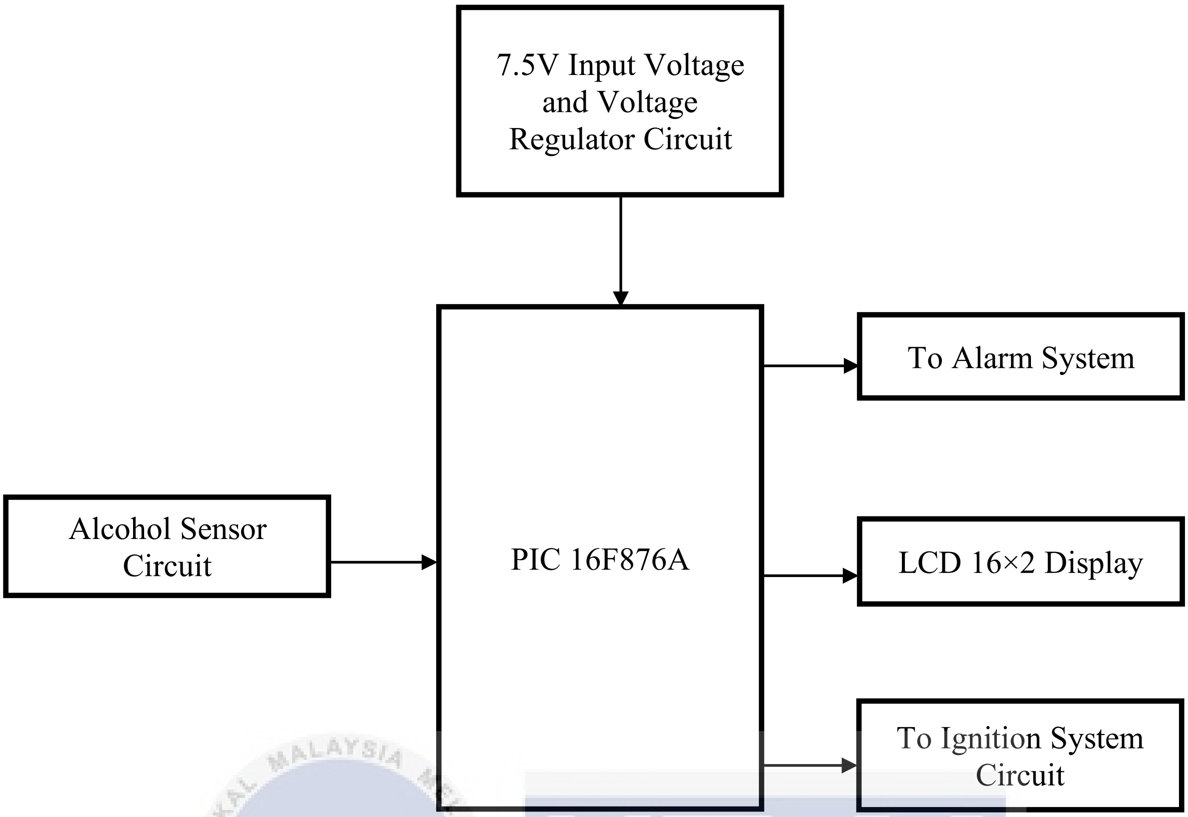


Figure 2.8Block diagram of the system

The system's hardware development entails designing the circuit and printed circuit board (PCB). The software development process is focused on simulating the circuit and designing the code that will be incorporated in the hardware. PIC C Compiler is used to write instructions, while PIC Kit 2 Programmer is used to load the programme into the microcontroller.

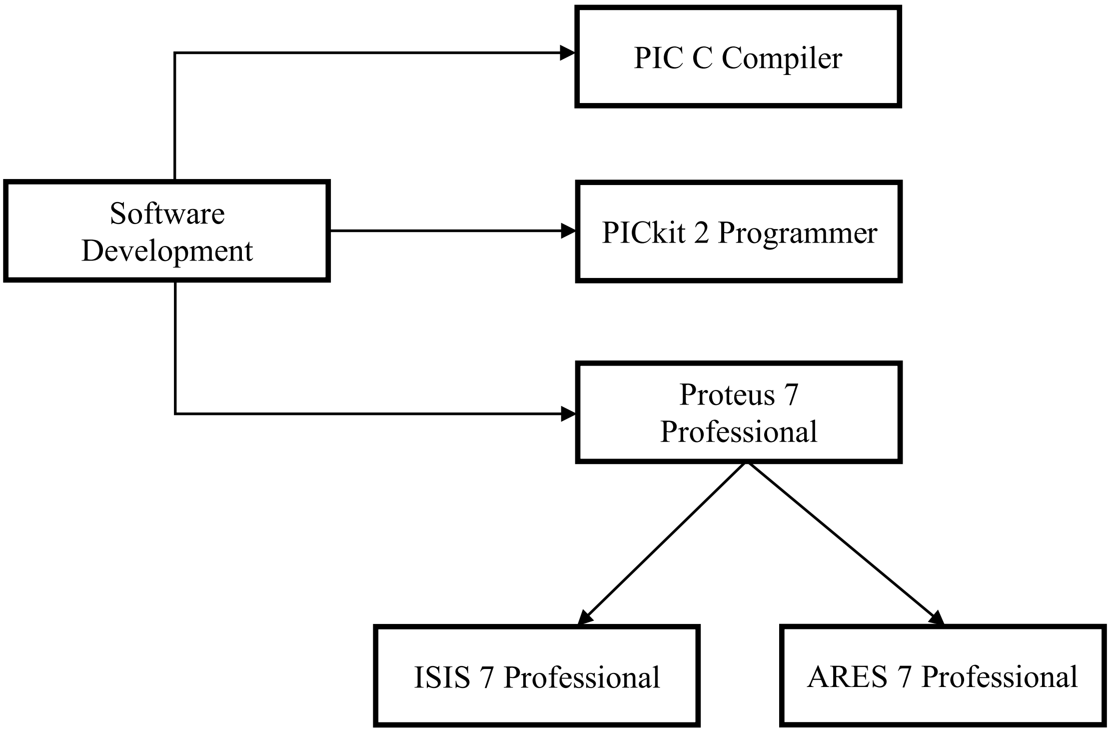


Figure 2.9 Software development

The experimental part explains the system prototype's construction, which contains the PIC 16F876A microcontroller, an alcohol sensor circuit, an alarm system, an LCD display, and an ignition system. The flowchart of the system depicts the response based on the voltage output of the alcohol sensor. The approach divides BAC values into three categories: intoxication, mildly intoxicated, and drunkenness.

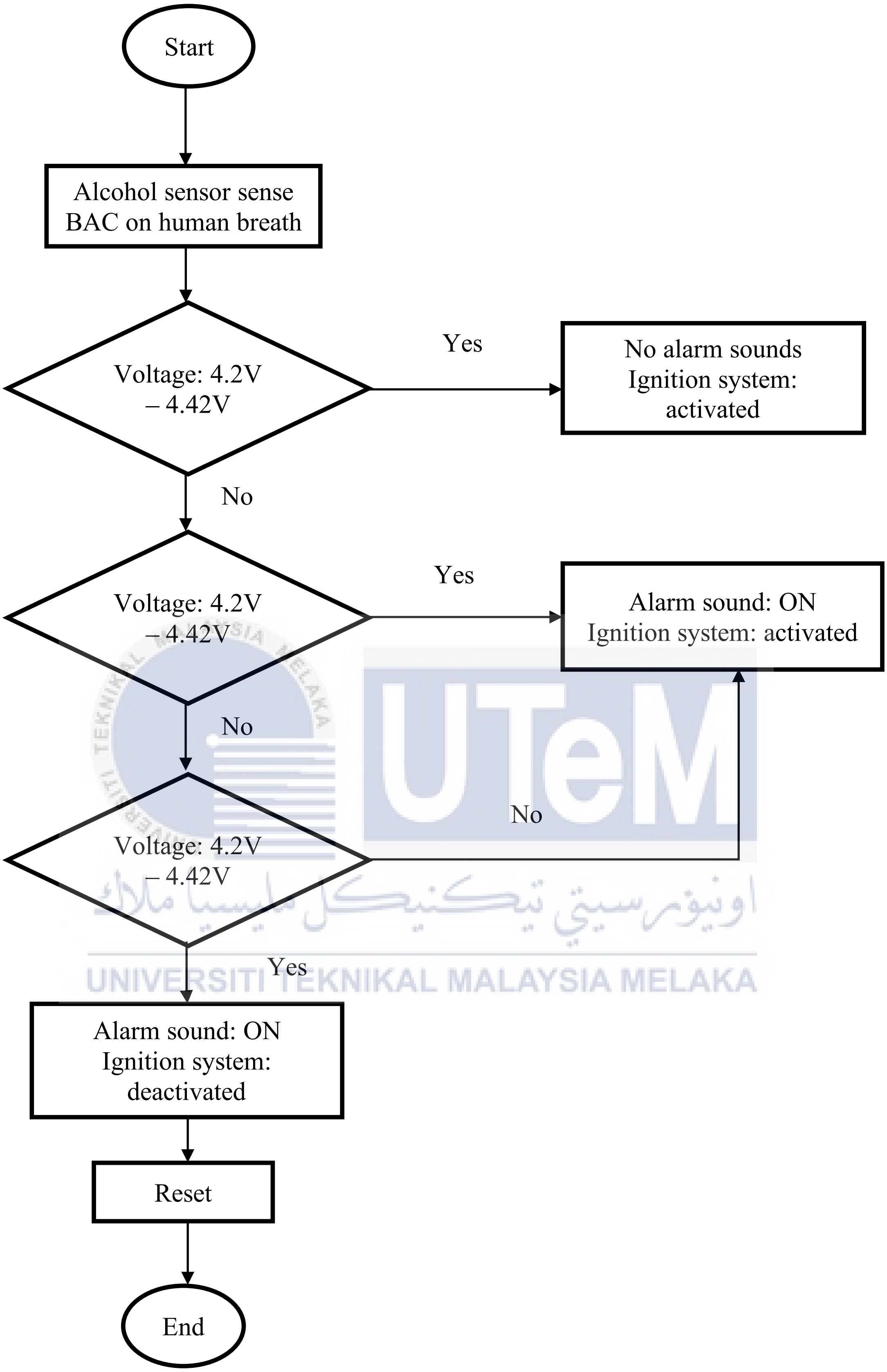


Figure 2.10 Flowchart of the system

Figure 2.11 Prototype overview

The findings and discussion section displays the obtained results for various levels of intoxication based on the ppm (parts per million) values observed by the alcohol sensor. Based on the BAC level, the system successfully displays the related conditions on the LCD display, triggers the alarm system, and enables or disables the ignition system.

Table 2.3 Result achieved in different level of drunkenness in ppm

Output	Level of Drunkenness		
	130 ppm - 260 ppm	261 ppm - 390 ppm	391 ppm - 650 ppm
LCD Display	“intoxication”	“slightly drunk”	“drunkenness”
Buzzer	Off	On	On
Ignition System	enable	enable	disable

To summarise, the vehicle accident prevention system equipped with an alcohol detector provides an effective answer to the problem of drunk driving. The technology cautions the driver, warns others nearby, and ultimately prevents very drunk drivers from starting the vehicle's engine, lowering the likelihood of an accident.

Table 2.4 Comparison of previous research for detecting alcohol

Ref. No	Operation of the System	Microcontroller and sensor	Ignition System
6	The system detects the presence of alcohol using a microcontroller and a sensor and utilizes IOT components to notify officers of the intoxicated driver's present location. The system also displays notifications when the alcohol level is high or low.	ATMEGA 2560 of Arduino Mega as controller and use sensor MQ-2 first and then change to MQ-3 sensor for better detection.	Turn off the ignition system when the prescribed limit is more than 400 ppm.
7	The MQ-3 sensor analyses the presence of alcohol in the environment. If the alcohol concentration is high, the sensor will send the reading to Arduino, and the DC motor, which represents the car's engine, will stop. The location will be sent to the civil forces for action using the notification system.	Arduino Uno as microcontroller, MQ-3 sensor as sensor for the detection system.	Turn off the DC motor when the reading of alcohol is greater than the threshold level.

8	Microprocessor and MQ-3 sensor used to detect alcohol level in the vehicle. If alcohol is discovered, the system shuts down the engine and adds function like vehicle monitoring and decreased fuel delivery.	AT89S51 as microcontroller and MQ-3 sensor for the alcohol detection.	When alcohol is detected, the system turns off the engine, monitors the car, and reduces fuel delivery.
9	The system combines a microcontroller and a MQ-3 sensor to detect alcohol in the driver's breath. It contains an ignition mechanism that been controlled by the detected blood alcohol content (BAC). When alcohol is detected, the system will warn the driver and disable the engine at certain BAC levels.	PIC 16F876A act as microcontroller and MQ-3 sensor to detect alcohol level in surrounding.	Detects alcohol in human breath, shows the driver's level of intoxication, alerts the driver and others, and turns off the vehicle's engine if a specific blood alcohol content (BAC) level is discovered.

2.8 Research Gap

Drunk driving seems to be the leading cause of accidents, injuries, and fatalities on the road. Excessive alcohol consumption blocks a driver's ability to operate a car safely, increasing the chance of an accident. Acknowledging the severity of the situation, governments have implemented harsher laws and regulations to discourage and prevent drunk driving incidences. As a result, researchers have investigated the development of alcohol detecting devices for vehicles in order to improve safety measures. However, there are significant research gaps in this subject that require further exploration and innovation.

While the studies described above offer alcohol detection devices for vehicles, there is a need for more study on real-time monitoring of alcohol levels while driving. Existing research focuses mostly on detecting alcohol in the driver's breath and acting, such as locking the vehicle or shutting off the fuel supply. However, there is a lack of attention to continuous, real-time alcohol monitoring during the whole journey. Researchers can get useful insights on the driver's impairment and intervene proactively by using technologies that enable continuous monitoring, such as wearables or sensors integrated in the vehicle's interior.

In addition, while present research relies on alcohol sensors, microcontrollers, and basic display systems, modern technologies have the potential to improve the accuracy and effectiveness of alcohol detection systems. The application of intelligent technology, machine learning, or data analysis may provide opportunities for greater detail alcohol level and pattern analysis. These technologies have the potential to increase detection accuracy, offer specific boundaries based on individual driver characteristics, and enable rapid responses.

The next research gap is driver-specific customization. Individual alcohol tolerance levels and reactions to alcohol use are likely to differ from driver to driver. As a result, it is critical to create systems that can be personalised to specific driver profiles. Weight, gender, metabolism, and personal traits should all be considered when establishing personalised criteria for alcohol detection and intervention. It is possible to provide more accurate and effective monitoring by adapting the system to the individual demands and features of each driver.

Furthermore, another research gap that we face is user acceptability and behaviour change. Investigating drivers' attitudes, beliefs, and behaviours regarding alcohol detecting technologies. Understanding how drivers view these technologies, their acceptability levels, and any behaviour changes they may cause can provide significant insights into their effectiveness and identify any obstacles to their acceptance.

Finally, the research gap is the implications for ethics and law. Installing alcohol detecting devices in vehicles creates ethical and legal concerns. It is critical to investigate the potential consequences of these systems, including as privacy, consent, reliability, and the legal implications for drivers. Understanding and addressing these concerns is critical for successful alcohol detection system implementation and acceptance. To effectively move through these ethical and legal obstacles, research should focus on constructing strong privacy frameworks, assuring transparency, and setting legal rules.

In conclusion, , to minimize the gap in this research, an approach is made to fulfil at least one of the gaps, which is to tackling the user acceptability and behaviour change. User will have option to notify a person abouts its location when their alcohol level is high. Some of the user may not prefer to tell their family about their drunk condition, thats why the Blynk apps will notify and sent location to other devices. Numerous research gaps must be filled in order to develop alcohol detection systems for vehicles. Researchers can promote advancement in this field by focusing on real-time monitoring, integrating advanced technology, applying driver-specific modification, evaluating system effectiveness, and considering ethical and legal consequences. These initiatives are going to assist in developing effective, dependable, and socially acceptable alcohol detection devices that will improve vehicle safety, reduce drunk driving incidences, and ultimately save lives on the road. Constant research and collaboration among academics, business, and regulators is critical to meeting these objectives in order to create a safer driving environment for everybody.

2.9 Summary

Excessive alcohol consumption is among the leading causes of traffic accidents and fatalities. To address this issue, the Malaysian government enforced tighter laws, including lowering the legally allowed maximum of alcohol consumption. Several experiments have been undertaken in order to develop alcohol detecting devices for vehicles. Certain research suggests a device that detects alcohol intake and immediately shuts down the engine using a microcontroller and a MQ3 alcohol sensor. Other research has concentrated on combining alcohol sensors with microprocessors, LCD screens, and alarm systems to alert the driver and prevent ignition. However, there are several research gaps in this topic. Existing research does not include continuous, real-time alcohol monitoring throughout the journey, and there is an opportunity for improvement by incorporating intelligent technologies and machine learning for more accurate identification. It is also critical to customise the system to driver characteristics. More study is required to assess the acceptance and behaviour change of the user, as well as to address ethical and legal concerns. Alcohol detection systems can be enhanced by solving research gaps in order to improve vehicle safety, minimise drunk driving occurrences and save lives on the road.

CHAPTER 3

METHODOLOGY

3.1 Introduction

In general, there are too many conflicting requirements in this topic to create a complete or perfect mechanism to reduce drunk driving incidents. Some of them are real-time monitoring of alcohol levels while driving, accuracy and effectiveness of alcohol detection systems, driver-specific customization, user acceptance and behaviour change and implications for ethics and law. In order to complete the project, it was determined which type of hardware specification would best suit the mechanisms in terms of power, degree of alcohol, and other parameters for better accuracy in alcohol detection. The specification is described below.

Table 3.1 Specification of hardware and software

Hardware	Software
Arduino uno	Arduino IDE
MQ-3 Alcohol Sensor	Fritzing
Dc Motor	Blynk
LCD	
LED	
Relay	
Node MCU	
GSM Module	
GPS Module	

3.1.1 Block Diagram

Figure below shows the block diagram of the proposed system. Microcontroller used in this project is ATmega328 of Arduino UNO. All the components are embedded to this microcontroller. Alcohol sensor, MQ-3 is the input to the microcontroller because it detects the presence of alcohol in the driver's breath and sends data to the microcontroller for the further action. As seen from the block diagram, LCD, DC motor, Ignition lock are connected to an output from the microcontroller.

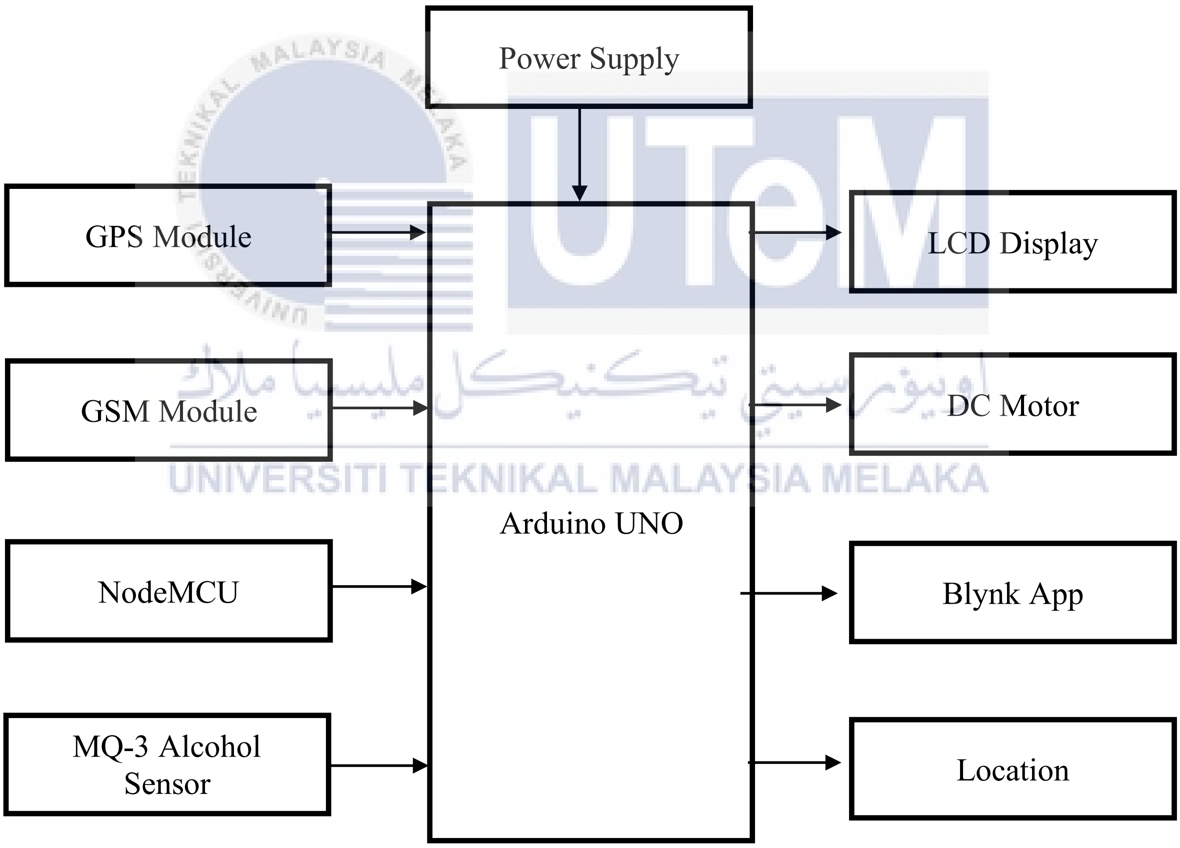


Figure 3.1 Block diagram of the system

3.1.2 Flowchart

There are two possible results from this experiment. Either a low or a high level of alcohol present is detected. If the reading is low, the motor will continue to run normally. As an additional information, the motor represented the driver's car engine. On the other hand, if the sensor detects a high level of alcohol, the motor will shut down on its own using a relay connected to this circuit.

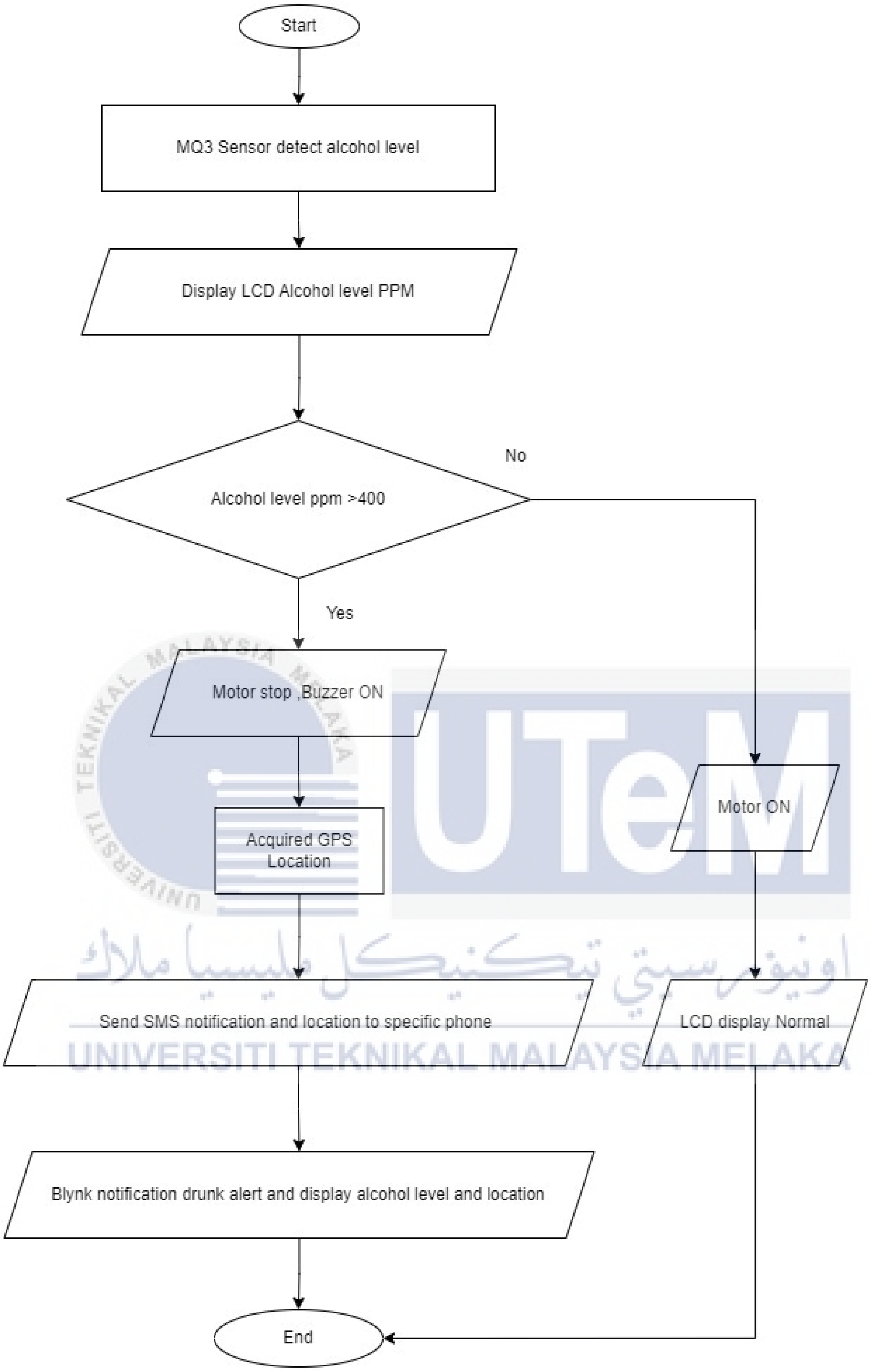
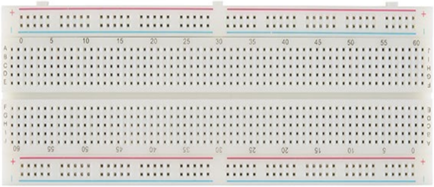
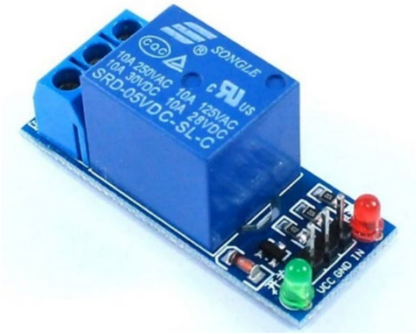
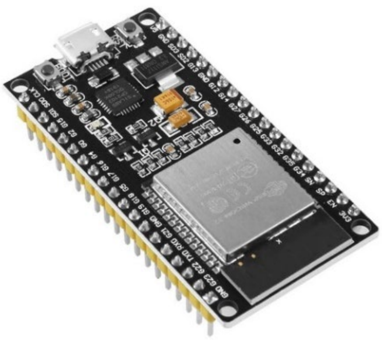


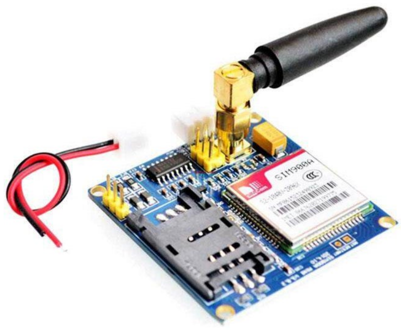
Figure 3.2 Flowchart of the system

3.1.3 Function of Every Components

Table 3.2 List of function for each components used

Component	Function
Breadboard 	Utilize multi-port metal sockets to connect components. The breadboard's conductive sections let electrons to flow between the components you insert into it.
Jumper wire male to male and male to female 	There are three types of jumper wire that are male-to-male, male-to-female and female-to-female. The difference between each is in the end point of the wire. Male ends have a pin protruding and can plug into things, while female ends do not and are used to plug things into.
DC motor 12V 	Converting direct current into mechanical energy otherwise.
ATmega328 Arduino UNO 	Programmes can be loaded into it using the simple Arduino computer software.

Relay  	Providing an easy and effective way of controlling the direction and speed of the rotating motor.
LCD 1602 	To display letters, numerals, and characters and more.
MQ3 Alcohol Sensor Module  	Detecting the amounts of alcohol gas in the air and delivers the reading as an analogue voltage.
Node MCU ESP8266 	open-source firmware and development kit that helps to prototype or build IoT products

GSM Module SIM900A 	allows users to send/receive data over GPRS, send/receive SMS and make/receive voice call
GPS Module Neo 8M 	Global Positioning System module is to receive signals from GPS satellites and provide accurate positioning information
Gear Motor 	Gear motor is to act as tyre system of a car, which will stop and start running on arduino signal.

3.2 Summary

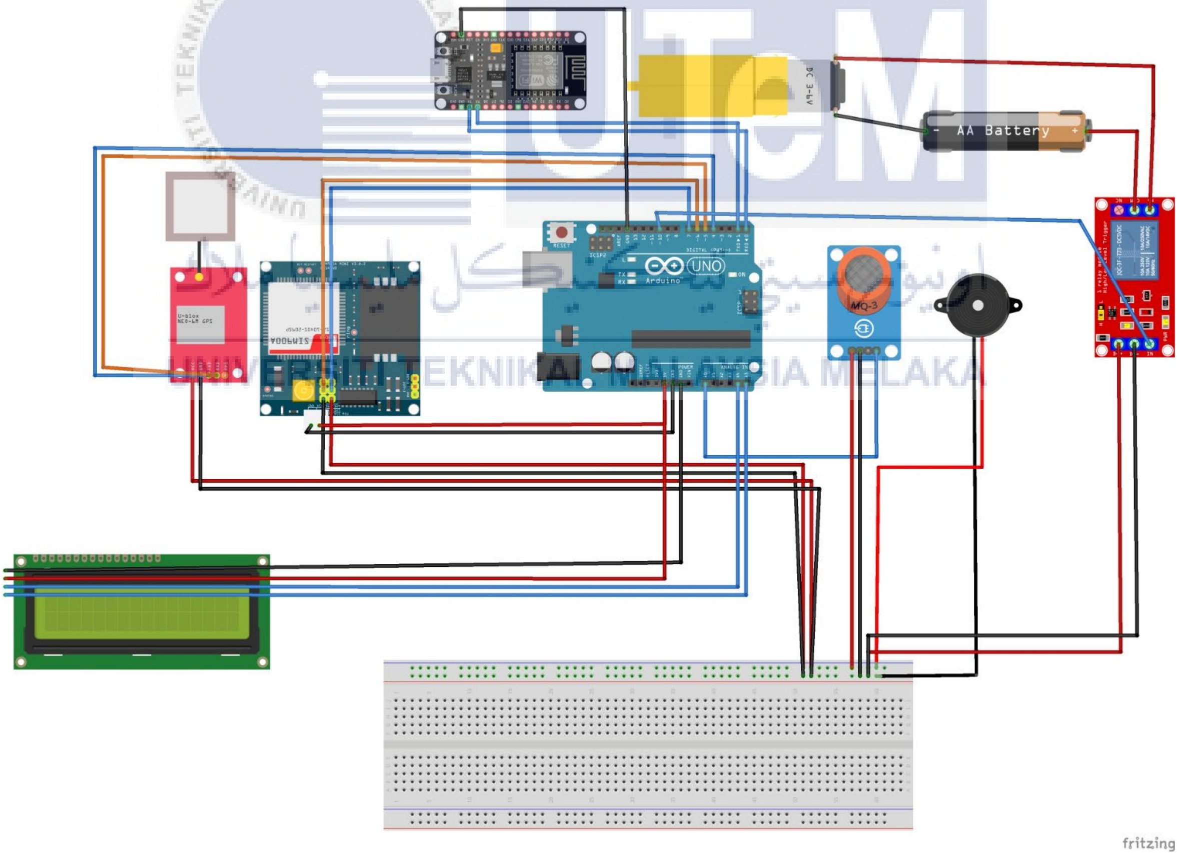
The proposed system utilizes an ATmega328 microcontroller, specifically from the Arduino UNO board. An alcohol sensor, specifically the MQ-3 sensor, provides input to the microcontroller by detecting the presence of alcohol in the driver's breath. The detected data is then transferred to the microcontroller for processing. The block diagram shows the connection of various output devices to the microcontroller, including an LCD display and DC motor. The system will ask for user’s level of BAC following the legal legislation of the particular country. If the alcohol sensor detects a lower level of alcohol that the decided BAC, showing that the driver is not intoxicated, the motor which represent the car engine will continue to operate normally. When the alcohol sensor detects a high level of alcohol, implying that the driver is intoxicated, the microcontroller activates a relay connected to the circuit. This relay will effectively disable the driver's ability to operate the car by shutting down the motor. Then, the GSM Module will detect the driver location and will send the location to relative via the Blynk apps. Overall, this system combines an alcohol sensor, microprocessor and IOT device to monitor alcohol levels in the driver's breath and take immediate action to prevent drunk driving.

CHAPTER 4

RESULT AND DISCUSSION

4.1 SIMULATION

After a lot of discussion and mistake, fritzing was selected to fully utilized full circuit for simulation instead of Proteus 8 Professional which is the initial selection. Figure below shows a complete circuit based on the project which Arduino Uno and NodeMCU as microcontroller that connect to all other components.



4.1 Simulation of system using Fritzing

4.2 CODING

C++ is the computer language used to create a coding to implant into the Arduino UNO. Figure 4.2 present the general C++ coding for MQ-3 alcohol sensor. However, the code needs to be adjusted according to the method suggested.

The code concentrates on receiving information from a MQ3 sensor, calculating alcohol intoxication levels, and activating an LED depending on those levels. It is made for a microcontroller or Arduino board. Specifically, "Sober" indicates the highest value (200) that is regarded sober, while "Drunk" represents the lowest value (400) that is considered intoxicated. The MQ3 sensor is attached to analogue input pin 0, which is marked "MQ3," and the LED is attached to digital pin 6, which is marked "ledPin."

The code initialises the serial communication, sets the LED pin as an output, disables the LED, and adds a 20-second wait for the MQ3 sensor to warm up in the "setup()" method.The "loop()" method contains the main part of the logic. It uses "analogRead()" to read the sensor value and publishes it to the serial monitor. The code then uses the sensor value to determine the person's status. If the value is less than "Slightly Drunk," it considers the person to be sober, if it is between "Slightly Drunk" and "Drunk," it indicates that the person is intoxicated but not yet legally intoxicated and if it is equal to or greater than "Drunk," it designates the person as being legally intoxicated.

Additionally, the code uses "map()" to convert the sensor value from a range of 0 to 1023 to a range of 0 to 255 and puts the outcome in "outputValue." The LED's brightness is managed using Pulse Width Modulation (PWM) if the sensor value is higher than 700 by setting the LED to the "outputValue." On the other side, the LED is switched off if the sensor value is less than or equal to 700.

4.3 MQ-3 Sensor Calibration

Due to the MQ3 is a heater-driven sensor, its calibration could become inaccurate if it is stored for a long duration of time. To achieve the best accuracy, the sensor must be thoroughly warmed up for 24-48 hours after being stored for a long period of time which is more than a month. It will only take 5-10 minutes for the sensor to fully warm up if it has recently been used. The sensor normally reads high during the warm-up phase and progressively reduces until it stabilises.

4.4 Basic Coding Condition

In the Figure 4.3 below, the limit of BAC level is set to 0.08% following the legal BAC level in Malaysia. Firsly, the code asked the BAC level for testing then compare the input to the coding condition stated in the code. If the BacLevel is higher than 0.08%, the code will ask about the push to OFF button. Value 1 represent that push to OFF button is activated while 0 represent otherwise. The engine will stop working if the push to OFF button is deactivated during high level of BAC detected. However, if the push to OFF button is activated during high level of BAC detected will allow the driver to continue their journey safely. Lastly, there will be no change in motor's motion when the detected BAC level is lower than 0.08%. Figure 4.4, figure 4.5 and figure 4.6 display the outputs for each situation that have been mentioned.

```cpp
#include <iostream>
using namespace std;
int main()
{
    float BacLevel;

    cout <<"Enter BAc level: ";
    cin >> BacLevel;


    if(BacLevel >= 0.08)
    {
        int OffButton;
        cout <<"Off button is ON: "; //1=activated,0=deactiavted
        cin >> OffButton;

        if(OffButton == 0)
        {
            cout << "DRUNK! Engine will stop working!!!" <<endl;
        }


        else if (OffButton == 1)
        {
            cout << "You can continue your journey :)" <<endl;
        }

    }   else{
        cout << "Not Drunk" <<endl;
    }
    return 0;
}
```

Figure 3.3 Coding for basic condition

```
Enter BAc level: 0.05
Not Drunk

--------------------------------
Process exited after 4.972 seconds with return value 0
Press any key to continue . . .
```

Figure 4.4 Output for low reading

4.5 RESULT

4.5.1 Testing on different parameter

Types of alcohol	Reading 1 (ppm)	Reading 2 (ppm)	Average
Perfume	530	523	526.5
Hand Sanitizer	610	668	639
Liquor (Direct)	649	661	655
Liquor (Breath)	441	457	449

Table 4.5.1 Table of Alcohol Reading

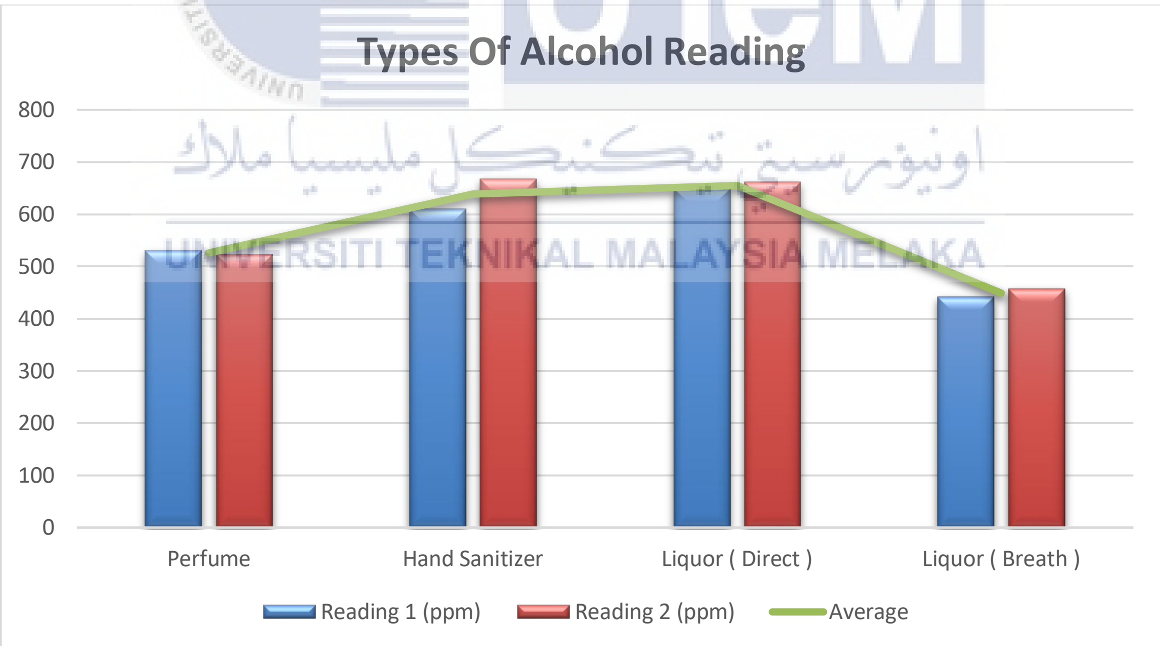


Figure 4.5.1 Bar Chart of Alcohol Reading

The MQ3 alcohol sensor detected 530 ppm and 523 ppm of alcohol vapor in the air when exposed to perfume, indicating the concentration of aromatic compounds in the fragrance.

When tested with the MQ3 alcohol sensor, Hand Sanitizer produced readings of 610 ppm and 668 ppm, suggesting varying concentrations of alcohol vapor and potential adjustments in formulation or potency.

The MQ3 alcohol sensor consistently recorded 1000 ppm for both readings when exposed to beer, indicating a stable concentration of alcohol vapor and other compounds, ensuring the beer's consistent flavor and quality.

4.6 Component Input and Output

Scenario with Reading	**Input**		**Output**	
	MQ3	DC Motor	LCD	SMS
Normal (0-179)	Not Detect	Running	Shown Normal	No
Slightly Drunk (180- 400)	Detect	Running	Shown Slightly Drunk	No
Drunk (401 ++)	Detect	Stop	Shown Drunk	Send

For the first reading, the MQ3 sensor reads a value between 0 and 179, indicating normal conditions. The DC Motor is running, the LCD displays "Normal," and no SMS notification is sent.

When the MQ3 sensor detects a reading between 180 and 400, it indicates a slightly drunk condition. The DC Motor is activated, the LCD displays "Slightly Drunk," and no SMS notification is sent.

If the MQ3 sensor reads a value of 401 or higher, it signifies a drunk condition. The DC Motor is activated, but the LCD displays "Drunk," and the system sends an SMS notification.

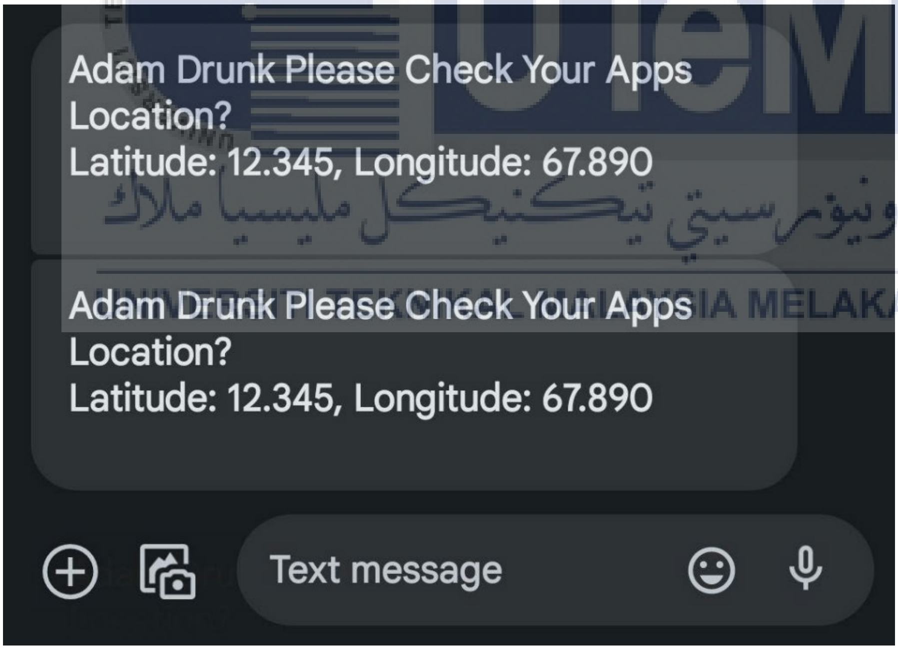


Figure 4.6 SMS sent by GSM Module

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The culmination of this bachelor's degree project, "Direct Current Motor Controller Using Alcohol Sensor with IoT," represents a significant achievement in the realm of applied electronics and Internet of Things (IoT) technology. By integrating an alcohol sensor with a direct current motor controller, the project addresses a critical aspect of safety and control in various industrial and consumer applications. The system's ability to detect alcohol vapor levels, as demonstrated through the MQ3 alcohol sensor, adds a layer of intelligence to the traditional motor control mechanism.

The implementation of IoT technology further elevates the project's impact by enabling remote monitoring and control of the motor system. Through connectivity and data exchange facilitated by the Internet of Things, users can efficiently manage the motor controller and monitor alcohol levels in real-time, fostering enhanced safety protocols and operational efficiency. This innovative integration showcases the adaptability of IoT in industrial scenarios, paving the way for future advancements in smart systems.

The project's significance extends beyond its technical aspects; it reflects the interdisciplinary nature of modern engineering projects, requiring expertise in electronics, sensor technology, and IoT applications. The meticulous design and implementation of the direct current motor controller showcase a deep understanding of control systems and signal processing.

Furthermore, the utilization of an alcohol sensor introduces a layer of preventive safety measures, particularly relevant in environments where alcohol presence can compromise operational safety. The real-world applications of this project extend to industries such as automotive, manufacturing, and security systems, where controlled motor operations and alcohol detection are paramount.

In conclusion, this bachelor's degree project not only represents a successful integration of hardware components but also highlights the potential for innovative solutions in addressing real-world challenges. The project's contributions to safety, efficiency, and remote monitoring underscore its relevance in the contemporary landscape of electronic engineering and IoT applications, providing a solid foundation for future research and practical implementations in related fields.

5.2 Recommendation

Consider expanding the capabilities of the motor controller system by incorporating additional sensors beyond alcohol detection. Integration with sensors for temperature, humidity, or other relevant environmental factors could enhance the system's adaptability to diverse conditions, providing a comprehensive monitoring and control solution.

Next, explore the integration of machine learning algorithms to analyze historical data collected by the IoT-enabled motor controller. By implementing predictive analysis, the system can anticipate trends in alcohol levels and motor behavior, allowing for proactive adjustments and preventive actions. This approach would contribute to a more intelligent and adaptive control system.

Lastly, engage in collaborations with industry partners to conduct real-world testing of the developed direct current motor controller. Collaborative efforts with companies in sectors such as manufacturing, automotive, or security systems can provide valuable insights into the system's performance, usability, and potential for integration into existing industrial setups. This real-world validation will strengthen the project's practical applications and pave the way for future implementations in industrial settings.

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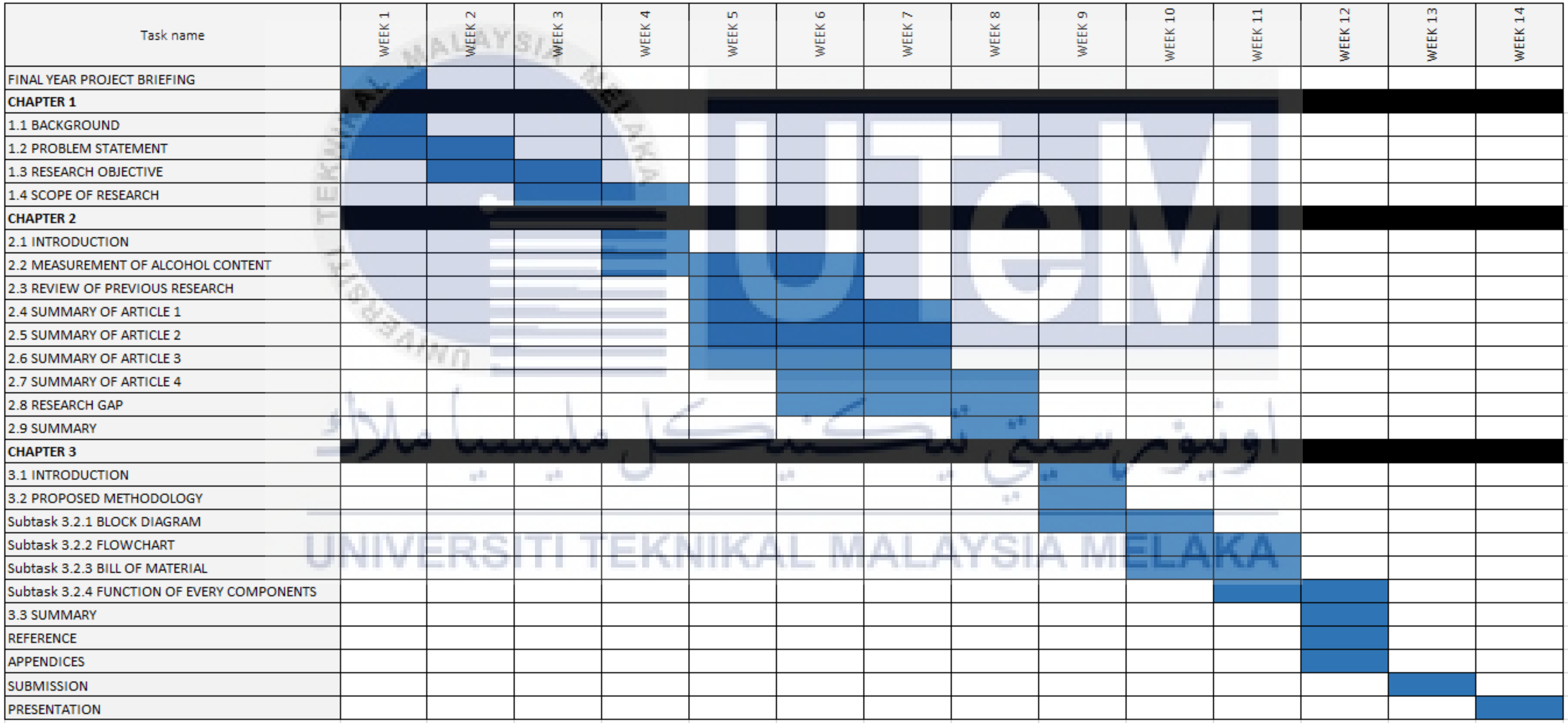
APPENDICES

APPENDIX A Gantchart



APPENDIX B Gantchart PSM2

Task name	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7	WEEK 8	WEEK 9	WEEK 10	WEEK 11	WEEK 12	WEEK 13	WEEK 14
PREPARATIONS														
PURCHASE COMPONENTS														
CONTRUCT SIMULATION														
BUILD THE CODING														
CIRCUIT CONSTRUCTION														
COMPONENTS CONNECTION														
CIRCUIT INSPECTION														
TROUBLESHOOTING														
ADJUSTMENT														
REPORT														
PARTS PER MILLION CONVERSION														
SIMULATION														
CODING														
CALIBRATION														
SCENARIO RESULT														
UPDATE ANY IMPROVEMENT														
APPENDICES														
SUBMISSION														
PRESENTATION														

Appendix C Coding For Components MQ3 Sensor

```
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
#include <SoftwareSerial.h>

LiquidCrystal_I2C lcd(0x27,20,4);

#define normal 180   // Define max value that we consider sober

#define Drunk 400   // Define min value that we consider drunk

#define MQ3 0

#define buzzer 11
#define relay 10
#define interruptPin 2


float sensorValue;
String Location = "";
boolean check = true;
String Message;
char MessageChar[60];


void setup() {
  Serial.begin(9600);
  delay(100);

  lcd.init();
  lcd.backlight();
```

```
#define Sober 200   // Define max value that we consider sober
#define Drunk 400   // Define min value that we consider drunk
#define MQ3 0
#define ledPin 6

float sensorValue;  //variable to store sensor value

void setup() {

  Serial.begin(9600); // sets the serial port to 9600

  pinMode(ledPin, OUTPUT);

  digitalWrite(ledPin, LOW);

  Serial.println("MQ3 Heating Up!");

  delay(20000); // allow the MQ3 to warm up

}

void loop() {

  sensorValue = analogRead(MQ3); // read analog input pin 0

  Serial.print("Sensor Value: ");

  Serial.print(sensorValue);

        // Return analog moisture value

  // Determine the status

  if (sensorValue < Sober) {

    Serial.println("  |  Status: Sober");

  } else if (sensorValue >= Sober && sensorValue < Drunk) {

    Serial.println("  |  Status: Drinking but within legal limits");

  } else {

    Serial.println("  |  Status: DRUNK");

  }

    unsigned int outputValue = map(sensorValue, 0, 1023, 0, 255);

  if (sensorValue > 700){

    analogWrite(ledPin, outputValue); // generate PWM signal

  }

  else{

    digitalWrite(ledPin, LOW);

  }

  return outputValue;

  delay(2000); // wait 2s for next reading

}
```

Appendix D Coding For GSM Module

```
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
#include <SoftwareSerial.h>

LiquidCrystal_I2C lcd(0x27, 20, 4);

SoftwareSerial SIM900A(7, 6);

#define normal 180 // Define max value that we consider sober

#define Drunk 400 // Define min value that we consider drunk

#define MQ3 0

#define buzzer 11
#define relay 10

#define interruptPin 2

#define key 2

float sensorValue;
String Location = "";
boolean check = true;
String Message;
char MessageChar[60];

void SendMessage() {
  Serial.println("Sending Message");
  SIM900A.println("AT+CMGF=1"); // Sets the GSM Module in Text Mode
```

```
delay(1000);
  Serial.println("Message has been sent ->SMS Selesai dikirim");
}

void setup() {
  SIM900A.begin(9600); // setting baudrate gsm module
  Serial.begin(9600); // setting baud rate serial monitor(arduino)
  Serial.println("SIM900A Ready");
  delay(100);

  lcd.init();
  lcd.backlight();

  lcd.begin(16, 2); // initializing LCD
  lcd.setCursor(0, 0);
  lcd.print("Alcohol");
  lcd.setCursor(0, 1);
  lcd.print("Detection");
  delay(3000);
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Press");
  lcd.setCursor(7, 0);
  lcd.print("key....");

  delay(1000);
}

void loop() {
  getSMSGPS();
```

```
}

void getSMSGPS() {
  Serial.println(MessageChar);

  sensorValue = analogRead(MQ3); // read analog input pin 0

  Serial.print("Sensor Value: ");
  float sensorvalue2 = sensorValue - 35;
  Serial.print(sensorvalue2);

  lcd.setCursor(0, 7);
  lcd.print("ppm");

  if (sensorvalue2 < normal) {
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print(sensorvalue2);
    lcd.setCursor(0, 1);
    lcd.print("Normal     ");
    Serial.println("  |  Status: Normal");
    digitalWrite(buzzer, LOW);
    digitalWrite(relay, LOW);
    delay(1000);
  } else if (sensorvalue2 >= normal && sensorvalue2 < Drunk) {
    Serial.println("  |  Status: Drinking but within legal limits");
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print(sensorvalue2);
    lcd.setCursor(0, 1);
lcd.print("Slightly Drunk       ");
    digitalWrite(buzzer, LOW);
    digitalWrite(relay, LOW);
    delay(1000);
  } else {
    Serial.println("  |  Status: DRUNK");
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print(sensorvalue2);
    lcd.setCursor(0, 1);
    lcd.print("DRUNK!    ");
    delay(3000);
    lcd.setCursor(0, 0);
    lcd.print(sensorvalue2);
    lcd.setCursor(0, 1);
    lcd.print("Engine Stop    ");
    digitalWrite(relay, HIGH);
    digitalWrite(buzzer, HIGH);


    SendMessage();
```

Appendix E Coding for NodeMCU

```
/*New blynk app project
   Home Page
*/

//Include the library files
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
#include <TinyGPS++.h>
#include <SoftwareSerial.h>

#define BLYNK_TEMPLATE_ID "TMPL6mhWU6gVb"
#define BLYNK_TEMPLATE_NAME "FirstProject"
#define BLYNK_AUTH_TOKEN "OuXKYVw9m2FV4HkXyUGZcHrwatrNcbId"

//#define BLYNK_AUTH_TOKEN "OuXKYVw9m2FV4HkXyUGZcHrwatrNcbId" //Enter your blynk auth token

char auth[] = "OuXKYVw9m2FV4HkXyUGZcHrwatrNcbId";
char ssid[] = "Flip";//Enter your WIFI name
char pass[] = "12345678910";//Enter your WIFI password

// Set up SoftwareSerial for GPS module
#define RX_PIN 12  // D6 on NodeMCU
#define TX_PIN 13  // D7 on NodeMCU
SoftwareSerial gpsSerial(RX_PIN, TX_PIN);

TinyGPSPlus gps;

//Get the button value
//BLYNK_WRITE(V0) {
```

```
  //digitalWrite(D0, param.asInt());
//}

void setup() {
  Serial.begin(115200);
  gpsSerial.begin(9600);
  Blynk.begin(auth, ssid, pass, "blynk.cloud", 80);
}

void loop() {
  while (gpsSerial.available() > 0) {
    if (gps.encode(gpsSerial.read())) {
      sendLocationToBlynk();
    }
  }
  Blynk.run();
}

void sendLocationToBlynk() {
  if (gps.location.isValid()) {
    float latitude = gps.location.lat();
    float longitude = gps.location.lng();

    Blynk.virtualWrite(V1, latitude, 6);  // V1 for latitude
    Blynk.virtualWrite(V2, longitude, 6); // V2 for longitude

    Serial.print("Latitude: ");
    Serial.println(latitude, 6);
    Serial.print("Longitude: ");
    Serial.println(longitude, 6);
```

Appendix E Table for quantity and cost

NO	COMPONENTS	QUANTITY	COST
1	Bread board	1	RM 5.00
2	Jumper wire male to male and male to female	1	RM 5.00
3	Resistor	1	RM 1.00
4	DC motor 12V	1	RM 20.00
5	ATmega328 Arduino UNO	1	RM 25.00
6	H bridge L298	1	RM 30.00
7	LCD 1602	1	RM 10.00
8	MQ3 Alcohol Sensor Module	1	RM 9.00
9	GPS Module Neo 8m	1	RM 52.00
10	Node MCU ESP8266	1	RM 33.00
11	GSM Module SIM900A	1	RM 30.00