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DEVELOPMENT OF ALCOHOL DETECTION SYSTEM WITH VEHICLE IMMOBILIZATION AND IOT

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2021

DECLARATION

I declare that this project report entitled "DEVELOPMENT OF ALCOHOL DETECTION SYSTEM WITH VEHICLE IMMOBILIZATION AND IOT" is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.



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 project is dedicated to both my parents. My mother, Dayang Saloma Binti Abg Abu Baker who did not only raise and nurture me but also a source of motivation and strength during moments of despair and discouragement. Her motherly care and support have been shown in incredible ways recently. My father, Mohammad Fikri Lai Bin Mohd Fikri has been supporting me in my education and intellectual development by going through blood, sweat and tears over the years.



ABSTRACT

In 1987, the Malaysian government passed the Road Transport Act 1987 where it is considered an offence when a person drink and drive. Through decades of research, it is concluded that drink-drivers have a higher risk of being involved in a traffic accident than non-drinking drivers. Hence the need for prevention of these accidents should be enacted in order to minimize the damaging effects of alcohol to our society. There are several ways drunk driving can be prevented, first is to designate a non-drinking driver, another is to call a taxi or a car-sharing service such as Grab. However, these methods have no way to prevent a drunk person from driving their own vehicle. Therefore, the purpose of this project is to develop an alcohol detection system with vehicle immobilization. The goal of the project is to develop a system based on a microcontroller, to monitor alcohol level in a person's breath, to create a lock mechanism on a vehicle's ignition and to evaluate the effectiveness of the project to prevention of drunk driving. The system utilizes an Arduino Uno as a microcontroller to control the input and output of the system and an alcohol sensor to measure the level of alcohol in a person's breath, moreover, an OLED will display the value of the alcohol level gained from the alcohol sensor then a servo motor is used as an automatic lock on a vehicle's ignition. This project is suitable as a method for recovering alcoholics or a person with a drunk driving offence to prevent themselves from commandeering a vehicle.

ABSTRAK

Pada tahun 1987, kerajaan Malaysia meluluskan Akta Pengangkutan Jalan 1987 di mana ia dianggap sebagai kesalahan ketika seseorang memandu dalam keadaan mabuk. Menurut kajian, didapati bahawa pemandu mabuk mempunyai risiko yang lebih tinggi untuk terlibat dalam kemalangan jalan raya daripada pemandu yang tidak minum mabuk. Oleh itu, pencegahan kemalangan seperti ini harus dikembangkan agar dapat mengurangkan kesan alkohol yang merosakkan masyarakat kita. Terdapat beberapa cara untuk mencegah daripada berlakunya pemanduan dalam keadaan mabuk, pertama adalah menetapkan seorang pemandu yang tidak minum minuman beralkohol, terdapat juga cara menghubungi teksi atau perkhidmatan e-hailing seperti Grab. Walau bagaimanapun, kaedah-kaedah tersebut tidak mempunyai cara untuk mencegah orang yang mabuk untuk memandu kenderaan mereka sendiri. Oleh itu, tujuan projek ini adalah untuk mengembangkan sebuah sistem pengesanan alkohol dengan penghalang pergerakan kenderaan. Matlamat projek ini adalah untuk mengembangkan sistem berdasarkan mikrokontroler, memantau tahap alkohol dalam nafas seseorang, membuat mekanisme kunci daripada motor servo pada penyalaan kenderaan dan menganalisis keberkesanan projek ini untuk mencegah pemanduan dalam keadaan mabuk. Sistem ini menggunakan Arduino UNO sebagai mikrokontroler untuk mengawal input dan output sistem dan sensor alkohol untuk mengukur tahap alkohol dalam nafas seseorang, lebih-lebih lagi, OLED menunjukkan nilai tahap alkohol yang diperoleh dari sensor alkohol dan motor servo digunakan sebagai kunci automatik pada pencucuhan kenderaan. Projek ini sesuai sebagai kaedah untuk memulihkan orang yang mempunyai masalah alkoholik atau kepada orang yang mempunyai sejarah jenayah pemandu mabuk.

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اونيۈم سيتي تيڪنيڪل مليسيا ملاك UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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LIST OF SYMBOLS

Water pressure Flow rate МРа -





LIST OF ABBREVIATIONS

BAC	-	Blood Alcohol Content
OLED	-	Organic Light-Emitting Diode
V	-	Voltage
PIC	-	Programmable Interface Controllers
MCU	-	Microcontroller Unit
EML	-	Emitting Layer
HTL	-	Hole-Transporting Layer
ETL	-	Electron-Transporting Layer
HIL	-	Hole-Injection Layer
EIL	-	Electron-Injection Layer
LCD	-	Liquid Crystal Display



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CHAPTER 1

INTRODUCTION

1.1 Background

Alcohol when consumed can wreak havoc in the human body, rendering them incapable of making rational decisions and when combined with the act of driving a vehicle could not only cause harm to the consumer but also to surrounding people ultimately causing injury and worst case is death. Blood Alcohol Content (BAC) is a measure of alcohol content in a person's blood, as the level of BAC rises, the worse the effect of alcohol inflicts on a person. In Malaysia, the prescribe limit of alcohol is 35 micrograms of alcohol in 100 millilitres of breath according to Section 45G of the Road Transport Act 1987.

There are several preventive measures to this problem which include enacting higher penalties for drink-drive offences, licence suspension or revocation and use of designated drivers. However, the vulnerability through these methods is that the penalties are enforced in hopes of people might think twice before committing the act itself but in the case of a person under the heavy influence of alcohol, rational thinking is out of the question. While for the use of designated non-drinking drivers, this is a reliable way of having a safe transport following a drinking event where one person in a group will abstain from drinking and provide safe transport for others and there is also ride service such as Grab available. The downside of this method is it is vulnerable to human error such as the designated driver might be prone to drinking as well.

Thus, to mitigate the problem of drinking and driving, this project is proposed to overcome this issue by developing a system where a person must blow through a water flow sensor to an alcohol detecting sensor to get an estimated reading of BAC to unlock a vehicle's ignition. The central controlling mechanism in this project is the Arduino UNO where it monitors and controls every input and output sent to it. An MQ-3 gas sensor is used in this project to detect the presence of alcohol, it suitable for this project as it has a range of 25 until 500 ppm and sensitive to alcohol presence in the air. Then, as the locking mechanism on the vehicle's ignition, this project will be using the SG90 Metal Gear Servo. An Organic

Light-Emitting Diode (OLED) is also used to display the value of BAC picked up by the MQ-3 gas sensor and the status of the servo motor position.

1.2 Problem Statement

Transport accidents has been a major contributor to deaths in Malaysia since the year 2006. Drinking and driving adds to the fatality rate of not only to drivers but also to pedestrians. Depending on how much alcohol is ingested, the acute effects on the brain are either depressing or relaxing. In any case, alcohol causes impairment, which raises the risk of a crash by impairing judgement, increasing response time, lowering attention, and lowering visual acuity. Alcohol lowers blood pressure and depresses consciousness and respiration on a physiological level. Alcohol is both an analgesic and a general anaesthetic. Even at low blood alcohol concentrations, alcohol can affect judgement and increase the likelihood of a crash. Drivers who have consumed alcohol have a much greater risk of being involved in accidents than those who have not consumed alcohol, and this risk increases exponentially as blood alcohol content rises. Hence this project aims to detect the presence of alcohol in a person's breath to prevent the usage of a vehicle by an intoxicated person to preserve the safety of the driver and the surrounding people.

1.3 Project Objective مليس Project Objective

The objectives of this project are: AL MALAYSIA MELAKA

- a) To design an alcohol detection system with vehicle ignition locking capabilities based on the microcontroller Arduino UNO and NodeMCU.
- b) To develop a system capable of measuring blood alcohol content using MQ-3 gas sensor and vehicle tracking.
- c) To evaluate the effectiveness of the alcohol detection system to drink-drive prevention.

1.4 Scope of Project

The aim of this project's scope is to provide information about the features and components that will be used. One of the scopes of the project is to utilize the Arduino Uno microcontroller as the main part of the project where it is used to process the information gained from the sensor and control the components in this project. In addition, a water flow sensor is for detecting the motion of a human blowing through to the MQ-3 gas sensor used in this project to collect the level of alcohol content in the air then sends the information to the Arduino UNO microcontroller to be monitored. Depending on the value of the alcohol detected by the MQ-3 gas sensor, an SG90 Metal Gear Servo act as the moving mechanism for the lock on the ignition of the vehicle. While the OLED is used to display information such as the level of BAC gained from the MQ-3 gas sensor and the status of the lock. Users will also be able to monitor the vehicle in real-time and send notification to the smartphone if the alcohol level is over the permissible limit.

1.5 Project Outline

This report is divided into five chapters. All these chapters are discussed in detail through the course of the project's implementation. The explanation of each chapter in this report is as follows:

Chapter 1 provides an overview of this project which includes a background statement, a problem statement, objectives of the project, scope of the project and a project outline.

Chapter 2 discusses some literatures of past studies. Some journals which are related to this project have been gathered and investigated. Technical details about materials, devices and technologies used, will be studied.

The methods utilized to complete this project is detailed in Chapter 3. The hardware and software are discussed in detail in this chapter. Additionally, materials such as project planning flowchart, block diagram and circuit diagram are also shown in this section.

While in chapter 4, the process of the system development is shown, and the results gained from testing the project components are recorded and compared to observe the impact of the project.

Lastly, chapter 5, concludes this project by revisiting the objectives of this project. The limitations of this project and recommendation for future work will also be highlighted.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter discusses the definition of alcohol in general, the impact of alcohol in the human body, its effect during driving and drunk driving regulations. This chapter also provides a summary of currently available instruments, microcontrollers in general, and alcohol sensor technologies. In addition, several previous associated works, papers, and publications related to this project will also be included.

2.2 Effects of Alcohol on The Human Body

The abuse of alcohol inflicts various harmful effects to the human body, alcohol itself is an organic compound that carries at least one hydroxyl functional group bound to a saturated atom in terms of chemistry. The term alcohol comes from the primary alcohol ethanol (ethyl alcohol). This compound is the main ingredient found in alcoholic beverages hence the name. Table 2.1 summarizes the various predictable effects of alcohol during driving on different concentration measured in Blood Alcohol Content (BAC) [1].

Blood Alcohol Concentration (BAC)*	• Effects	Predictable effects on driving
.02% Approximately equal to two alcoholic beverages	 Impairment of judgement, relaxation small increase in body temperature changed mood 	 Impairment of visual functions Decreased capacity to do two activities concurrently
.05% Equivalent to three alcoholic beverages	 Exaggerated behavior Possible loss of small-muscle control (e.g., focusing your eyes) Impairment of judgement Usually, a pleasantsensation Decreased attentiveness Inhibition release 	 Impairment of coordination. Impairment in tracking moving objects. Steering difficulty Decreased response time in emergency driving circumstances
.08% Approximately equal to four alcoholic beverages	 Muscle coordination deteriorates (e.g., balance, speech, vision, reaction time, and hearing) Difficulty in detecting danger. Impairment of judgement, self- control, logic, and memory 	 Impairment of concentration Impairment of short-term memory Impairment of speed control Impairment of information processing abilities (e.g., signal detection, visual search)
.10% The equivalent of five alcoholic beverages	 Significant decline in reaction speed and control Slurred speech, impaired coordination, and sluggish thinking 	• Reduced ability to maintain proper lane position and apply the brakes when necessary
.15% Equivalent to seven alcoholic beverages	• Significantly less muscular control than normal (unless this level is reached slowly, or a person has developed a tolerance for alcohol)	• Significant impairment in vehicle control, concentration on the driving task, and processing of important visual and aural information

Table 2.1: Concentration of Alcohol and Effects on Driving

Alcohol (ethanol) is a chemical whereby it is a thin, water-soluble molecule that absorbs slowly in the liver, absorbs faster in the small intestine, and is widely spread throughout the body. Since alcohol is absorbed in the body's water, most tissues, including the heart, brain, and muscles, are subjected to the same concentration of alcohol as the blood. The liver is an exception since blood is delivered directly from the stomach and small bowel through the portal vein [2].

2.2.1 Laws and Regulations on Drunk Driving

Different jurisdictions have different standards for what constitutes a legal alcohol intake before driving. Where the alcohol concentration of a person's breath, blood, or urine crosses the permissible amount under the Road Transport Act 1987, it is illegal to drive a vehicle in Malaysia. This crime is generally referred to as "drunk driving," "drunk driving," or "driving while intoxicated." An individual who causes the death or disability of another person when driving a vehicle while under the influence of alcohol to the degree that they are incapable of maintaining proper control of the vehicle, or has an alcohol concentration in their saliva, blood, or urine that exceeds the permissible limit, commits an offence under Section 44 of the Road Transport Act 1987.

Under Section 45G of the Road Transport Act 1987, the prescribed limit for alcohol is 35 micrograms per 100 millilitres of breath; 80 milligrams per 100 millilitres of blood; or 107 milligrams per 100 millilitres of urine. If a person is detained by appropriate authorities and determined to be more than the authorised alcohol limit, the penalty is as specified in table 2.2 [3].

Offence	Penalty	
Section 44 Offence (Causing Death/Injury)	• Three to ten years in prison and a fine of between RM8,000 and RM20,000.	
	• For a period of not less than five years from the date of conviction, you are prohibited from possessing or getting a driver's licence.	
	If convicted again, shall be permanently barred from possessing or acquiring a driver's licence for a period of ten years from the date of conviction.	
Section 45A Offence	• Imprisonment for a maximum of 12 months and a fine ranging from RM1,000 to RM6,000.	
ANA TEKNIN	If convicted again subsequently,	
Seannin .	• A period of imprisonment of no more than two years and a fine of between RM2 000 and RM10 000.	
ليكل مليسيا ملاك	اوييوهر سيتي نيك	
UNIVERSITI TEKNIKAL	• For a period of not less than 12 months from the date of conviction, you are prohibited from possessing or getting a	
	driver's license.	

Table 2.2: Penalty for Drunk Driving Conviction

To obtain a sample of a breath test, a police officer or other appropriate authority will demand a person to provide a sample of his or her breath by breathing into a breath analyser. The breath analyser will produce an approximation of the amount of alcohol in a person's blood (BAC). If his or her blood alcohol level exceeds the legal limit of 80 milligrams of alcohol per 100 millilitres of blood, he or she will be prosecuted with drunk driving.

2.3 Overview of Existing Project System

This section will look at how past project implementations have been extended to this project framework. A wide range of experts have worked to identify the most effective techniques for optimising the use of alcohol detector systems.

2.3.1 Alcohol Detection System

This system was developed to detect alcohol with MQ-3 gas sensor when a driver starts an ignition within a vehicle equipped with this system, the gas sensor will measure the Blood Alcohol Content in the driver's breath and switches off the car with a relay if the driver's breath is above the permissible level of alcohol and a buzzer will sound. This project consists of components such as PIC16F877A, relay, buzzer, and MQ-3 gas sensor [4].

By comparing the existing project with the current project, the main difference is the microcontroller itself. The existing project uses PIC16F877A while the current project uses Arduino UNO, the usage of PIC is complicated when compared to newer types of microcontrollers which can be more easily set up. PIC requires an external programmer device to upload codes into the PIC and the pins are prone to damage, but Arduino is not only robust and only require a personal computer with Arduino IDE installed and a USB cable. In short, the newer type of microcontroller is more feasible to use as it is more flexible and user-friendly.

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2.3.2 Detection of Volatile Compounds Emitted by Bacteria in Wounds Using Gas Sensors

In this project, several type of gas sensor were utilised to detect the presence of bacteria in infected wounds. Chemicals such as ammonia, alcohol, carbon dioxide and acetone needed to be sensed by the sensors to determine the validity of this system to detect said chemicals in infected wounds. The aim of this project is to provide a low-cost alternative of determining an infected wound compared to the method of sending samples to a laboratory for testing which is more time-consuming and costly [5].

The purpose of the MQ-3 sensor in this project is the same as the Alcohol Detection System which is to detect the presence of alcohol. This project affirms the effectiveness of the MQ-3 sensor capability of sensing the presence of alcohol, even though the amount of alcohol emitted by the bacteria is miniscule, the MQ-3 sensor can sense the presence of alcohol at 5mm away.

2.3.3 Alcohol Detection based Engine Locking System using MQ-3 Sensor

This paper describes utilizing an ATmega8 microcontroller and a MQ-3 alcohol sensor for alcohol detection and engine locking. The driver's conditions were recorded in real time and the alcohol level was detected using an alcohol sensor connected to a microcontroller. When the alcohol level exceeds a permissible limit, the vehicle engine system is turned off and the GPS module records the vehicle's current location, which is then sent to preregistered phone numbers via the GSM module [6].

This project implements the usage of a GPS module to track the location of the vehicle in which the system is installed, and a message will be relayed with the use of GSM module. The controlling component in this project is the Atmega8 microcontroller and the function of the MQ-3 sensor is to detect alcohol which is the same with the current project. A difficulty arises with this project since the alcohol detection procedure occurs when a driver commandeers the vehicle using this technology; this puts the driver in danger, therefore the alcohol detection process should occur prior to the vehicle's ignition.

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2.4 Microcontroller

A microcontroller is a small integrated circuit that controls a single operation in an embedded device. On a single chip, a microcontroller contains a CPU, memory, and input/output (I/O) peripherals. Microcontrollers, also known as embedded controllers or microcontroller units (MCUs), are used in a variety of products, including automobiles, robots, office computers, medical devices, handheld radio transceivers, vending machines, and home appliances. They are basically basic miniature personal computers (PCs) with no sophisticated front-end operating system, programmed to monitor small features of a larger component (OS).

A microcontroller is a computer that is inserted inside a circuit to monitor a single feature. It accomplishes this by decoding data from its I/O peripherals using its central

processor. The microcontroller's transient information is stored in its data memory, where the processor accesses it and uses instructions from its program memory to decipher and apply the incoming data. It then communicates and takes the requisite action using its I/O peripherals. Microcontrollers are used in a variety of applications and computers. Devices also make use of several microcontrollers that collaborate within the system to manage their respective tasks. Commonly used microcontrollers are Arduino, Raspberry Pi and Peripheral Interface Controller or also known as PIC [7].

2.4.1 Arduino

Arduino is a freely available and open-source platform for creating and programming electronic creations. It can accept and transmitting data to and from most computers, as well as sending commands to and from electrical devices via the internet. The board is programmed using an Arduino Uno circuit board and a simplified C++ software programme.

For a variety of reasons, Arduino was widely used in microcontroller programming. As with any microcontroller, an Arduino is a circuit board with a programmable chip. It delivers data from a computer programme to the Arduino microcontroller, which in turn delivers it to a specific circuit or machine with numerous circuits to finish the operation. Arduino is divided into two components: hardware and software. The Arduino board hardware is comprised of numerous components that work together to make it function, but the primary components are the USB connector, which is used to upload programmes to the microcontroller and provides regulated 5V power to the Arduino board. If the USB does not offer enough power to conduct some complex processes that require additional power, an external power supply with a regulated voltage of 9 to 12 volts is utilised to power the board. Additionally, the Arduino Board includes a reset button for resetting the programming uploaded to the board. The microcontroller is the device that receives and transmits data or commands to and from the associated circuit. The Analog, Digital, and Power pins on the sides of the Arduino board are where the Arduino receives and sends commands, as well as supplies power to attached components via the pins. Figure 2.1 below shows the layout of the Arduino UNO.



Figure 2.1: Layout of Arduino

The Arduino IDE compiler is the next step; the Arduino IDE is a collection of programme instructions that direct the hardware on what to do and how to accomplish it. The Arduino IDE (Integrated Development Environment) is composed of three components: the Command Area, which contains menu items such as File, Edit, Sketch, Tools, and Help, as well as icons such as the Verify Icon for software verification, the Upload Icon for programme uploading, the New, Open, and Save buttons, and the Serial Monitor for data transmission between the Arduino and the IDE. The code is typed in the Text Area, where users are instructed to utilise a simplified form of the C++ programming language, sometimes known as a sketch, to write the codes. The Message Window Area is where the IDE displays messages in a black area, most of which are verifications of the written code [8]. Figure 2.2 depicts the Arduino IDE compiler.



2.5 Alcohol Sensing Technology

In recent years, gas sensing technology has been improving constantly and new approaches were made to detect the presence of alcohol in the human body. There are various types of gas sensor available including catalytic combustion, electrochemical, thermal conductive, infrared absorption, paramagnetic, solid electrolyte, and metal oxide semiconductor sensors. However, this project will focus on metal oxide semiconductor.

2.5.1 Metal Oxide Semiconductor Sensor

Metal oxide sensors are ideal for low-cost, low-power applications such disposable medical, smart home, and consumer electronics. Metal oxide sensors detect the concentration of different gases by measuring the resistance change of the metal oxide caused by gas adsorption. The target gases minimise the amount of oxygen on the metal oxide sensor surface, allowing more electrons to enter the metal oxide material's conduction band. This resistance drop is reversible and varies based on the reactivity of the sensing materials, the availability of catalyst materials, and the sensor's working temperature [9]. The figure shown in Figure 2.3 shows the structure of a metal oxide semiconductor sensor.



Figure 2.3: Structure of metal oxide semiconductor sensor

2.6 SG90 Servo Motor

A servo control is one of the most fundamental and widely used components of the control system. Servo instruments allow for the control of powerful devices using signals from devices with considerably lower control. The majority of hobby servo motor operates with a voltage supply from 4.8V to 6.5V, the higher voltage, the higher the torque although usually it operates at +5V which the default supply from the Arduino. Due to their gear arrangement, almost all hobby servo motors can only rotate from 0° to 180° and there is separate servo motor that can turn from 0° to 360° to form a full circle. The gears in the motors are easily worn out, so if the application calls for stronger, longer-running motors, there are ones with metal gear instead of plastic ones [10]. The structure of a servo motor used in this project is shown in Figure 2.4.



Figure 2.4: Structure of a servo motor

2.7 Organic Light-Emitting Diode

Organic light-emitting diodes (OLEDs) are composed of organic stacks placed between the anode and cathode. Due to the injection of electrons and holes from electrodes into organic layers for recombination and light emission, an OLED display is an emissive display. Figure 2.5 illustrates the schematic of OLED where a is the basic structure design and b is the current design of OLEDs. Figure 2.5 shows the schematic of OLED.

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Figure 2.5: Schematic of OLED

The emitting layer (EML) is used to generate light. It is composed of high-quantum efficiency and carrier mobility dopant and host materials. Between the EML and the electrodes, a hole-transporting layer (HTL) and an electron transporting layer (ETL) are sandwiched to transport carriers into the EML for recombination. To promote carrier injection from the conductors to the organic layers, hole- and electron-injection layers (HIL and EIL, respectively) are positioned between the electrodes and the HTL and ETL interfaces. When the OLED is energised, electrons and holes are moved from the cathode and anode to the EML for recombination and the generation of light [11].

2.8 YF-S201B Water Flow Sensor

The water flow sensor is composed of a plastic valve body, a water rotor, and a halleffect sensor. When water flows through the rotor, it rolls, and the rotor's speed varies in proportion to the flow rate. The hall-effect sensor generates the associated pulse signal. This sensor is available in a variety of diameters, water pressure (MPa), and flow rate (L/m) ranges [12]. The Hall Effect is the voltage difference that occurs between a conductor that is perpendicular to the electric current and a conductor that is perpendicular to the magnetic field [13]. This flow metre utilises the Hall Effect by inserting a small fan/propeller-shaped rotor into the path of the flowing liquid. Figure 2.6 illustrates the operation of the water flow sensor.



Figure 2.6: Water flow sensor operation

The liquid presses on the rotor's fins, causing it to spin. The rotor's shaft is coupled to a Hall Effect sensor. It consists of a current-flowing coil and a magnet linked to the rotor's shaft; while the rotor rotates, a voltage/pulse is induced. This flow metre generates approximately 4.5 pulses for every litre of liquid that passes through it every minute. This is because the magnetic field changes because of the magnet linked to the rotor shaft. The pulses were counted using an Arduino and then use a simple conversion calculation to determine the flow rate in litres per hour (L/hr) and total volume in litres [14].

2.9 Summary

Based on the findings of the literature review, the suitable microcontroller for this project would be the Arduino Uno as when compared to the Raspberry Pi, the Arduino Uno is more user-friendly, and the cost of an Arduino is less expensive than the Raspberry Pi. The Arduino is also compatible with the rest of the components such as the MQ-3 metal oxide sensor, the SG90 servo motor and the Liquid Crystal Display.



CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter explains the methodology to produce alcohol detection system with reference to research that have been done in chapter 2 previously. Several illustrations of flowchart and block diagram are used to probe in detail the information on this project. The project is divided into two key components: hardware and software development, both of which will be discussed in this chapter. Figures 3.1 and 3.2 shows the flowchart for the bachelor's degree project and the project development flowchart.



Figure 3.1: Flowchart for Bachelor's Degree Project



3.2 Design of Alcohol Detection System with Vehicle Immobilization

This project will be placed in front of the driver's seat in the vehicle. To use it, the driver will need to blow their breath into the breathalyser which contains the flow sensor and the alcohol sensor to take a reading of the user's estimated breath alcohol content. If the user's breath alcohol content is below the limit permissible by the system, the lock which are located at the vehicle's ignition will then be unlocked thus allowing the driver to insert their vehicle's key into the ignition. The result will be vice versa if the driver's breath alcohol content is over the limit, then the servo will hold its locking position and prevent the driver from inserting their key into the ignition while the vehicle's location will be notified to a guardian's smartphone.

3.2.1 Project Design with Proteus

The circuit diagram for the project was created to verify the viability of the proposed design simulations. We will also be able to test the previously discussed control techniques. Using the Proteus software, a circuit model for the proposed system was simulated as shown in Figure 3.3.



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3.2.2 Development of Alcohol Detection System with Vehicle Immobilization

The project consists of an Arduino Uno as a central hub to control the input and output. The operation of the project starts with a push button to initiate the process and activate the detection system in which a water flow sensor will be blowed through by a human and an MQ-3 alcohol sensor will detect any trace of alcohol then sends a signal to Arduino UNO to be interpreted as a readable data.

Since the signal of the MQ-3 is analogue, the built in Analog to Digital converter in the Arduino will translate the signal to be sent to other components such as the OLED display for the reading of the Blood Alcohol Content to be displayed. If the Blood Alcohol Content exceeds the value permitted by the law, the servo motor which acts as a locking mechanism will lock the vehicle's ignition to immobilize the vehicle. The project block diagram is used to illustrate the system's flow and purpose in Figure 3.4.



To complement the Arduino UNO simulation on Proteus, a source code must be written for the Arduino UNO to properly manage the components, the code is written on Arduino IDE compiler using the C/C++ programming language. The commands written will then be uploaded to Arduino UNO in Proteus simulation or a physical Arduino. The program starts with the push button to allow for the rest of the components to be activated. The MQ-3 Alcohol sensor can detect from a range of 0.05-10mg/L alcohol hence the program is set to allow a permissible level of alcohol or no alcohol presence to be detected before the servo motor can operate to unlock the vehicle ignition. Figure 3.5 shows the flowchart of the program uploaded onto the Arduino.



Figure 3.5: Flowchart of the project programming

3.2.2.2 Arduino UNO

The Arduino UNO is a microcontroller capable of controlling several components and interpreting a variety of signals received from external components. The Arduino UNO's major function in this project is to handle the entire system. The specification of the Arduino UNO is specified on Table 3.1 below.

Microcontroller	ATMega328
Clock Speed	16MHz
Operating Voltage	5V
Maximum supply voltage	20V
Supply voltage	5V-12V
Analog input pins	6
Digital input/output pins	14
DC current per input/output pin	اونوم سنتي تن <mark>طق</mark>
DC current in 3.3V pin	50mA MELAKA
SRAM	2kB
EEPROM	1kB
Flash memory	32kB of which 0.5kB is used by bootloader

Table 3.1: Specification of Arduino UNO

Arduino programme code can be uploaded immediately from a laptop or desktop computer via a USB cable, eliminating the need for any further external devices. It can be powered through USB connection or an external 12V power supply. The main component for the Arduino UNO is the ATMega328 microcontroller which processes any input or output going into the board. Then there are 14 digital and 6 analogue inputs available on the board of the Arduino where components can be easily installed on the input/output ports.

Several other features on incorporated on the Arduino UNO would be the reset button, ICSP header and a 16MHz quartz crystal. Figure 3.6 illustrates the Arduino UNO board layout.



Figure 3.6: Layout of the Arduino Uno



MQ-3 gas sensor is a type of Metal Oxide semiconductor sensor or chemiresistor, then sensing element used in this sensor are Tin Dioxide (SnO2) and Aluminium Oxide (AL2O3). Tin Dioxide is the primary component that is sensitive to alcohol. The ceramic substrate, on the other hand, boosts heating efficiency and ensures that the sensor area is maintained at the operating temperature as the sensor is heat-driven sensor where it requires to be at around 40° Celsius to properly operate. The MQ-3 sensor can detect at concentration of 25 to 500 ppm. Figure 3.7 shows the component MQ-3 sensor.



Figure 3.7: MQ-3 gas sensor

3.2.2.4 128 x 64 Graphic OLED (OLED)

An OLED is a display unit that generates light by transmitting electricity to the organic components interposed between the electrodes. The OLED is driven by a strong single-chip CMOS OLED driver controller SSD1306 that is integrated within the OLED. Multiple communication protocols, including I2C and SPI, are available for use with the microcontroller. SPI is quicker than I2C, but it requires more I/O pins. While I2C only requires two pins and can be shared with other I2C devices, SPI requires four pins. The role of the OLED in this project is to display the value of alcohol concentration detected by the gas sensor and showing the status of the servo motor position. Figure 3.8 illustrates a 128x64 OLED display module.



Figure 3.8: An 128x64 OLED display module

3.2.2.5 SG90 Servo Motor

The term servo refers to a closed loop control system in general. A closed loop system adjusts the motor's speed and direction in response to the feedback signal. It is equipped with a small direct current motor that is coupled to the output shaft through gears. The output shaft is attached to a potentiometer and drives the servo arm that can turn from an angle of 0 to 180 degrees. The signal line can be used to drive a servo motor by transmitting a series of pulses. A typical analogue servo motor anticipates receiving a pulse approximately every 20 milliseconds. The pulse length determines the servo arm rotation. By using the servo motor, a lock can be made by utilising the servo motion to lock or unlock a vehicle's ignition in the case of this project. Figure 3.9 shows a SG90 servo motor.



Figure 3.9: SG90 servo motor

3.2.2.6 YF-S201B Water Flow Sensor

A water flow sensor is made up of three parts: a plastic valve body, a water rotor, and a hall-effect sensor (which measures the flow of water). When water passes through therotor, the rotor begins to roll back and forth. Its speed changes depending on how fast the flow is moving. The hall-effect sensor generates and emits the matching pulse signal. However, in this project, the purpose of this sensor is for a user to blow into the sensor and enable the MQ-3 gas sensor to take a measurement of alcohol in human breath. Figure 3.10 shows the water flow sensor.



Figure 3.10: Water flow sensor

3.2.2.7 NodeMCU V2 ESP8266 Wi-Fi Module

NodeMCU is an open-source firmware and development kit for prototyping and building Internet-of-Things (IoT) products. It comprises firmware that operates on Espressif Systems' ESP8266 Wi-Fi SoC and hardware based on the ESP-12 module. Lua is the scripting language used by the firmware. It was created using the Espressif Non-OS SDK for ESP8266 and is based on the eLua project. Figure 3.11 shows the pin layout of NodeMCU.



Figure 3.11: Pin layout of NodeMCU

3.2.2.8 GY-NEO6MV2 GPS Module

The Global Positioning System (GPS) is a satellite-based navigation system that gives users information about their location and time. Anyone with a GPS receiver and an unobstructed line of sight to at least four GPS satellites can use the system for free. The position of a GPS receiver is calculated by accurately timing the signals sent by GPS satellites. The u-Blox Neo-6M GPS module is used in the GY-NEO6MV2 GPS receiver. This module includes a hot-start battery and an EEPROM. To improve signal reception, an external ceramic antenna is connected to the board via a U.FL connector.

It can function between 3.3 and 5 volts, making it compatible with most 5V Arduino boards such the CT-UNO, Maker-UNO, Arduino-UNO, Mega, Leonardo, and 3.3V controllers like Arduino and Raspberry Pi. Although it is 5V compliant, it requires a level shifter to connect to the serial (UART) line.



Figure 3.12: Pin layout of NodeMCU

3.3 **Project Analysis**

To test the functionality of this project, several methods of experiment will be conducted and observed to determine the feasibility of the system. Firstly, distance between the source of alcohol and the gas sensor would be recorded while the alcohol differs in concentration. This method would prove the effectiveness of the MQ-3 gas sensor. As for components such as the servo motor, water flow sensor and OLED. These components will be connected to the Arduino UNO individually to check for any defectiveness by running simple test codes in the Arduino UNO.

3.4 Summary

This chapter demonstrated the development process for "Development of Alcohol Detection System with Vehicle Immobilization". The project's implementation requires hardware such as an Arduino UNO microcontroller, a MQ-3 Alcohol Gas Sensor, a 128x64 OLED display, NodeMCU, GPS module and a servo motor. The following chapter will discuss the outcomes of this project.

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CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter describes the outcome and provides solutions to the issues that arose during the project's implementation. The testing procedure is used to evaluate and report on the system's performance. This chapter will describe the tabulated results as well as the analysed data.

4.2 Development of Alcohol Detection System with Vehicle Immobilization and IoT

The project consists of components such as Arduino UNO, MQ-3 alcohol sensor, 128x64 OLED display, flow sensor, servo motor, NodeMCU and a gps module. This project is powered by two power sources which are 2 AA battery and a 9V battery connected via a battery holder to the Arduino and NodeMCU respectively. During the assembly of the prototype, safety precautions were taken to ensure accuracy of alcohol reading. For the testing of the MQ-3 alcohol sensor, the sensor was first calibrated with isopropyl pure alcohol to get the maximum value that can be gained from the sensor. The code in the Arduino UNO microcontroller enables the alcohol detection system. Before powering on the power supply, each component must be connected properly. When the result was correct and consistent, the prototype case was fabricated. The final build of the prototype is depicted in Figure 4.1.



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4.2.1 Calibration of MQ-3 Alcohol Sensor

Before any value was taken, the sensor must be warmed up for 24 to 48 hours for maximum accuracy but in this case, 15 minutes was enough for the sensor to idle at a reading of 30 ppm. The value gained from the alcohol sensor is in the unit part-per-million (ppm). Hence Table 4.1 was made as a reference to convert the unit PPM to Blood Alcohol Content (BAC). In an idle state, the alcohol sensor read at around 30 to 40 ppm but when the isopropyl pure alcohol was present in front of the sensor, the sensor read a maximum value of 500 ppm which is in line with the datasheet of the MQ-3 alcohol sensor in appendix C.

mg/l (BrAC)	ppm	µg/l	mg/100ml	%(mg/ml)/promile	%(BAC)
0.05	26	50	10	0.10	0.01
0.10	52	100	20	0.20	0.02
0.20	104	200	40	0.40	0.04
0.25	130	250	50	0.50	0.05
0.30	156	300	60	0.60	0.06
0.40	208	400	80	0.80	0.08
0.50	260	500	100	1.00	0.10
0.60	312	600	120	1.20	0.12
0.70	364	700	- 140 -	1.40	0.14
0.80	INI\416RSI	800	(AL 1604LA)	YSIA 11:60LAKA	0.16
0.90	468	900	180	1.80	0.18
1.00	520	1000	200	2.00	0.20

Table 4.1: Conversion table

4.2.2 Detection of Alcohol Presence

Once the power supply was connected to the microcontroller and powering all the circuit's components, the system began to run. Following that, the OLED display will illuminate to signify that the circuit was completely operational. The sensor was set to 130 ppm for the alcohol content limit which was estimated to be equivalent to 0.05% BAC, in accordance with the drunk driving law in Malaysia where the limit is 0.05% BAC. There were two conditions to test the alcohol sensor capabilities to sense alcohol and there are also

different concentrations of alcohol. The first condition was where the sensor is placed directly above the alcohol substance as shown in Figure 4.2. The second condition was where the sensor placed 3 cm away from alcohol substance as shown in figure 4.3 while the results were tabulated in Table 4.2 and Table 4.3.



Figure 4.3: Sensor is placed 3 cm away from alcohol substance

Initial ppm	Shandy (1%)	Tiger (4.5%)	Soju (13.5%)
	Alcohol Content	Alcohol Content	Alcohol Content
34	66	118	230
36	70	97	222
31	65	114	250
38	69	110	220
34	68	123	240

Table 4.2: Alcohol detection experiment with sensor directly above alcohol substance

 Table 4.3: Alcohol detection experiment with 3cm distance between alcohol and sensor

Initial ppm	Shandy (1%)	Tiger (4.5%)	Soju (13.5%)	
4	Alcohol Content	Alcohol Content	Alcohol Content	
34	42	100	128	
36	39	86	150	
31	40	90	144	
38	*4/wn = 42	82	141	
34 🧯	کے ملتقینا ملا	مرسبة 90	145	
		O. V.	- ,	

As shown in the tables above, as the alcohol content increases, the value of ppm detected by the alcohol sensor also increases. The drink with 1% alcohol content does not exceed the limit of 120 ppm. Hence the servo motor moves from an angle of 0° to 180° to unlock the vehicle's ignition. However, while the reading with above 120 ppm and above was registered as drunk on the Arduino UNO, so the servo motor stayed on a locking angle. Theoretically, alcohol concentrations are directly proportional to MQ-3 alcohol gas sensor ppm reading.

4.3 An Alert IoT system

The IoT system will be triggered when the value of the alcohol concentration detected by the MQ-3 alcohol gas sensor exceeds the permitted limit which is 120 ppm. When the value exceeds the limit, a notification will be sent to a registered guardian to notify the location and the condition of the driver to send help. This is achieved using NodeMCU Wi-Fi module, GPS module and Blynk application. More detail can be observed when the application is opened such as the coordinates of the vehicle and the current alcohol level detected by the sensor. Figure 4.4 illustrates the usage of the application.



Figure 4.4: Blynk application interface and the alert notification when driver is found drunk

4.4 Cost Estimation

Cost estimation is critical for managing and tracking project expenditures in accordance with the project's authorised budget. The total cost of implementing this project is RM 165.29, as shown in Table 4.4.

No	Component	Price per unit	Quantity	Total (RM)	
		(RM)			
1	Flow Sensor YF-S201B	21.50	1	21.50	
2	MQ-3 Alcohol Gas Sensor	6.90	2 13.80		
3 Arduino UNO set		44.90	1	44.90	
4	MG90s Servo Motor	10.90	1	10.90	
5	128x64 OLED Display	14.90	1	14.90	
6	Male to Female Jumper Wire set	9.49		9.49	
7	NodeMCU V2	22.90		22.90	
8	GY-NEO6MV2 GPS	22.90	1	22.90	
	Module	Sis	ىيەم سىت ت	0	
9	PVC Junction Box	4.00	· · · · · · · · ·	4.00	
UNIVERSITI Total (RM)AL MALAYSIA MELA (ARM165.29					

Table 4.4: Components and their pricing

4.5 Summary

The performance of this project's implementation has been discussed. Several experiments and testing procedures have been undertaken to evaluate the alcohol detection system's performance in conjunction with car immobilisation and IoT. The experiment's outcome was satisfactory. In general, the system accomplishes the objectives, and the alcohol detection system for vehicles performed admirably.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The development of this alcohol detection system integrated with vehicle immobilization capability and IoT is a project effort aimed at preventing road accidents caused by drunk driving. According to the Insurance Institute for Highway Safety (IIHS) in the United States, equipping all automobiles with alcohol detection technology has the potential to save over 9,000 lives every year.

5.2 **Project's Objectives**

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The three main objectives of this project were briefly revised in the following sections.

5.2.1 To Design an Alcohol Detection System with Vehicle Ignition Locking Capabilities Based on The Microcontroller Arduino UNO and NodeMCU

This project objective was achieved through the research of previous project works done and a design of this project was made on these studies as a basis. A complete list of the components was then listed and procured, the functions of each component was then identified to complete the design of this project.

5.2.2 To Develop a System Capable of Measuring Blood Alcohol Content using MQ-3 Gas Sensor and Vehicle Tracking

A project design was in mind then the project was developed by assembling the procured components and the components were tested for any defects. After the assembly, the project was observed for additional complementary components then added when necessary, such as the IoT system. In effect, this fulfils the second objective of the project which is to develop this project.

5.2.3 To Evaluate the Effectiveness of the Alcohol Detection System to Drink-Drive Prevention

Lastly, the project was then ran through several experiments and the data gained from the experiment were recorded to evaluate the effectiveness of this project towards preventing drunk driving. The results were gained were satisfactory and further improvements can also be made thus satisfying the last objective of this project.

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5.3 **Project Limitations**

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During the project fabrication process, one of the problems encountered was the inaccuracy of the MQ-3 alcohol gas sensor even with several calibrations had been done. The exact and precise result could not be determined because the measuring value could not be compared to the accuracy of a blood test. The manufacturer also provided a data sheet with lack of data to the specification and usage of the sensor.

5.4 Future Works

There are a few modifications that may be made to improve this project. The following advice is summarised as follows:

- A facial recognition capability would improve the project significantly by having the facial characteristics of the driver be recognized by the system and preventing other people than the driver from taking the breath test.
- ii) By utilising the Printed Circuit Board, the wire system may be decreased. The PCB board design must be precise and conformed to the dimensions of the components. This assists cable management in reducing the number of connected connections and so lowers the cost of wired installation.
- iii) A specially designed casing for the project built by utilising current 3D printing would be beneficial for the project effectiveness to be installed in any vehicle. This would efficiently conserve space for the components used and ultimately make the design be more user-friendly and compact.

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APPENDICES

- Appendix A Datasheet of Arduino Uno
- Appendix B Datasheet of MQ-3 Alcohol Gas Sensor
- Appendix C Project Coding in Arduino UNO
- Appendix D Project Coding in NodeMCU



Appendix A

Datasheet of Arduino UNO



Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock Speed	16 MHz

Schematic & Reference Design

EAGLE files: arduino-uno-Rev3-reference-desian.zip (NOTE: works with Eagle 6.0 and newer) Schematic: arduino-uno-Rev3-schematic.pdf

Note: The Arduino reference design can use an Atmega8, 168, or 328, Current models use an ATmega328, but an Atmega8 is shown in the schematic for reference. The pin configuration is identical on all three processors.

Power

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically.

External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts. The power pins are as follows:

- VIN. The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- 5V.This pin outputs a regulated SV from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. We don't advise it.
- 3V3. A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA. ەىۋى ung 20 2.---

5.

10

GND. Ground pins.

100 000

Memory

The ATmega328 has 32 KB (with 0.5 KB used for the bootloader). It also has 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).

1.0

Input and Output

Each of the 14 digital pins on the Uno can be used as an input or output, using <u>pinMode()</u>, digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. In addition, some pins have specialized functions:

- Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.
- External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt() function for details.
- PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analogWrite() function.

- SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication using the <u>SPI library</u>.
- LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

The Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the <u>analogReference()</u> function. Additionally, some pins have specialized functionality:

TWI: A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library.

There are a couple of other pins on the board:

- AREF. Reference voltage for the analog inputs. Used with <u>analogReference()</u>.
- Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

See also the <u>mapping between Arduino pins and ATmega328 ports</u>. The mapping for the Atmega8, 168, and 328 is identical.

Communication

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, <u>on Windows</u>, <u>a .inf file is required</u>. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1).

A <u>SoftwareSerial library</u> allows for serial communication on any of the Uno's digital pins. The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus; see the <u>documentation</u> for details. For SPI communication, use the <u>SPI library</u>.

Programming

The Arduino Uno can be programmed with the Arduino software (<u>download</u>). Select "Arduino Uno from the Tools > Board menu (according to the microcontroller on your board). For details, see the reference and tutorials.

The ATmega328 on the Arduino Uno comes preburned with a <u>bootloader</u> that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, <u>C header files</u>).

You can also bypass the bootloader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header; see <u>these instructions</u> for details.

The ATmega16U2 (or 8U2 in the rev1 and rev2 boards) firmware source code is available . The ATmega16U2/8U2 is loaded with a DFU bootloader, which can be activated by:

- On Rev1 boards: connecting the solder jumper on the back of the board (near the map of Italy) and then resetting the 8U2.
- On Rev2 or later boards: there is a resistor that pulling the 8U2/16U2 HWB line to ground, making it easier to put into DFU mode.

You can then use <u>Atmel's FLIP software</u> (Windows) or the <u>DFU programmer</u> (Mac OS X and Linux) to load a new firmware. Or you can use the ISP header with an external programmer (overwriting the DFU bootloader). See <u>this user-contributed tutorial</u> for more information.

Automatic (Software) Reset

Rather than requiring a physical press of the reset button before an upload, the Arduino Uno is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2/16U2 is connected to the reset line of the ATmega328 via a 100 nanofarad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip. The Arduino software uses this capability to allow you to upload code by simply pressing the upload button in the Arduino environment. This means that the bootloader can have a shorter timeout, as the lowering of DTR can be well-coordinated with the start of the upload. This setup has other implications. When the Uno is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the bootloader is running on the Uno. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened. If a sketch running on the board receives one-time configuration or other data when it first starts, make sure that the software with which it communicates waits a second after opening the connection and before sending this data.

The Uno contains a trace that can be cut to disable the auto-reset. The pads on either side of the trace can be soldered together to re-enable it. It's labeled "RESET-EN". You may also be able to disable the auto-reset by connecting a 110 ohm resistor from 5V to the reset line; see <u>this forum thread</u> for details.

USB Overcurrent Protection

The Arduino Uno has a resettable polyfuse that protects your computer's USB ports from shorts and overcurrent. Although most computers provide their own internal protection, the fuse provides an extra layer of protection. If more than 500 mA is applied to the USB port, the fuse will automatically break the connection until the short or overload is removed.

Physical Characteristics

The maximum length and width of the Uno PCB are 2.7 and 2.1 inches respectively, with the USB connector and power jack extending beyond the former dimension. Four screw holes allow the board to be attached to a surface or case. Note that the distance between digital pins 7 and 8 is 160 mil (0.16"), not an even multiple of the 100 mil spacing of the other pins.

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Appendix B

Datasheet of MQ-3 Alcohol Gas Sensor

ECHN	ICAL DATA	MQ-3	GAS SENSOR
EATURES			
PEATURES	the second second second second		
* Figh s	ensitivity to alcohol and small	sensitivity to Denzine .	
* Stable	and long life		
* Simple	e drive circuit		
APPLICATIO	N		
They are	suitable for alcohol checker, B	reathalyser.	
SPECIFICAT	TIONS		
A. Stand	lard work condition	Technical condition	Demarks
Vc	Circuit voltage	SV=0.1	AC OR DC
VH	Heating voltage	5V=0.1	ACOR DC
RL	Load resistance	200K Q	
R _H	Heater resistance	33 Ω ± 5%	Room Tem
P _H	Heating consumption	less than 750mw	
B. Envi	ronment condition	Technical and Miles	D
Tao	Using Tem	1000-5000	Kemarks
Tas	Storage Tem	-2010-7010	
R _H	Related humidity	less than 95%Rh	
O2	Oxygen concentration	21%(standard condition)Oxygen	minimum value is
C.S.	inity abaya twictio	concentration can affect sensitivity	over 2%
C. Sensit	Darameter name	Technical parameter	Remarks
Rs	Sensing Resistance	IMQ-SMQ	Detecting concentration
63		(0.4mg/L alcohol)	scope:
×47.	dan		0.05mg/L-10mg/L
a	Concentration slong rate	-0.6	Alcohol
(0.4/1 mg/L)	Concentration stope rate	0.8	* 1
Standard	Temp: 20 C ± 2 C	Vc:5V=0.1	a naval
condition	Humidity: 05%=5%	Vn: 5V=0.1	1 2.1
Preheat time	Over 24	hour +"	1
D. Struct	ure and configuration, basic m	easuring circuit	MEL AIZA
UNIVE	KSIII I <u>EKNI</u>	<u>KAL MALAYSIA</u>	MELAKA
	5-		
Parts	Materials		—н
Gas sensing	SaO2 4-00	-₄	4
Electrode	An		╢╡╟┧┷┉╹╸
Electrode line	Pt 3 3	3 A B DC 5v 4	497 Ivan
Tubular coramic	Al ₂ O ₁	-6 H 1	
	Stainless steel gauze		
Ant-explosion	Conner plating Ns	∽_−──₽₽₽₽−₽ └──	
Ant-explosion network Clamp ring	Copper protonic i to	~~~ \ / /	
Anti-explosion network Clamp ring Resin base Tuke Pin	Bakelite		
Ann-explosion network Clamp ring Resin base Tube Pin	Bakeline Copper plating Na 20mm	<u></u>	Fig.2
Ant-explosion network Clamp ring Resin base Tube Pin	Copper plating No	<u>_9</u> H Fig. 1	Fig.2
Ant-explosion network Clamp ring Resin base Tube Pin	Balalite Copper plating No	-9 H Fig. 1	Fig.2
Anth-explosion network Clamp ring Retin base Tube Pin	Bakeline Copper plating N 20nn 1 99,5	-9 H Fig. 1	Fig.2
Anth-explosion metwork Clamp ring Resin base Tube Pin onfiguration A	Balative Copper plating N 1 1 0000	-9 H Fig. 1	Fig.2
And-explora on metwork Clamp ring Rean base Tube Pin	Copper plating N Copper plating N 1 0 0 0 0 0 0 0 0 0 0 0 0 0		Fig.2
And-explosion metwork Clamp ring Resin base Tube Pin	Copper plating N Copper plating N 1 20nn 1 1 20nn 1 1 20nn 1 20nn 1 20nn 1 20nn 1 20nn 1 20nn 1 20nn 1 20nn 1 20n 1 20 1 20 20 1 20 1 20 1 20 20 1 20 1 20 1 1 1 1 1 1 1 1 1 1 1 1 1	-#1 Configuration B	Fig.2
And-explosion metwork Clamp ring Rean base Tube Pin	Copper plating N Copper plating N 1 1 1 1 1 1 1 1 1 1 1 1 1	-#1 Configuration B	Fig.2
Auto-explosion metwork Clamp ring Rean base Tube Pin	Copper plating N Copper plati	-#1 Configuration B -#1 ±0.5 + A 6.5	Fig.2
And-explosion metwork Clamp ring Reain base Tube Pin	Bakalite Copper plating N Copper plating N Cop		Fig.2

HANWEI ELETRONICS CO., LTD

MQ-3

http://www.hwsensor.com

Structure and configuration of MQ-3 gas sensor is shown as Fig. 1 (Configuration A or B), sensor composed by micro AL2O3 ceramic tube, Tin Dioxide (SnO2) sensitive layer, measuring electrode and heater are fixed into a crust made by plastic and stainless steel net. The heater provides necessary work conditions for work of sensitive components. The enveloped MQ-3 have 6 pin ,4 of them are used to fetch signals, and other 2 are used for providing heating current.

Electric parameter measurement circuit is shown as Fig.2 E. Sensitivity characteristic curve

103 100 Fig.3 is shows the typical sensitivity characteristics of Acto the MQ-3 for several gases. in their: Temp: 20°C. Bazine Humidity: 65%. - 0-4 O2 concentration 21% 10 Heare RL=200k Q -LPG Ro: sensor resistance at 0.4mg/L of Ð 2 Alcohol in the clean air. Rs:sensor resistance at various Ar concentrations of gases. 01 01 1 10 ng/L Fig.2 sensitivity characteristics of the MQ-3 Fig.4 is shows the typical 1.70 dependence of the MQ-3 on R/Ro-Ter 1.50 temperature and humidity. 334 Ro: sensor resistance at 0.4mg/L of 88/R 1.30 Alcohol in air at 33%RH and 20 R/Ro Rs: sensor resistance at 0.4mg/L of 1.10 Alcohol at different temperatures and humidities. 0.90 13.9 0.80 Fig.4 060 Ter 050 10 0 10 20 30 40 50 60 SIA MELAKA

SENSITVITY ADJUSTMENT

Resistance value of MQ-3 is difference to various kinds and various concentration gases. So,When using this components, sensitivity adjustment is very necessary. we recommend that you calibrate the detector for 0.4mg/L (approximately 200ppm) of Alcohol concentration in air and use value of Load resistancethat(Re) about 200 K Q (100KQ to 470 KQ).

When accurately measuring, the proper alarm point for the gas detector should be determined after considering the temperature and humidity influence.

TEL: 85-371- 67169070 67169080 FAX: 86-371-67169090 E-mail: sales@hwsensor.com

Appendix C

Project Coding in Arduino UNO

```
#include <SPI.h>
#include <Wire.h>
#include <Adafruit GFX.h>
#include <Adafruit SSD1306.h>
#include <Servo.h>
Servo myservo;
#define OLED RESET 4
int TIME_UNTIL_WARMUP = 10;
unsigned long time;
unsigned char flowsensor = 2;
volatile int flow frequency;
int pos=0;
int analogPin = 0;
int val = 0;
Adafruit_SSD1306 display(OLED_RESET);
void flow () // Interrupt function
ملىسىا ملاك ،
                              2.
                               10
  flow_frequency++;
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```

```
void setup()
{
    pinMode(flowsensor, INPUT);
    digitalWrite(flowsensor, HIGH);
    Serial.begin(9600);
    attachInterrupt(0, flow, RISING);
    sei();
    myservo.attach(9);
    display.begin(SSD1306_SWITCHCAPVCC, 0x3C);
    display.clearDisplay();
}
```



```
void printAlcoholLevel(int value)
   {
     display.setTextSize(1);
     display.setTextColor(WHITE);
     display.setCursor(10,15);
     if(value<200)
     {
        display.println(" Acceptable Level");
          myservo.write(0);
          delay(15);
     }
     if (value>=200 && value<350)
     {
                                             Limit");
        display.println("Warning: Approach \n
          myservo.write(0);
          delay(15);
     }
     if (value>350)
     {
        display.println("Ignition Locked");
          myservo.write(180);
          delay(15);
     }
    }
      AALAYSIA
     int readAlcohol()
     {
      int val = 0;
      int val1;
      int val2;
      int val3;
      display.clearDisplay();
UNIVERIST analogRead (analogPin) AYSIA MELAKA
      delay(10);
      val2 = analogRead(analogPin);
      delay(10);
      val3 = analogRead(analogPin);
      val = (val1+val2+val3)/3;
      return val;
     }
    void printstandby()
    {
      display.clearDisplay();
      display.setTextSize(1);
      display.setTextColor(WHITE);
      display.setCursor(40,15);
      display.println("Standby ");
    }
```

Appendix D

Project Coding in NodeMCU

<pre>#include <tinygps++.h></tinygps++.h></pre>
<pre>#include <softwareserial.h></softwareserial.h></pre>
#define BLYNK PRINT Serial
<pre>#include <esp8266wifi.h></esp8266wifi.h></pre>
<pre>#include <blynksimpleesp8266.h></blynksimpleesp8266.h></pre>
<pre>#include <mqunifiedsensor.h></mqunifiedsensor.h></pre>
static const int RXPin = 3, TXPin = 1; // GPIO 4=D2 (conneect Tx of GPS) and GPIO 5=D1 (Connect Rx of GPS
<pre>static const uint32_t GPSBaud = 9600; //if Baud rate 9600 didn't work in your case then use 4800</pre>
TinyGPSPlus gps; // The TinyGPS++ object
WidgetMap myMap(V0); // V0 for virtual pin of Map Widget
SoftwareSerial ss(RXPin, TXPin); // The serial connection to the GPS device
BlynkTimer timer:
float spa; // variable to store the speed
Strike heaviers //Whitehe to store no. of satellites response
String Searing, // variable to stole offentiation of direction of GFS
char auth[] = "gz8zzzkOHgrzyHmf9fdNiZztofrlixC". //Your Project authentication key
char said[] = "Gaming House 2.468unifi": // Name of your network (HotSpot or Router name)
char pass[] = "Ilovegame_101"; // Corresponding Password
//unsigned int move_index; // moving index, to be used later
unsigned int move index = 1; // fixed location for now
const int analogPin = A0;
int val = 0;
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```
void setup()
{
   Serial.begin(115200);
   Serial.println();
   ss.begin(GFSBaud);
   Blynk.begin(auth, ssid, pass);
   timer.setInterval(5000L, checkGPS); // every 5s check if GPS is connected, only really needs to be done once
}
void checkGPS(){
   if (gps.charsProcessed() < 10)
   {
     Serial.println(F("No GPS detected: check wiring."));
     Blynk.virtualWrite(V4, "GPS ERROR"); // Value Display widget on V4 if GPS not detected
   }
}</pre>
```

```
void Loop()
{
   while (ss.available() > 0)
   {
     // sketch displays information every time a new sentence is correctly encoded.
     if (gps.encode(ss.read()))
      displayInfo();
  }
 Blynk.run();
 timer.run();
 int val1:
 int val2;
 int val3;
 val1 = analogRead(analogPin);
 delay(10);
 val2 = analogRead(analogPin);
 delay(10);
 val3 = analogRead(analogPin);
 val = (val1+val2+val3)/3;
 if(val>=120)
 {
   Blynk.notify("Driver is Drunk! Send help at the current location");
   delay(5000);
  }
}
void displayInfo()
{
  if (gps.location.isValid() )
  {
    float latitude = (gps.location.fat()); //Storing the Lat. and Lon.
                                                       مسيتى
    float longitude = (gps.location.lng());
                                                                  ٥ دري ٨
                                                               V
                   10
                                                   14
                        100
                                        1.0
    Serial.print("LAT: ");
    Serial.println(latitude, 6); // float to x decimal places AKA
    Serial.print("LONG: ");
    Serial.println(longitude, 6);
   Blynk.virtualWrite(V1, String(latitude, 6));
   Blynk.virtualWrite(V2, String(longitude, 6));
   myMap.location(move_index, latitude, longitude, "GPS_Location");
    spd = gps.speed.kmph();
                                         //get speed
      Blynk.virtualWrite(V3, spd);
                                      //get number of satellites
       sats = gps.satellites.value();
      Blynk.virtualWrite(V4, sats);
       bearing = TinyGPSPlus::cardinal(gps.course.value()); // get the direction
       Blynk.virtualWrite(V5, bearing);
  }
 Serial.println();
}
```