Faculty of Electrical and Electronic Engineering Technology

Development of Smart Motorcycle Starter with Safety and Tracking System

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Bachelor of Electronics Engineering Technology with Honours

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

I declare that this project report entitled “Development of Smart Motorcycle Starter with Safety and Tracking” 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.

Signature : 

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Date : 9/1/2022

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 Electronics Engineering Technology (Industrial Electronics) with Honours.

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Name (if any)

Date :

DEDICATION

I dedicate this bachelor degree project to God Almighty my creator, my strong pillar, my source of inspiration, wisdom, knowledge and understanding. He has been the source of my strength throughout this course and on His wings only have I soared. I also dedicate this work to my father, Fuad bin Ramin and my mother, Haslinda binti Haron who has encouraged me all the way and whose encouragement has made sure that I give it all it takes to finish that which I have started. Not forgetting to all my lecturers and my friends, who never tired of giving me guidance and advice that has been very beneficial to me in completing this project.

ABSTRACT

Vehicle theft is a common occurrence nowadays. Labeled as a peaceful country, but in reality, it is not so quiet because a number of people in society continue to commit this crime without our knowledge. Theft of motorcycles was the most common type of theft in the country. Although the number of vehicle theft cases is reducing every year, according to statistics from the Vehicle Theft Reduction Council Malaysia Berhad (VTREC), the motorcycle remains the most common vehicle stolen. A smart motorcycle startup project with security and tracking was built to address this issue. The project is propose to increase motorcycle safety by making it easier to start the engine and allowing the motorcycle owner to easily track the location of his motorcycle at any time, even if no theft occurs. The Arduino Mega is used as a microcontroller in this project to control the system's inputs and outputs. An RFID tag is a type of identification system that uses a small radio frequency device to identify the motorcycle so that it may be started once the key is placed. The SIM808 GSM/GPS module is used to locate the motorcycle, regardless of whether it has been stolen or not. If someone tries to steal a motorcycle, a piezoelectric transducer is utilised in conjunction with a burglar alarm. This means that if the piezoelectric transducer detects a vibration or force against the motorcycle's actual structure, the alarm will be activated. Based on result, the proposed system will make it difficult for thieves to steal motorcycles as well as make it easier for motorcycle users to track the location of their motorcycles no matter where they are. This project is easy to use and user-friendly as it introduced a better improvement to vehicle security system.

ABSTRAK

Pada masa kini, kes kecurian kenderaan bukanlah perkara baru. Dilabel sebagai negara yang damai, tetapi pada hakikatnya tidak begitu damai kerana ada sebilangan masyarakat yang tidak bertanggungjawab masih melakukan jenayah ini demi kepuasan hidup mereka. Motosikal adalah kenderaan dengan kadar kes kecurian tertinggi di Malaysia. Menurut data statistik oleh Majlis Pengurangan Kecurian Kenderaan Malaysia Berhad (VTREC), walaupun kes kecurian kenderaan ini semakin berkurang setiap tahun, tetapi motosikal tersebut masih dicatatkan sebagai kes kecurian tertinggi. Untuk mengurangkan kes ini, projek pemula motosikal pintar dengan keselamatan dan sistem penjejakan dilaksanakan. Projek ini dicadangkan untuk meningkatkan keselamatan motosikal, mudah menghidupkan enjin motosikal dan pemilik motosikal mudah mengetahui lokasi motosikalnya pada bila-bila masa walaupun kecurian tidak berlaku. Projek ini menggunakan Arduino Mega sebagai mikropengawal untuk mengawal input dan output sistem. Tag RFID adalah sistem ID yang menggunakan alat frekuensi radio kecil untuk tujuan pengenalpastian sehingga enjin motosikal dapat dimulakan setelah kunci motosikal dimasukkan. Modul SIM808 GSM / GPS digunakan untuk mengetahui lokasi motosikal sama ada kecurian berlaku atau tidak. Penggunaan transduser piezoelektrik yang digunakan bersama dengan penggera pencuri jika seseorang cuba mencuri motosikal. Ini bermaksud bahawa apabila terdapat getaran atau hentakan terhadap fizikal motosikal, transduser piezoelektrik akan bertindak balas maka penggera akan diaktifkan. Berdasarkan keputusan, sistem yang dicadangkan ini akan menyukarkan pencuri untuk mencuri motosikal selain memudahkan pengguna motosikal mengesan lokasi motosikal mereka tidak kira di mana mereka berada. Projek ini mudah digunakan dan mesra pengguna kerana peningkatan sistem keselamatan kenderaan yang lebih baik.

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Next, I would like to thank my supervisor, Encik Zulkarnain bin Zainudin, for his support, guidance, advice, encouragement, and, most importantly, for not giving up on me during the completion of this thesis.

Lastly, I want to express my gratitude to my friends and classmates for their encouragement and support in helping me finish this thesis. I would have had a lot of trouble finishing this thesis if they hadn't helped me. This gratitude is also extended to other individuals who assisted me greatly in the completion of this thesis but who are not mentioned here. Only God has the power to reward you for your good deeds.

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LIST OF SYMBOLS

%	-	Percentage
>	-	Greater than
°	-	Angle degree
kph	-	Kilometer Per Hour
dbm	-	Decibel-milliwatts
MHz	-	Mega Hertz
dBi	-	Decibel Relative to Isotrope

LIST OF ABBREVIATIONS

V	-	Voltage
A	-	Ampere
GPS	-	Global Positioning System
GSM	-	Global System for Mobile Communication
IoT	-	Internet of Things
LED	-	Light Emitting Diode
LCD	-	Liquid Crystal Display
SMS	-	Short Message Service
ID	-	Identity Document
VIP	-	Very Important Person
URL	-	Uniform Resource Locators
RFID	-	Radio Frequency Identification
DIY	-	Do It Yourself
SOS	-	Save Our Souls / Save Our Ship
Wi-Fi	-	Wireless Fidelity
DC	-	Direct Current

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CHAPTER 1

INTRODUCTION

1.1 Background

According to Pew Research Center estimates, 83 percent of Malaysian households own a motorcycle, making it the country's second most common mode of transportation. The lower cost of owning a motorcycle has always been the primary motivator for many Malaysians to purchase motorcycles compared to four-wheelers. Additionally, the use of these motorcycles is also able to escape traffic congestion. Similar with the technological advances available on motorcycles, it will definitely encourage more people to own motorcycles compared to four-wheeled vehicles. These circumstances, however, have resulted in a rise in motorcycle theft incidents across the country.

There are two situations that can lead to a motorcycle theft. The first is the owner of the motorcycle's own carelessness. They didn't take this crime seriously until they failed to install any safety equipment on the motorcycle. As a result, motorcycles can be stolen without being detected. The use of disk lock alone does not guarantee 100% safety on the motorcycle. The use of the best and most expensive disk lock will make it difficult for thieves to steal a motorcycle in a short period of time. However, there is still a chance that a motorcycle will be stolen. Similarly, relying solely on the remote alarm does not ensure the motorcycle's safety for an extended period of time. Therefore, this project is being executed in order to create a more efficient motorcycle security system in order to lower the rate of motorcycle theft in the country.

1.2 Problem Statement

The development technologies on motorcycle always improving every year. The production of advanced technologies on motorcycle such as electronic fuel injection, electronic rider assistance, pneumatic tires, Multi-Cylinder engine, Anti-Lock Brake System and brake disc have given high efficiency and performance on motorcycles. However, these premium grade and popular motorcycle has also led towards the increase in theft cases in the country because the thieves like the technologies that have been incorporated into the motorcycle. This situation stems from the weakness of the safety system that exists on the motorcycle itself. The use of a motorcycle lock alone is not enough because thieves can steal a motorcycle without the knowledge of the motorcycle owner. Thieves will do anything as possible to break the lock of the motorcycle. They are able to have a duplicate key created by themselves, or a duplicate key from the store. Therefore, with the absence of additional tools or additional keys such as ID number to start the motorcycle engine will give opportunity for thieves to steal motorcycles easily. At the same time, when a motorcycle is successfully stolen, no warning alarm is triggered and finally, the motorcycle owner will find it difficult to track down his or her lost motorcycle. Thus, based on all the problem statements mentioned above, the absence of effective security equipment can lead to an increase in theft cases in the community.

1.3 Project Objective

The objective of this smart motorcycle starter with safety and tracking system is to minimize the rate of theft cases in community.

a) The main purpose of this project is to provide extra security to motorcycles.

b) To develop a new method to turn on motorcycle engine and in the same time it can increase motorcycle safety.

c) To develop a system to track down the loss of motorcycle.

1.4 Scope of Project

The scope of this project are as follows:

a) A smart motorcycle starter with a safety and tracking system adds an additional level of security by alerting the owner if the motorcycle is stolen. It will be good to have a burglar alarm that works similarly to a car burglar alarm. If a motorcycle theft incident or any act that may cause the motorcycle to be out of its original position occurs near him/her, the piezoelectric transducer (shock sensor) will play a vital role. The burglar alarm is activated when the shock sensor is triggered, and the motorcycle owner is notified. At the same time, the location of the motorcycle is sent to the owner by SMS. If the motorcycle owner is too far away from his or her motorcycle, an SMS with the location of the motorcycle can be sent to his or her smartphone.

b) Smart motorcycle starter with safety and tracking system, as well as the ability to start the motorcycle engine using an ID card. Because the main key is insufficient, an additional key (an ID card) is required. An ID card is utilized since making a duplicate key is difficult. Because this ID card has its own code or information stored in memory, this is the case. As a result,

using an ID card to start a motorcycle engine is not only innovative, but it may also increase motorcycle safety.

c) Lastly, this system will be able to send the location of the motorcycle to its owner via smartphone. SIM808 GSM/GPS will be used to send the location of the motorcycle to its owner. After the burglar alarm is activated, the motorcycle owner will be notified of the location. Even if the theft does not occur, the user can still easily track the location of his or her motorcycle at any time by request the location of motorcycle from SIM808 GSM/GPS module.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A literature review is a synopsis of a thesis's previous analysis. The goal of a literature review is to communicate what information and ideas have been produced on a certain topic, as well as the strengths and limitations of each. Prior to beginning this study, a literature review was undertaken to gather information on the technology available and the approaches utilized by other researchers working on the same topic throughout the world at the same time. This chapter will provide the project, which will include a detailed explanation of the best way for designing a smart motorcycle starter with a safety and tracking system.

2.2 Structure of Smart Motorcycle Starter with Safety and Tracking System

2.2.1 Global System for Mobile Communication (GSM)

According to [2], the Global System for Mobile Communications (GSM) is a protocol standard for second-generation (2G) digital cellular networks, which are utilized by mobile devices such as phones and tablets. GSM (Global System for Mobile Communication) is a second-generation (2G) digital cellular network used by mobile phones. This network replaces the analogue cellular network of the first generation (1G). The available frequency bands are 850 MHz, 900 MHz, 1800 MHz, and 1900 MHz. The proposed system is aimed at Malaysia, an Asian country where the majority of Asian countries use the 900 MHz or 1800 MHz bands. The GSM network can be used anywhere on the world as long as the country supports the

relevant frequency range. GSM employs Time Division Several Access (TDMA) technology, which divides a signal into various time slots to allow multiple users to utilize the same frequency channel.

Figure 2.1: GSM Module

Based on Figure 2.1 above, the 3dBi GSM Module is small, light, and sensitive. If you're constructing anything like a DIY phone, the antenna juts out from its base with a stick-on back so you can attach it to an enclosure. It has a tiny uFL connector on the end, which is ideal for the 1946, but it can also be used on the 850/900/1800/1900/2100 bands. [5].

2.2.2 Global Positioning System (GPS)

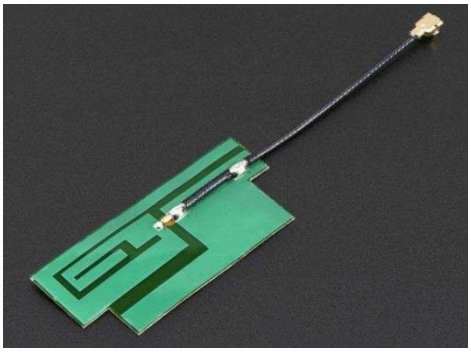


Figure 2.2: GPS Antenna

The GPS (Global Positioning System) is a satellite-based navigation system with at least 24 satellites. With no subscription fees or setup charges, GPS works in any weather condition, anywhere in the world, 24 hours a day. GPS receivers are made up

of an antenna that is set to the frequencies transmitted by the satellites and monitored by the channels, receiver-processors, and a very stable clock (often a crystal oscillator) [11]. According to reference [2,] GPS is a system that allows users to get an accurate position on the Earth at any time and from any location, depending on the weather at that moment. Latitude, longitude, and altitude are the parameters that GPS may collect. Angles ranging from 0º to 90º are used to measure latitude (North or South). The angle will be positive when the point is at the North Pole from the equator, and negative when it is at the South Pole. Negative angles will be found in regions that are lower than the equator, and vice versa. Meanwhile, the longitude ranges from 0 to 180 degrees. The positive and negative angles, like latitude, denote different regions on the Earth. However, the East and West regions determine the angle of latitude. The east will have a positive angle, whereas the west will have a negative value. As a result, both latitude and longitude are required in order to monitor a specific position

2.2.3 RFID Module

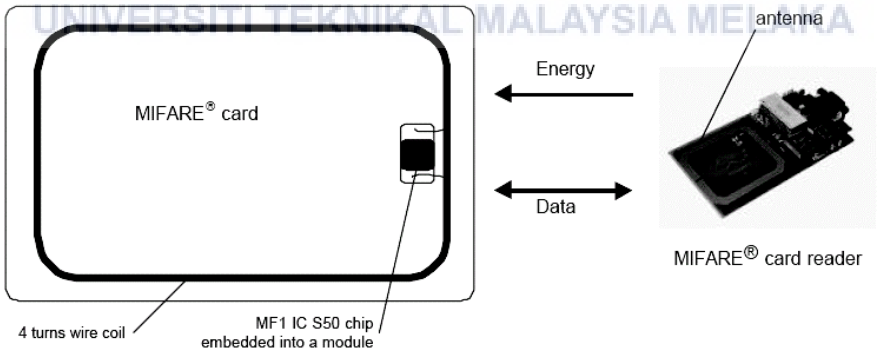


Figure 2.3: Diagram of RFID Module

Radio-frequency identification (RFID) uses electromagnetic fields to recognize and track tags attached to objects, as shown in Figure 2.3. A radio transponder, a radio receiver, and a transmitter make up an RFID system. The tag

transmits digital data, usually an identifying inventory number, back to the reader when triggered by an electromagnetic interrogation pulse from a nearby RFID reader device. According to reference [10], Radio Frequency Identification (RFID) is the process of identifying a person or object through radio frequency transmission, RFID reads data from a tiny device called a tag or transponder using radio frequency. When the RFID tag detects a signal from a compatible device, such as the RFID Reader, it will recognize itself. RFID technology is made up of two major parts: an RFID reader and an RFID tag. RFID Readers are used to read signal information from RFID Tags that is transmitted via a specific frequency. This instrument can only read signal information from RFID Tags. An RFID tag is a device with an integrated IC and antenna that contains a memory and can be used to store data. RFID tags come in a variety of shapes and sizes, but they are generally categorized into two categories which are active tags and passive tags.

2.2.4 Vibration or Shock Sensor

Flex, touch, vibration, and shock are all measured using the piezoelectric sensor. At the risk of oversimplification, the underlying principle is as follows: if a structure moves, it experiences acceleration. When a piezoelectric shock sensor is physically accelerated, it can generate a charge. In other words, it has the ability to convert mechanical energy into electrical energy. Piezoelectric devices can detect single-pressure events as well as recurring events since the voltage caused by pressure is proportional to the applied pressure.

2.3 Literature Review Based on Several Research Paper

Reference [1] proposed that the vehicle system should use GPS and GSM technology. The Global Positioning System (GPS) is a communication system based on satellites. The GPS satellites emit signals at L1 and L2 frequencies that carry ephemeris data, navigation data, codes, and other information that is used to establish the vehicle's location in three-dimensional coordinates, such as latitude, longitude, and altitude, as well as the precise time. The signals from GPS satellites are free of charge, and they allow GPS receivers to establish their location, time, and velocity. GPS receivers have a tracking sensitivity of -160dBm, which permits continuous position coverage in all conditions. The Global System for Mobile Communication (GSM) is an acronym for Global System for Mobile Communication. Short Message Service (SMS) is a GSM-based alternative to voice calls (SMS). When the security mode is enabled and there are varying values, the GSM modem communicates the GPS parameters of latitude and longitude values. There may also be a system in place that allows the vehicle's speed to be automatically controlled when certain facilities, such as schools and hospitals, are approaching. The temperature of the engine of the car is also constantly monitored, alerting the driver to take action if necessary. However, this system has its own weaknesses which the output used was 16x2 LCD display. The use of LCD display is not very attractive and relevant compared when using a smartphone. Smartphones are capable of displaying more details and attractive outputs compared to LCD display. Not only that, the large size of the hardware installation is due to using too many components even though the system is effective in improving vehicle security.

Reference [2] suggested a better alert system to raise the owner's awareness of their motorcycle's condition. Shock and vibration sensors, tilt sensors, and ultrasonic sensors were utilized in this project. The first sensor, a shock sensor, will be mounted on the motorcycle seat's bottom. When the thief sits on the motorcycle, the active sensor detects the shock and sends a command to the Arduino UNO, which causes the Global System for Mobile Communication (GSM) to initiate a voice call. The ultrasonic sensor will be integrated into the motorcycle's body. If the sensor detects someone approaching the motorcycle in a very near distance, the GSM will make a voice call. The tilt sensor will be positioned at the motorbike stand as the third sensor. This is to see if the stand is skewed, indicating that the thief is attempting to steal the motorcycle. The Arduino UNO will then activate the GSM, causing the owner to receive a voice call. The owner can now monitor his motorcycle anywhere and at any time using the Global Positioning System (GPS). All that is required of the owner is a phone call to the system's phone number. The system will then send a Short Message Service (SMS) to GSM shield with the location's latitude, longitude, altitude, and a Uniform Resource Locator (URL) in the form of Google Maps. This type of security alarm system does not guarantee that the motorcycle will not be stolen and that the thief will be apprehended. However, this low-cost solution can benefit the owner by making it more difficult for the motorcycle to be stolen.

According to [3], some researches has given for the vehicle security system with the vehicle tracking system. Some of them are vehicle security system using GPS module and IoT Platform. The Internet of Things platform needs internet connection using GSM modules. Some researchers have developed vehicle security system using biometrics. Biometrics data could be an image form and it needs more memory to save

the data rather than in a text form. The researches mentioned has not used the control system to the vehicle yet. The control system is used to taking control the vehicle (by the system) when the vehicle is stolen by the thieves. So, they proposed the security vehicle system that combined the vehicle position tracking and vehicle controlling. A mobile security vehicle system is based on IoT that embedding the hardware (Arduino based) in the vehicle and control it using the mobile application. The term of "control" consist of controlling the on/off vehicle engine when the system detects the thieves, tracking the vehicle location and ringing the alarms when the vehicle is exposed to a vibration or moving around. One of the existing service in this system is "force shut down" service. When the "force shut down" service is activated by the user, the vehicle engine will be off automatically. This remote system using IoT concept, so that wherever the user is, they can control and monitor their vehicle remotely. Since this system used can control the ON/OFF vehicle engine, so the failure or corrupted of web mobile application may cause failure on vehicle safety.

A Very Important Person (VIP) model of security system was proposed in reference [4]. To summarize, a VIP security model is made up of numerous layers, including the first, second, third, and so on. There were two layers of security employed. The first is the method of authentication, and the second is the way of point positioning. Many computer security systems utilize the authentication method, but the global positioning system uses the Point Positioning approach. The introduction of the ID number as an authentication technique was employed in the investigation. There will be no duplication of ID numbers if RFID technology is used. The primary method of a global positioning system is the point positioning method, which tries to obtain a position in real-time with high accuracy. The first secure point in the security system is

a conventional security system that uses the Authentication method. To start the motorcycle, the rider must first provide his ID number. The second secure point was the Global Positioning System (GPS), which was utilized to track the position of the system using the Point Positioning method. A single component which is microcontroller controls all systems. RFID serves as the system's controller. The security of the motorcycle is substantially improved by using the Authentication method, because the rider must input his ID number to free the handle bar and start the engine. The position can be detected in real-time with high accuracy using the Point Positioning method. Furthermore, by using the ways, the motorcycle owner can follow the location of the motorcycle and cut off the engine if it is stolen. The results of the testing revealed that the system's time delay is caused by the influence of external factors such as building construction and weather, which can disturb the state of signals for data transfers and the effect of the time delay program. During a signal loss, the weather has an impact on GSM Shield's ability to receive data in the form of a short message or a call.

Reference [5] stated that Vehicle tracking systems are designed in such a way that their location can be displayed on Google Maps. The GPS, GSM/GPRS, and Arduino MEGA modules are installed inside the vehicle. As the vehicle moves, the position of the vehicle is updated every 10 seconds in this manner. This system also allows the owner to monitor and track the vehicle, as well as learn about its location and previous activity. This system, also known as real-time Vehicle Tracking Systems, has proven to be effective in assuring vehicle security. This gear is installed in such a way that it cannot be seen by anyone inside or outside the vehicle. As a result, it is utilized as a hidden device that provides location data to the monitoring unit

continuously or as a result of system interruptions. When the vehicle is stolen, the tracking system's location data can be utilized to locate the vehicle and alert the authorities, who can then take appropriate action. The GPS coordinates of the vehicle are provided to a selected mobile when consumers submit a request. The location of the vehicle in terms of latitude and longitude will be sent to the user, which may be examined using Google Maps. In addition, the system contains an SOS feature that allows the driver to summon assistance in an emergency by pressing a button. This security system is usually provided at a low cost. This information is available to authorized system users via the system's web pages. However, if the vehicle is stolen, this technology does not issue an immediate alert. Vehicle owner will know where his or her motorcycle after the vehicle has been effectively taken by the criminals

Reference [6] proposed to develop the satellite communication technology to identify the location of vehicle. Vehicle tracking technologies now are part of common person's amenities. Nowadays GPS is used in automobiles also previously it was only used by ships, airplanes and military. IoT based technology is now important, with GPS and IoT author can track the vehicle in real time basis which will help to find the vehicle if stolen easily or calamity happens to it. The Internet of Things (IoT) is a network of physical objects or "things" that are equipped with electronics, sensors, software, and internet connectivity, allowing them to collect and exchange data. This will interact directly with real worlds and computer-based systems, improving accuracy, efficiency, and economic benefits. At present not all devices are connected to internet by IoT embedded technology it can happens. This will help communication between machines easy even they are place long from each other. The IoT technology will help to build smart Cities in which all physical aspects can be converted into digital.

However, the proposed system is only in primary stage and no result provided in this paper work to know either this safety system is effective or not.

Based on reference [7], the technology is evolving at a rapid rate at the moment. Various technological works, including the security system, have been built to make it easier for humans to carry out their operations. However, due to the lack of a security system on motorcycles that solely employ ignition, there are still regular occurrences of motorbike theft. A dual safety system has been devised for the motorcycle to prevent motorcycle theft using SMS and GPS tracking, which is integrated directly into the internet network on a smartphone, and to monitor the whereabouts of the motorcycle via Google Maps. A security system with an artificial intelligence algorithm could find the shortest path to a user's destination. When a motorcycle is stolen, an alarm is activated, which sends an SMS alert to the Android smartphone. The owner will be notified as soon as the motorcycle has been taken in this manner. If the motorcycle has been stolen, the location of the motorcycle can be determined by tracking the coordinates given via SMS Module SIM 808. The owner can use Google Maps to trace the stolen motorcycle's location by entering the SIM card number inserted in the GSM Module and the GPS Tracker. The Global Positioning System (GPS) Tracker module is useful because it reliably calculates the geographical location of the motorcycle using data received from GPS satellites. The GPS Tracker obtains vehicle location coordinates (latitude and longitude) and uses Google Maps to display a map of the location, with the GSM module serving as an intermediary device for communication with the Arduino UNO microcontroller. The advantage of this system is if the satellite detects coordinate changes on the motorcycle, it means the position of the motorcycle has changed from its original position. Then SMS warning

and motor location will be sent through owner smartphone. However, this system will send SMS for every minute, if in one day it will generate over 1000 messages to the owner and the owner must delete the messages at all times.

Reference [8] stated the vehicle tracking system is a complete fleet management and security solution. It is the technology that determines a vehicle's location using various methods such as GPS and other navigation systems that operate via satellite and ground-based stations. Modern vehicle tracking systems use GPS technology to track and find the vehicle anywhere on the world, although other types of automatic vehicle location technology are sometimes used as well. The vehicle tracking device is installed within the vehicle and offers accurate real-time location information. The data can also be saved and downloaded to a computer for future study. This system is a must-have for tracking a car whenever the owner wishes to keep an eye on it, and it is becoming incredibly popular among those who own expensive cars for theft prevention and recovery. The information gathered can be displayed on electronic maps via the internet and a web page. The advantage of this system is provide low cost and the system is easy to make. However, the vehicle is easy to be stolen because there is no additional security system such as sensors and actuators. The system can only be function if user request the vehicle location. Therefore, if user does not request vehicle location, then the user does not know the condition of his/her vehicle and the probability to lost his/her vehicle are high.

Reference [9] stated that the main advantage of vehicle tracking systems is that they provide security by monitoring the vehicle's location. This can be used as a protection strategy for vehicles involved in accidents or stolen vehicles by sending the

vehicle's location coordinates to the police station or other designated points as an alert. When a stolen or accident car alert is received by the center or point, action can be taken to prevent theft or provide rescue operations. Because of growing traffic and careless driving, the number of accidents on highways has increased. Traffic risks and road accidents have increased as a result of the strong demand and supply of vehicles. The occurrence of accidents has placed people's lives in jeopardy. In many of these accidents, the victims' families, the ambulance or emergency services, or the police are not informed in a timely manner. As a result, rescue activities for accident victims are delayed. This project, which uses the Global Positioning System (GPS) to track vehicles in real time and detect accidents, is intended to handle such circumstances. This project seeks to locate the vehicle by sending a message through a technology installed inside the vehicle. Because of a lack of information on the accident's occurrence and location, most accident locations are difficult or impossible to locate. When an accident happens, the automatic alert system automatically sends a message to the central emergency dispatch server. The message is sent using the GSM module, and the accident location is determined using the GPS module. With the help of a vibration sensor, the accident can be precisely identified. For cost-effectiveness and convenience of usage, an ATMEGA328 microcontroller is used. Assembly programming was also utilized to improve the precision and application of the GPS and GSM modules, which allow the car to be tracked and communications to be sent. The GSM modem transmits the vehicle's exact location to remote devices (mobile phones). The advantages of this system are that the results demonstrate a high level of sensitivity and accuracy. The technology is also simple to operate and dependable. However, this system is more focus on accident alert compared to increase safety on the vehicle.

Based on [10], the rise of theft that occurs especially on motorcycles makes many people try to further improve the motorcycle security system, either by using safety devices, or by using security services such as security guards or parking attendants. Although the security provided is quite tight, but sometimes thieves can still break into this, this can happen due to the negligence of the security officers. Seeing this situation, motorized vehicle safety is used using Radio Frequency Identification (RFID). This security is installed on motorized vehicles and Radio Frequency Identification (RFID) security also uses an ID tag card as an identity or identification when trying to start a motorized vehicle. The advantage of using security with Radio Frequency Identification (RFID) is as a motor vehicle safety. Of course, a security lock like this is better than a security lock that is usually used because a lock like this cannot be easily identified how to use it. This key is also connected to the support for the vehicle's electrical system that allows the vehicle's engine to run. Another advantage is that the RFID security is equipped with an alarm system, so that if the ID tag card used does not match the ID tag code stored on the Arduino microcontroller, it will automatically turn on the alarm. The disadvantages of this system is RFID only can be read perfectly at 0cm to 2cm distance. Besides, from experimental results, a total of 10 attempts were made to start the engine using RFID, but only 8 times were successful. This situation indicates that this security system is not yet fully perfect.

2.4 Comparison Between Chosen Literature Reviews

Table 2.1: Comparison Between Chosen Literature Reviews

Title of journal	Author	Description	Advantages	Disadvantages
[1] Vehicle Monitoring and Tracking System using GPS and GSM Technologies	Kumar, B Hari and Tehseen, Syeda Faathima and Thanveer, S and Krishna, Guntha Vamshi and Akram	GSM technology was used to design a vehicle tracking system as well as monitor vehicle parameters. The vehicle is followed using GPS technology, the parameters are monitored using thermistors, and the state of the vehicle is sent to the owner via GSM, ensuring its security. The AT89S52 was used as the main controller in this project.	➢ Use thermistor as additional safety to vehicle to check temperature of vehicle engine	➢ The use of LCD display is not very attractive and relevant compared when using a smartphone. ➢ Large size of the hardware installation is due to using too many components even though the system is effective in improving vehicle security.

[2] Anti-Theft Motorcycle Alarm System Using GSM and GPS	S. Z. N. Zool Ambia, and N. A. Samsuri	The anti-theft technology uses the GSM network to make a voice call to the motorcycle owner when someone is attempting to steal it, and GPS to track the motorcycle's location. Shock sensors, ultrasonic sensors, and tilt sensors all trigger these networks. All of the processes will be managed by the Arduino UNO board's microcontroller.	➢ The owner can benefit from a low-cost solution by keeping the motorcycle from being stolen easily.	➢ The presence of a security alarm system does not guarantee that the motorcycle will not be stolen and that the thief will be apprehended.
[3] Mobile Security Vehicle's based on Internet of Things	M. Husni, R. V. H. Ginardi, K. Gozali, R. Rahman, A. S. Indrawanti, and M. I. Senoaji6	The research uses Relay Module 2 Channel HL-525 to control the vehicle machine, GPS Module Neo-7M to get the vehicle location, SIM800L Module to connect to the internet network and ACS-712 Voltage sensor to detect the voltage in the vehicle electricity. This research	➢ This remote system using IoT concept, so that wherever the user is, they can control and monitor their vehicle remotely.	➢ The failure or corrupted of web mobile application may cause failure on vehicle safety.

		uses multi-platform (web application) as the component software to monitor and control the vehicle condition and its location. The term of "control" consist of controlling the on/off vehicle engine when the system detects the thieves, tracking the vehicle location and ringing the alarms when the vehicle is exposed to a vibration or moving around.		
[4] Microcontroller-based RFID, GSM and GPS for Motorcycle Security System	Kunnu Purwanto, Iswanto , Tony Khristanto Hariadi, and Muhammad Yusvin Muhtar	The study developed an autonomous motorcycle safety system, known as narcissistic germs. The major invention of autonomous vehicle security using GPS, GSM, and RFID is germs narcissist. This system was intended to	➢ There will be no duplication of ID numbers if RFID technology is used. ➢ The security of the motorcycle is substantially	➢ The testing revealed that the system's time delay is caused by the influence of external factors such as building construction

		communicate vehicle information such as time, position, and alarm to the motorcycle owner via short message service (SMS).	improved by using the Authentication method, because the rider must input his ID number to release the handle bar and start the engine.	and weather, which can disturb the state of signals for data transfers and the effect of the time delay programme. ➢ During a signal loss, the weather gave an impact on GSM Shield's ability to receive data in the form of a short message or a call.
[5] Real Time Vehicle Tracking Using Arduino Mega	Humaid Alshamsi, Veton Këpuska, and Hazza Alshamsi	Using GPS and GSM technology, a vehicle tracking system can track vehicle theft. Arduino MEGA2560 is used for the GPS receiver and GSM modem. The system is	➢ The system has an SOS feature, which allows the driver to summon assistance in an emergency by	➢ The system does not apply any initial warning if the motorcycle has been stolen. Motorcycle

		permanently fitted to the car. The information can be sent and received using a GSM phone. As a result, the GPS system will send the GSM Modem the longitudinal and latitudinal numbers corresponding to the vehicle's position.	pressing a button. ➢ Typically, this service is supplied at a low cost.	owner will know the location of his/her motorcycle after the motorcycle is successfully stolen by the thieves.
[6] An Intelligent automobile Anti- Theft Tracking and Calamity Detection System Based on IoT using RASPBERRY PI For Real Time Applications	Vaibhav Nalavade, Nilesh Swami, Sumit Sutrave, and Ankur M. Bobade	➢ Gps and IoT using RASPBERRY PI can track the vehicle in real time basis which will help to find the vehicle if stolen easily or calamity happens to it. ➢ Accelerometer module, solenoid valve, camera module, 4x4 matrix keypad with 8 input and output port, piezoelectric Sensor, battery bank and power	➢ The use of IoT increase accuracy, efficiency and economic benefits ➢ It also will helps communication between machines easy even they are place long from each other.	➢ The proposed system is only in primary stage and no result provided in this paper work to know either this safety system are effective or not.

		supply were used to produce this system		
[7] Motorcycle Security System using SMS Warning and GPS Tracking	Budi Artono, Tri Lestariningsih, R. Gaguk Pratama Yudha, Arizal Alfan Bachri	A motorcycle security system with SMS warnings and GPS monitoring is required to prevent motorcycle theft. The goal of the study was to create a motorcycle security system that included a SIM808 GSM Module for sending warning messages and a GPS tracker for providing information in latitude and longitude coordinates so that the stolen motorcycle could be tracked using Google Maps. The GPS Tracker functioned by reading the coordinates of the object.	➢ Satellite detects coordinate changes on the motor, it means the position of the motorcycle has changed from its original position. Then SMS warning and motor location will be sent through owner smartphone	➢ The system will send SMS for every minute, if in one day it will generate over 1000 messages to the owner and the owner must delete the messages at all times.
[8] Real-Time Vehicle Tracking System Using	Mo Khin and Nyein Oo	The Arduino Uno R3, SIM800A module, and NEO 6M GPS module are used to track the location of a car in	➢ The system is a vital gadget for tracking a car whenever its	➢ Vehicle is easy to be stolen because there is no additional

Arduino, GPS, GSM and Web-Based Technologies		real time. A GSM module and a GPS module are serially connected to an Arduino Uno R3. The GSM module is used to send the vehicle's location in real time from a remote location. The GPS module, which relies on satellite technology for navigation, will provide data such as longitude, latitude, speed, and distance travelled on a continual basis. The position of a vehicle on a digital map is viewed using Google Maps. The tools XAMPP and the Google Map API are utilized in this project.	owner wants to keep an eye on it, and it is now incredibly popular among people who own costly cars, where it is used to prevent theft and recover stolen vehicles.	security system such as sensors and actuators. The system can only be function if user request the vehicle location. ➢ If user does not request vehicle location, then the user does not know the condition of his/her vehicle and the probability to lost his/her vehicle are high.
[9] Vehicle Tracking and Accident Alert System Using	Musa	When an accident happens, the automatic alert system automatically sends a message to the central emergency dispatch server.	➢ The system's sensitivity and accuracy are great, as	➢ More focus on accident alert compared to increase safety on the vehicle.

GPS and GSM Modules		The message is sent using the GSM module, and the accident location is determined using the GPS module. With the help of a vibration sensor, the accident can be precisely identified. For cost-effectiveness and convenience of usage, an ATMEGA328 microcontroller is used.	evidenced by the results. ➢ The technology is also simple to operate and dependable.	
[10] Development of motor Vehicle Safety Based on RFID System	Hamdani, Puspita and Wildan	This study aims to create a motor vehicle security system based on Radio Frequency Identification (RFID). Where this security system is equipped with an alarm, so that if the Tag ID card used does not match the Tag ID code stored on the Arduino microcontroller, it will automatically turn on the alarm. The making of a	➢ The use of RFID is better than a security lock that is usually used because a lock like this cannot be easily identified how to use it. ➢ RFID security is equipped with an alarm system,	➢ RFID only can be read perfectly at 0cm to 2cm distance. ➢ From experimental results, a total of 10 attempts were made to start the engine using RFID, but only 8 times

		RFID-Based Motor Vehicle Security System uses two sensors, namely an RFID sensor and a NC-type SW-420 vibration sensor as input to start a motorized vehicle and detect vibrations when a motorized vehicle is about to be stolen. The minimum system used is the ATmega328P microcontroller.	so that if the ID tag card used does not match the ID tag code stored on the Arduino microcontroller, it will automatically turn on the alarm	were successful. This situation indicates that this security system is not yet fully perfect.

2.5 Summary

In this chapter, the overall structure of a smart motorbike starter with safety and tracking system has been analyzed, as well as previous studies on how to increase motorcycle safety through the use of various modern technologies. This section discusses the benefits and drawbacks of previous research conducted over the years in order to determine the most useable system and what may be improved in order to build a simple but effective motorcycle safety system. The advantage that has been highlighted in previous studies is that it is capable of improving safety on consumer motorcycles. Previous study has shown that the Internet of Things (IoT) system can not only track the location of a motorcycle, but it can also regulate the engine remotely. However, based on previous studies, using just one system, or even a few

systems are insufficient to improve a motorcycle's control and safety. Although the system is simple and inexpensive, but it is not very practical and the probability of losing a motorcycle is still high.

Therefore, through this project that will be implemented, there are three safety systems will be used in order to improve motorcycle safety. The first is the "Smart Motorcycle Starter" where the system uses an RFID module as an ID Authentication method to start the motorcycle engine. The motorcycle engine cannot be started by simply inserting the key into the ignition key, but it also needs an Authentication ID. The second system is the “Safety” system where it contains components such as speakers and piezoelectric sensors. When there is a vibration or shock that occurs on the piezoelectric sensor, then this sensor plays a role to convert the energy(vibration) into electrical energy, then it will assist the speaker in producing a loud sound. In other words, this burglar alarm system is identical to the burglar alarm designed for automobiles. The third system is a motorcycle "tracking system" using the SIM808 GPS/GSM module. This tracking system is compatible with burglar alarm systems. When the burglar alarm is activated, the SIM808 is activated as well, and the location of the motorcycle is automatically transmitted to the user. This tracking system can also work alone without burglar alarm system. This means, users can request the location of the motorcycle manually by sending a short message service (SMS) to SIM808.

All of the following descriptions demonstrate that the project to be implemented is quite good and effective compare to previous studies. Although the project's cost is higher than previous research projects, but the motorcycle safety should be a priority.

CHAPTER 3

METHODOLOGY

3.1 Introduction

Introduction to Research Methodology presents a thorough review of a wide range of research paradigms and methodologies, as well as the tools and techniques that go along with them. The goal of this chapter is to concentrate on the overall research and hardware process flow as well as the design approach. This section will also include instructions on how to create a research design for a study. It's a fundamental review of the research methodologies section of a study proposal, followed by data analysis templates for various design types. This methodology has a structured plan that includes finding an appropriate title for the project, conducting research through journals and articles, planning a project design and parts that will be required, implementing hardware and software into the project, testing the project, troubleshooting problems that arise, and writing a report. An organization that elaborates the method for completing a project is a necessary in any project. To do so, a full flow chart detailing the processes required to complete the project from beginning to conclusion is prepared. Apart from that, before beginning this project, it is important to grasp the hardware and software tools that will be employed.

3.2 Methodology

The goal of project methodology is to ensure the success of specific processes, approaches, techniques, methodologies, and technologies by allowing for effective decision-making and problem-solving throughout the management process. Firstly,

looking for existing motorcycle safety systems today and looking for system weaknesses and then planning to improve on that systems. Then, the next step is drafting the design of the smart motorcycle starter with safety and tracking system and do simulation part by using Proteus 8 professional. The implementation of program was done in Arduino C language software. Then, fabricated to get the equivalent hardware. The fabricated of this project has been tasted and project parameter that been mentioned previously has been measured. For the last step, the measurement result and simulation results have been compared to validate the hardware performance. The flowchart below shows how to write a report, which includes designing a project, deploying the necessary hardware and software, and analyzing the project's overall success. Also provided is a qualitative method for locating project-related information.

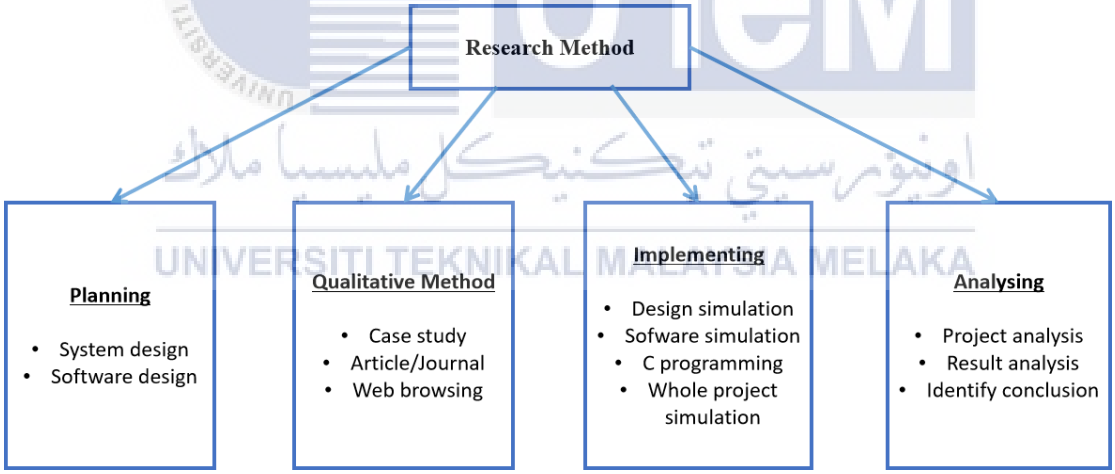


Figure 3.1: Methodology Materials

3.2.1 Flow Chart

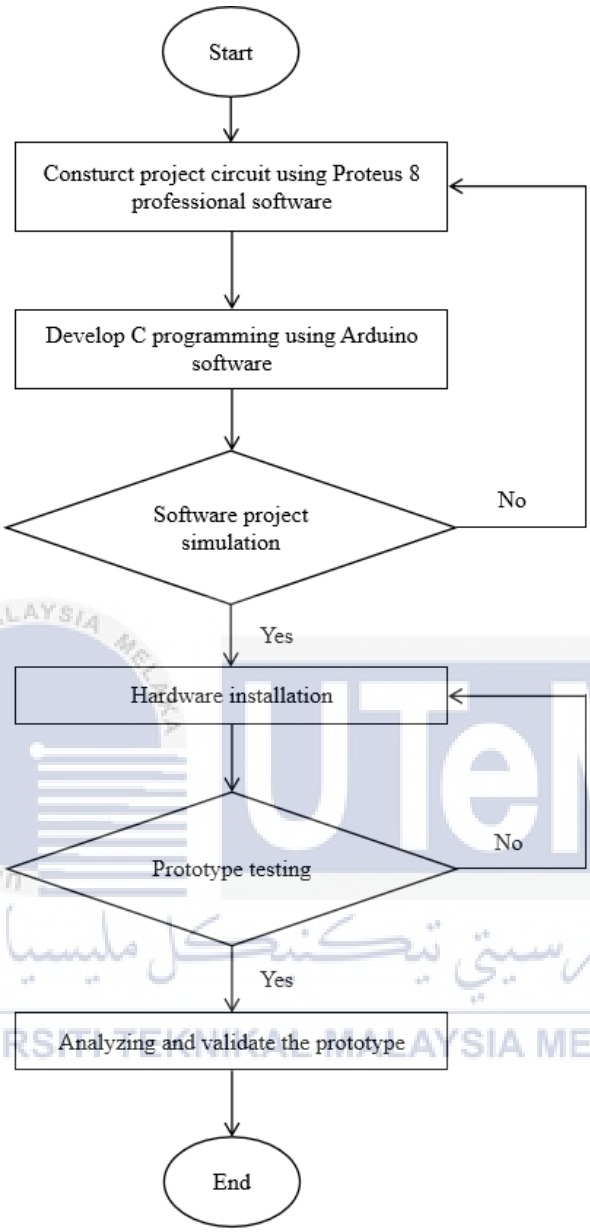


Figure 3.2: Project Implementation Flow Chart

The flow chart depicted in Figure 3.2 indicates the project's progress from BDP 1 until BDP 2. The first stage is to come up with a project idea and plan the design of that idea. Then, when investigating a related topic, consider the prospect of coming up with a project idea on the spur of the moment. Then, design a schematic whether sketch it or using Proteus 8 Professional software simulation. After that, the C

program language of the project implemented in Arduino C language software. Then the program is uploaded into Arduino in the Proteus 8 and the circuit simulation is run to observe the circuit work. If the simulation work successfully, print the simulation circuit and transfer it into circuit board. Then, do the hardware installation. After that, testing the prototype to see either it is work or not. If not work, the troubleshooting is need to be done. Lastly, analyzing and validate the prototype if the project is work properly.

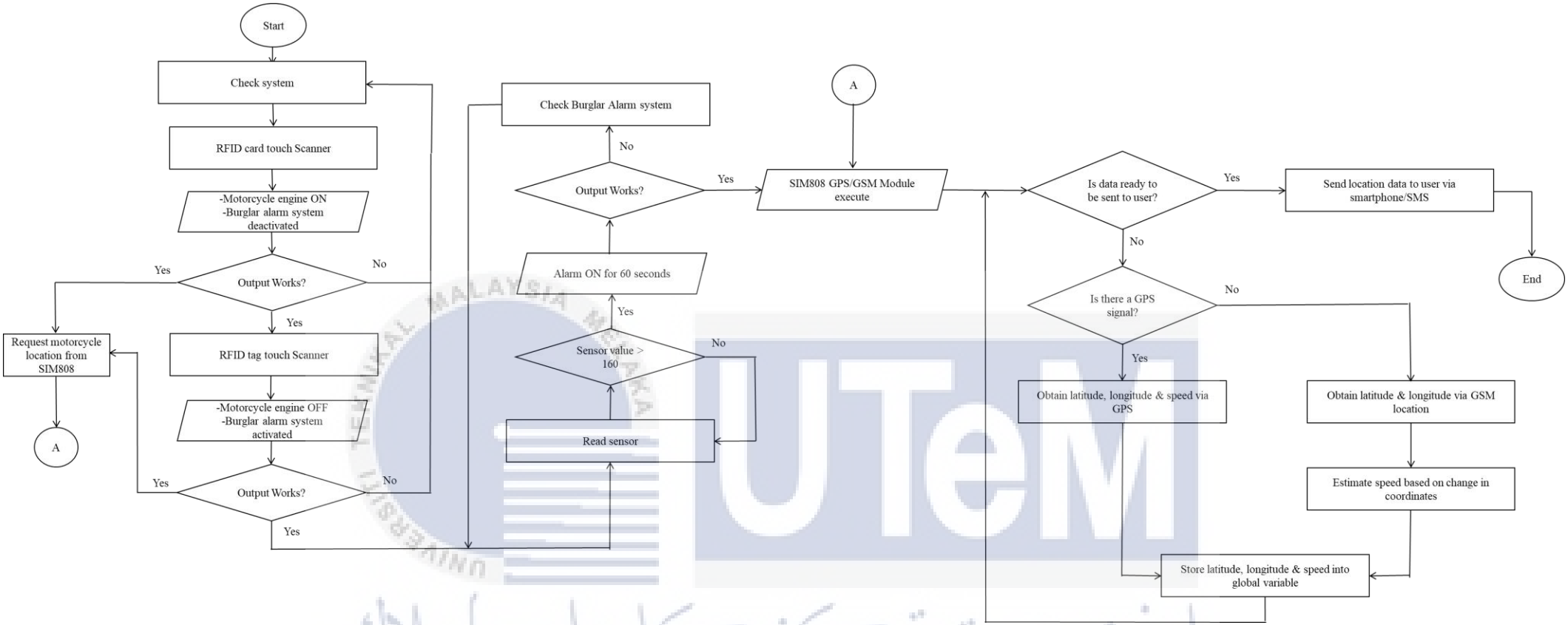


Figure 3.3: Smart Motorcycle Starter with Safety and Tracking System Flow Chart

The project system is indicated in Figure 3.3 as a flow chart. To succeed this project, it needs to go through two conditions. The first condition is when the user wants to ride or riding the motorcycle. For the first system as shown in Figure 3.4 flow chart below, the user will touch the RFID card to the scanner to turn on his motorcycle engine. The main key must be put into the ignition key to start the motorcycle engine. The motorcycle engine will not start without it. The green LED indication and burglar alarm system will not work if the motorcycle engine is already running. Burglar alarms with piezoelectric sensors (shock sensors) are extremely sensitive to vibrations in the environment. Naturally, there will be a lot of vibration on the motorcycle as it is moving down the road, especially on uneven surfaces. This scenario causes a lot of vibrations or pressure to be applied to the piezoelectric sensor. The warning alarm is activated immediately when the sensor reading reaches a predetermined value (in the Arduino C program). As a result, the burglar alarm system does not need to be turned on while the motorcycle is moving (motorcycle engine is in the ON state).

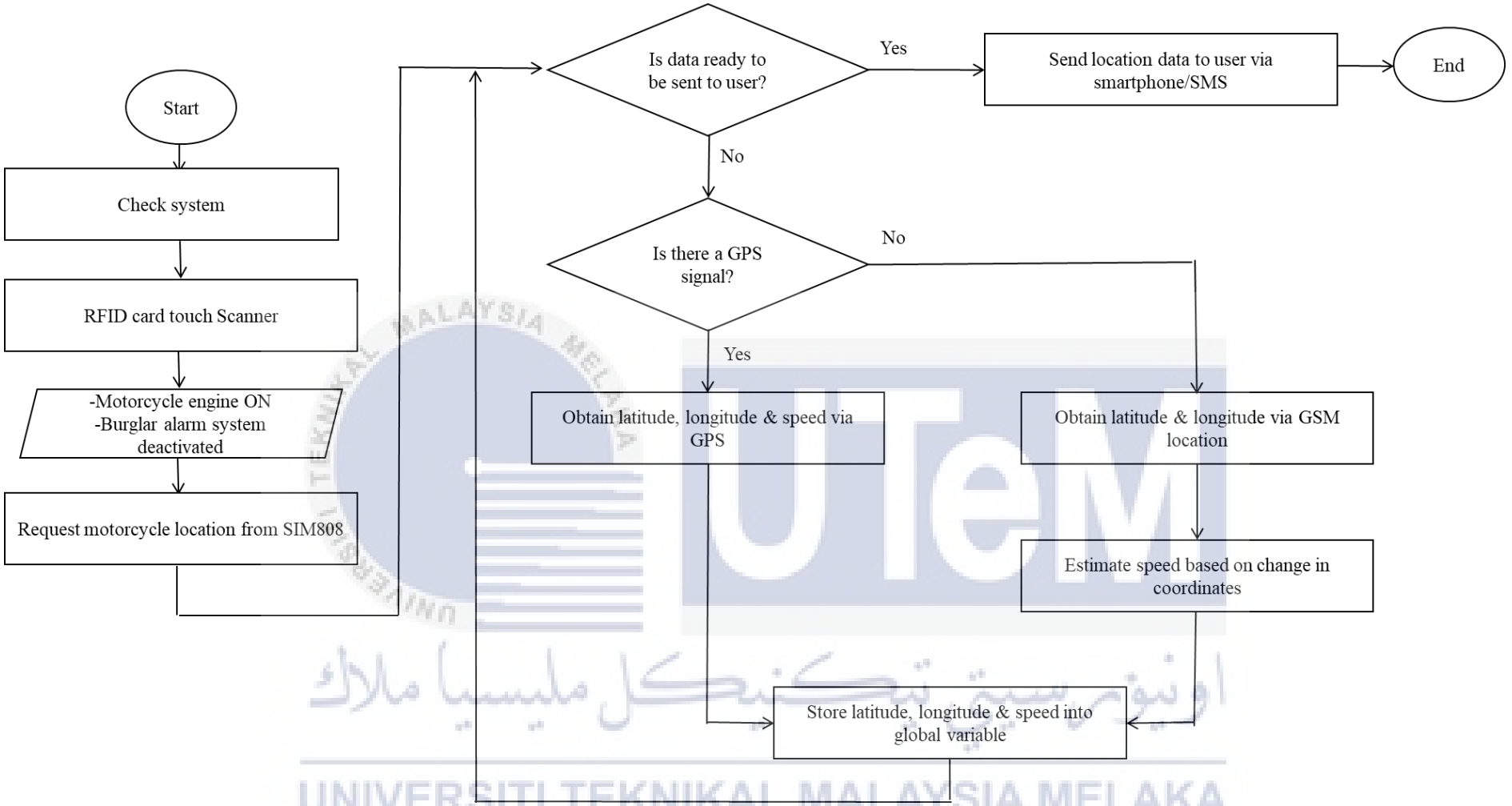


Figure 3.4: Flow chart when riding the motorcycle

The second condition is when the motorcycle engine is turned off (not riding the motorcycle as shown in Figure 3.5 flow chart below). The RFID tag must be in contact with the scanner to turn off the motorcycle engine. When the motorcycle engine is in OFF condition, the red LED indicator is ON and the burglar alarm system is ready to operate. When the owner of the motorcycle is away from his motorcycle, the burglar alarm will keep the motorcycle secure. If the motorcycle produces a shock or vibration, the piezoelectric sensor will respond to transform the vibration energy into electrical energy. The warning alarm will activate for 60 seconds if the sensor reading value surpasses 160. After 60 seconds, the SIM808 GPS/GSM module will begin processing the motorcycle's location in the form of coordinates. After a few seconds, the location of the motorcycle will be sent (in the form of coordinates and google map link) to the smartphone owner of the motorcycle via SMS. If the SIM808 GPS/GSM works well, then the location given to the motorcycle owner is correct. If the SIM808 GPS/GSM is not working properly, then the location given to the owner of the motorcycle is incorrect. To find out whether the location received is correct or not, the owner of the motorcycle can click on the link (Google Map link) of the location provided. For additional information, the SIM808 GPS/GSM module remains ON whether the motorcycle engine is in ON or OFF condition.

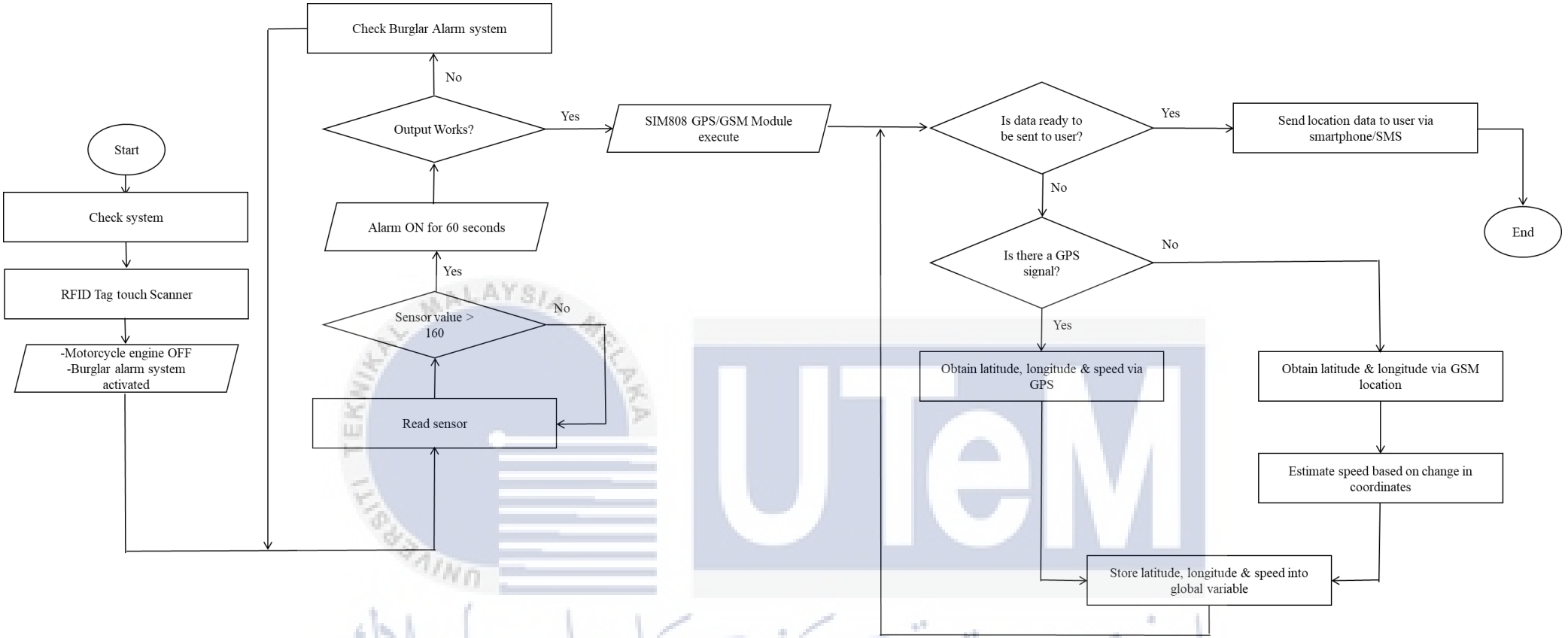


Figure 3.5: Flow chart when leave motorcycle without supervision

3.3 Software Implementation

3.4.1 Proteus 8 Professional

Proteus 8 is a software that can design schemes, PCB design, coding, and even simulate the schematics using Proteus 8 Professionals. In this project, the circuit construction was done in this software so the output from the circuit can be seen.

3.4.2 Arduino IDE C Language

Arduino IDE is an open source software used mostly to write the code into the Arduino module. The main code, which also is known as a sketch, produces a hex file on the IDE platform which is translated and uploaded to the controller on the board. To ease the understanding, the C program of the project is implemented in this Arduino IDE software, then when want to upload the program into the board, Hex file is generated.

3.4 Hardware Implementation

3.4.1 Arduino Mega

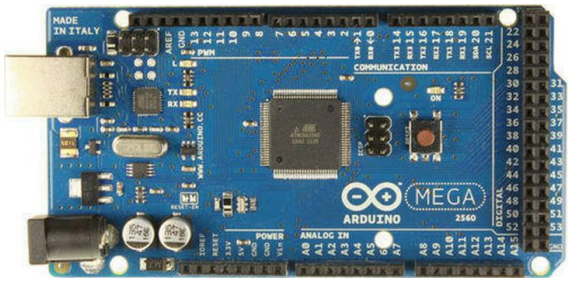


Figure 3.6: Arduino Mega 2560

Generally, Arduino known as the microcontroller kits that able to construct the digital device that able to sensing in both physically and digitally. Table 3.1 below shows the Arduino Mega 2560 Specifications:

Table 3.1: Arduino Mega Specifications

Microcontroller	Atmega2560
Operating Voltage	5V
Input Voltage	7V – 12V
USB Port	Yes
DC Power Jack	Yes
Current Rating Per I/O Pin	20mA
Current Drawn from Chip	50mA
Digital I/O Pins	54
PWM	15
Analog Pins (Can be used as Digital Pins)	16 (Out of Digital I/O Pins)
Flash Memory	256KB
SRAM	8KB
EEPROM	4KB
Crystal Oscillator	16 MHz
LED	Yes/Attached with Digital Pin 13
Wi-Fi	No
Shield Compatibility	Yes

3.4.2 SIM808 GPS/GSM Module

Figure 3.7: SIM808 GPS/GSM Module

The SIM808 module is a comprehensive Quad-Band GSM/GPRS module that also includes GPS for satellite navigation. The compact design

integrated into an SMT package by GPRS and GPS will save users a lot of time to develop GPS-enabled applications. With an industry-standard interface and GPS function, it allows the tracking of variable assets everywhere and with a signal coverage at all times. The AT controls can be used to control the module.

3.4.3 RC 522 RFID Module

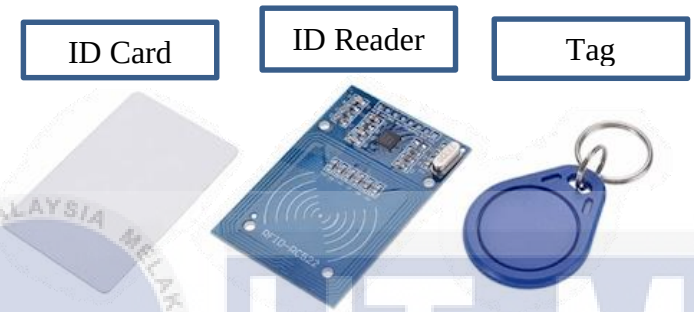


Figure 3.8: RFID module

The RC522 is a radio frequency module with an RFID reader, an RFID card, and a key chain. The module runs on the 13.56MHz industrial (ISM) band and therefore does not require a licence. Because the module's operational voltage ranges from 2.5 to 3.3V, it's widely used in 3.3V systems. It's typically utilized in applications where a certain person or thing needs to be identified by a unique ID.

The key chain features 1KB of memory, which can be used to store one-of-a-kind information. Both reading and writing data into these memory elements is possible with the RC522 reader module. Only passive tags operating at 13.56MHz can be read by the reader.

3.4.4 Burglar alarm

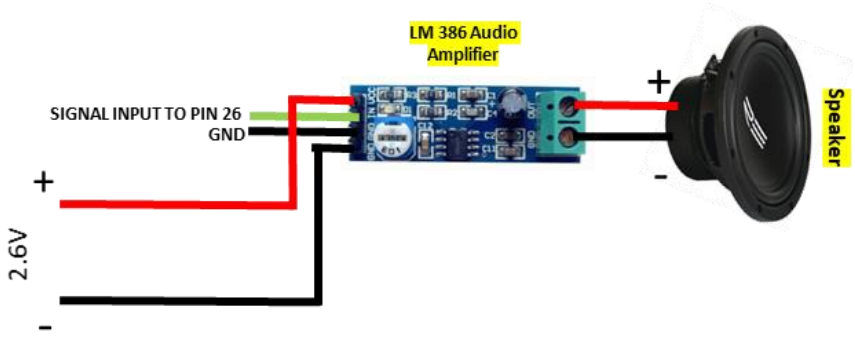


Figure 3.9: Burglar alarm system

The Figure 3.9 above shows the burglar alarm circuit and it controlled by using Arduino Mega. LM386 is a low-power audio frequency amplifier that requires a low-voltage power supply to operate. It is used in conjunction with 2.6v speakers, which takes an input potential (voltage) and produces an output potential that is tens or thousands of times the magnitude of the input potential. The LM386 also used in amplifier circuits to raise the potential of an audio input signal by 20 to 200 times. The sound volume can be adjusted by turning the potentiometer knob on the LM368 module.

3.4.5 Piezoelectric Transducer

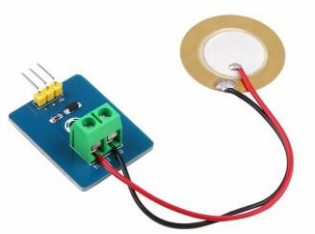


Figure 3.10: Piezoelectric Transducer

A piezoelectric transducer (also known as a piezoelectric sensor) is a device that converts energy into an electrical charge and employs the piezoelectric effect to measure changes in acceleration, pressure, strain, temperature, or force. Any device that transforms one kind of energy to another is referred to as a transducer. One type of transducer is piezoelectric material. The transducer turns energy into voltage when we squeeze this piezoelectric material or apply any force or pressure. The force or pressure applied to it determines the voltage.

3.4.6 SPDT 5-Pin Relay

Figure 3.11: SPDT 12V 5-Pin Relay

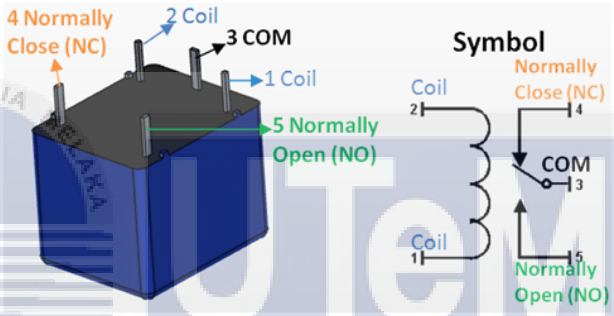


Figure 3.12: SPDT 12V 5-Pin Relay Diagram

A relay is a device that allows a low voltage to regulate higher-power circuits. A relay accomplishes this by energising an electromagnet with 5V from an Arduino pin, which then shuts an internal, physical switch to turn on or off a higher-power circuit.

3.4.7 Other related

- **LM2596 DC-DC Step-Down Buck Converter**

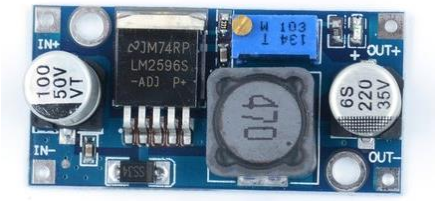


Figure 3.13: LM2596 DC to DC Step Down Buck Converter

The LM2596 DC to DC Step-Down Module, also known as a Buck regulator, converts a higher voltage supply into a lower, controlled DC voltage output. It is substantially more efficient and has a lower heat dissipation rate.

3.5 Block Diagram

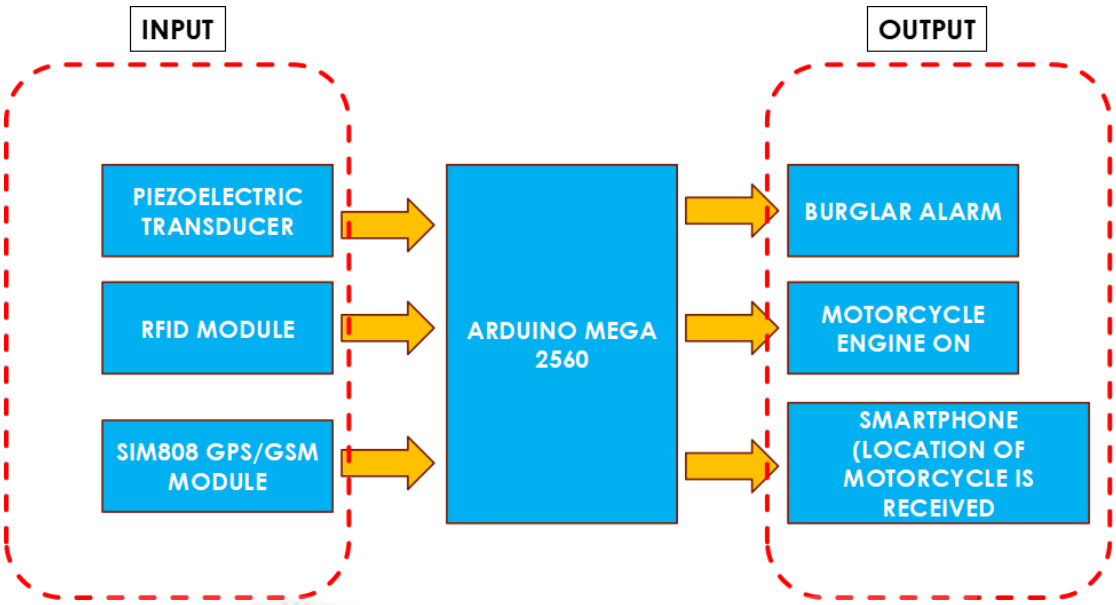


Figure 3.14: System Block Diagram

Figure 3.14 above shows the inputs and outputs used in the form of block diagram for Smart Motorcycle Starter with Safety and Tracking System. Piezoelectric transducer or piezoelectric sensor (shock sensor), RC522 RFID module and SIM808 GPS/GSM module are labelled as the input. Meanwhile the burglar alarm, motorcycle engine ON (use of SPDT 5-Pin Relay) and smartphone are labelled as the output. Arduino Mega 2560 is microcontroller to control both input and output devices.

3.6 Project Circuit

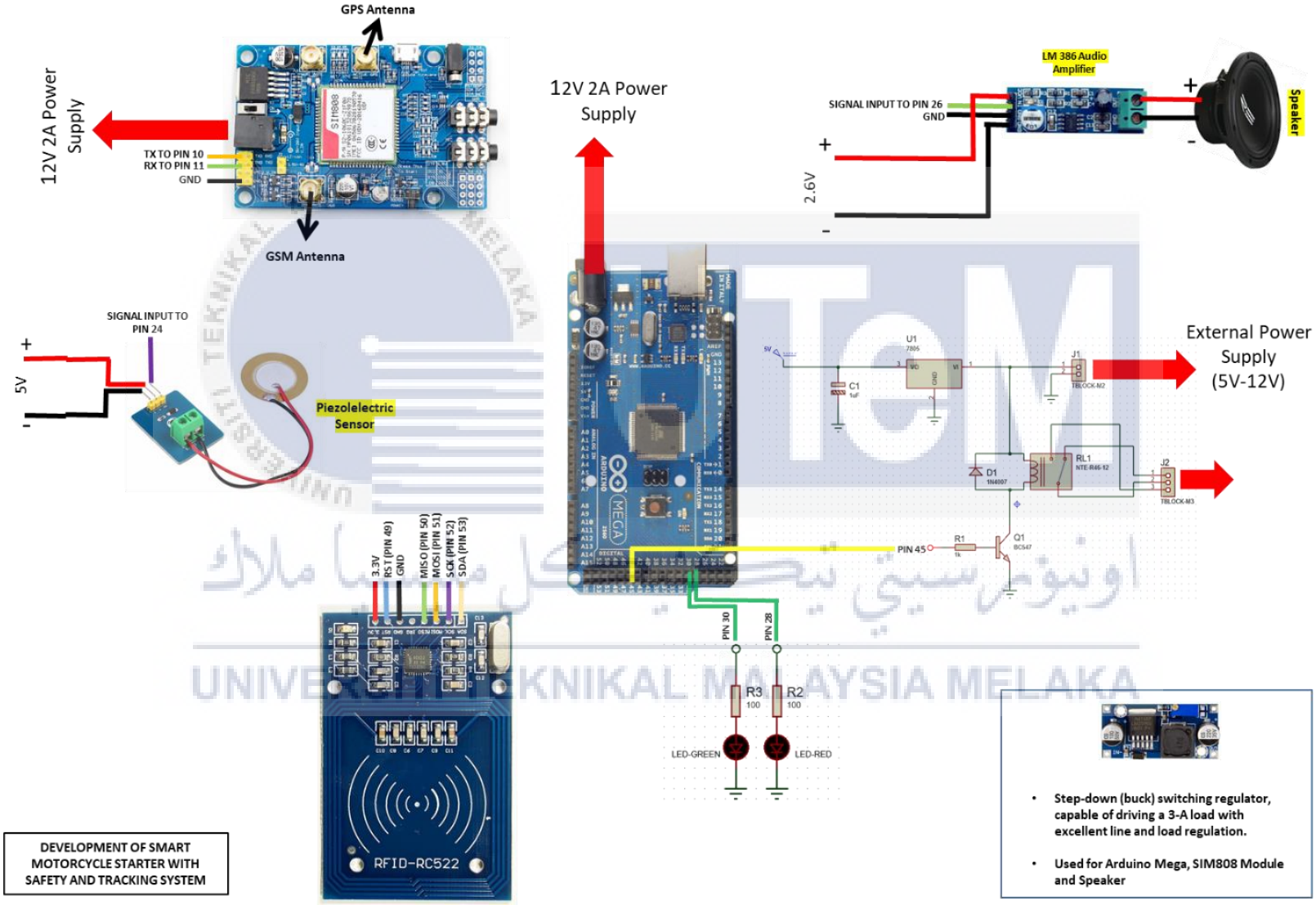


Figure 3.15: Smart Motorcycle Starter with Safety and Tracking System schematic diagram

3.7 Gantt Chart

NO	ACTIVITY	WEEK & DATE														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		4-10 Oct	11-17 Oct	18-24 Oct	25-31 Oct	1-7 Nov	8-14 Nov	15-21 Nov		24-30 Nov	1-7 Dec	8-14 Dec	15-21 Dec	22 -28 Dec	29 Dec-4 Jan	5-11 Jan
1	Briefing Project (BDP 2)															
2	Buy Hardware & components															
3	RM200 Claim Form															
4	Briefing of Module 3 & Module 4 as PSM 2 report guidance: Result & Discussion															
5	Discussion with Supervisor (online meeting)															
6	Circuit Simulation on Proteus 8 software															
7	Construct circuit simulation on breadboard															
8	Construct project circuit on strip board															
9	Soldering															
10	Project test & troubleshooting															
11	Hardware installation in the casing box															
12	Hardware installation on motorcycle															
13	Collect & record the data															
14	BDP 2 final report															
15	Turnitin Report															
16	Preparing Slide Presentation for BDP 2															
17	Preparing Video Presentation for BDP 2															
18	Live BDP 2 presentation/Q&A with Panels															

Work Planning Work Progress Midsem Break

3.8 Summary

This chapter outlines a recommended methodology for developing a new, effective, and integrated strategy to improve motorcycle safety and lowering motorcycle theft rates. A project progress flow chart has been created to ensure that the project implementation process works smoothly. The selection of components has been completed before beginning this project, whether it is with software or hardware. The selection of these components is critical to ensuring that the project's later production is efficient, simple, and within budget. To ensure that the project's objectives are met, the operation principle of the smart motorcycle starter with safety and tracking system also thoroughly investigated. If there is a problem with the hardware, the problems must be tracked to ensure that the circuits perform properly. On the other hand, the project will be allowed to move forward to the final report stage.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

The effectiveness of motorcycle safety devices will be discussed and demonstrated in Chapter 4. This project's effectiveness must be demonstrated not only on a theoretical level, but also in practice. The use of a smart motorcycle starter with a safety and tracking system is used to see if the project can meet the thesis's overall goals. The success of all three systems applied in this project, namely the use of ID to turn on and off the motorcycle engine, the use of a burglar alarm as a motorcycle safety, and a tracking system to track the locations of motorcycles, will be demonstrated in this chapter. These three systems are utilized in two scenarios. The first scenario is when riding the motorcycle and the second scenario is when stopping or leaving the motorcycle alone without the owner's supervision. The data (location distance) from motorcycle locations to its owner will also be included in this chapter.

4.2 Completed Project Hardware

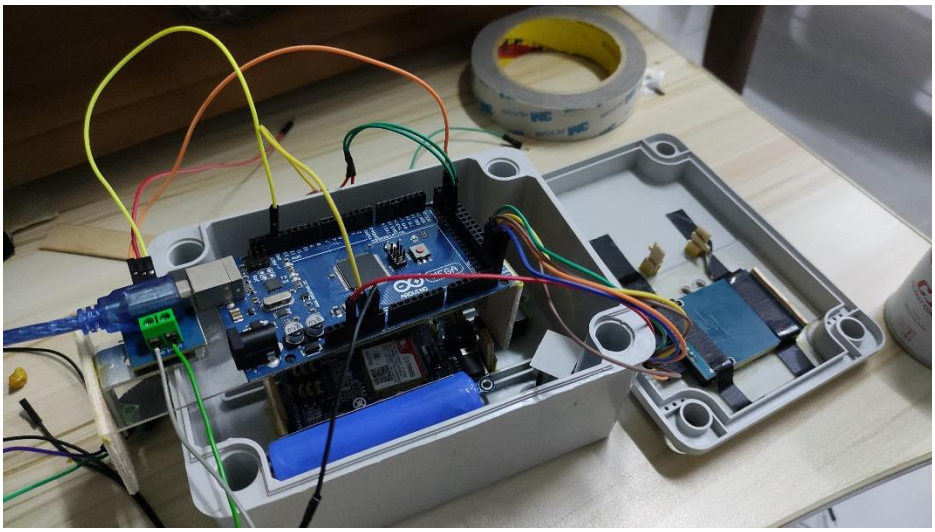


Figure 4.1: Before inserting the circuit into project box

Figure 4.2: After inserting the circuit into project box

4.3 System Functionality

4.3.1 Smart Motorcycle Starter

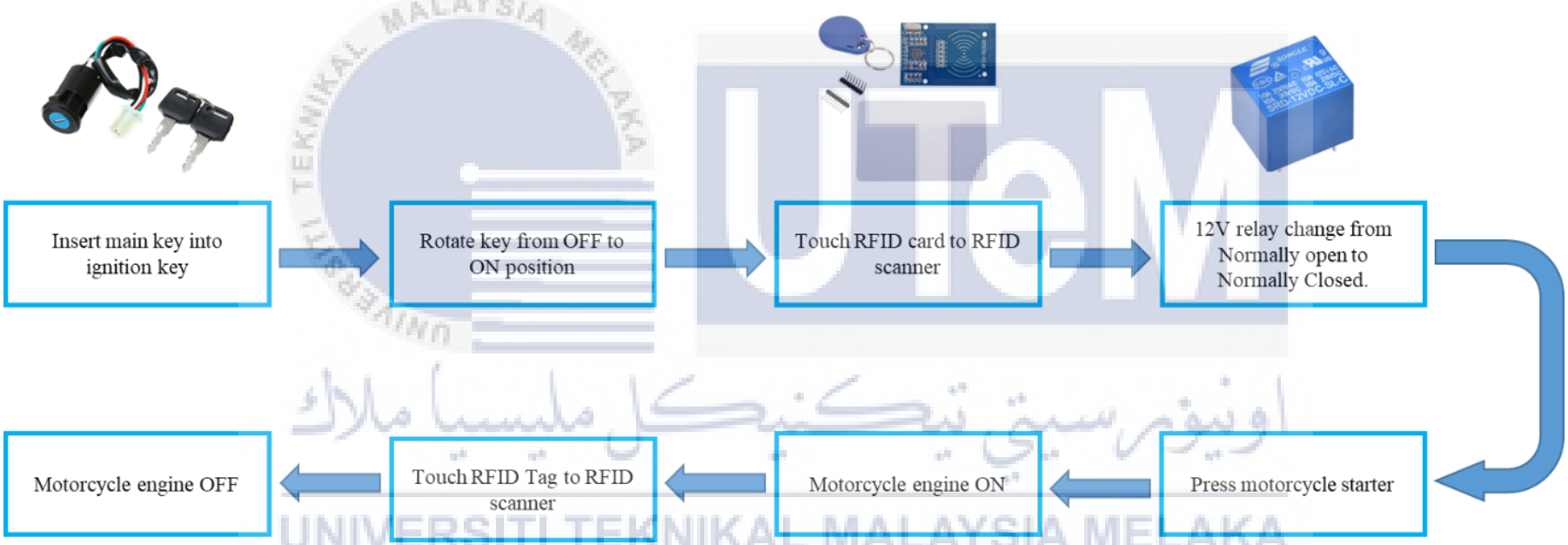


Figure 4.3: Work System of Smart Motorcycle Starter

Smart motorcycle starter required RFID module and 12V relay to turn ON motorcycle engine as shown in Figure 4.3 above. However, when this system was put to the test on a motorcycle, it did not work. The motorcycle engine can only be started by using an RFID card, however it cannot be switched off after using the RFID tag.

Figure 4.4: Installation on motorcycle

Various methods of troubleshooting have been implemented to address this issue, however failures continue to occur. The following are examples of troubleshooting that has been carried out:

1. Used a multi meter to inspect the circuit connection.
2. Used a multi meter to check the status of each component.
3. Replaced each circuit component into new component.

4. Modify the motorcycle's wiring.

It works perfectly when performing simulations on a breadboard using LEDs and a 3.3V DC motor to simulate a motorcycle engine. As a result, this failure might be attributed to communication issues between the motorcycle and the Arduino Mega microcontroller. This system, however, is still required because it will have an impact on other systems.

4.3.2 Burglar Alarm System

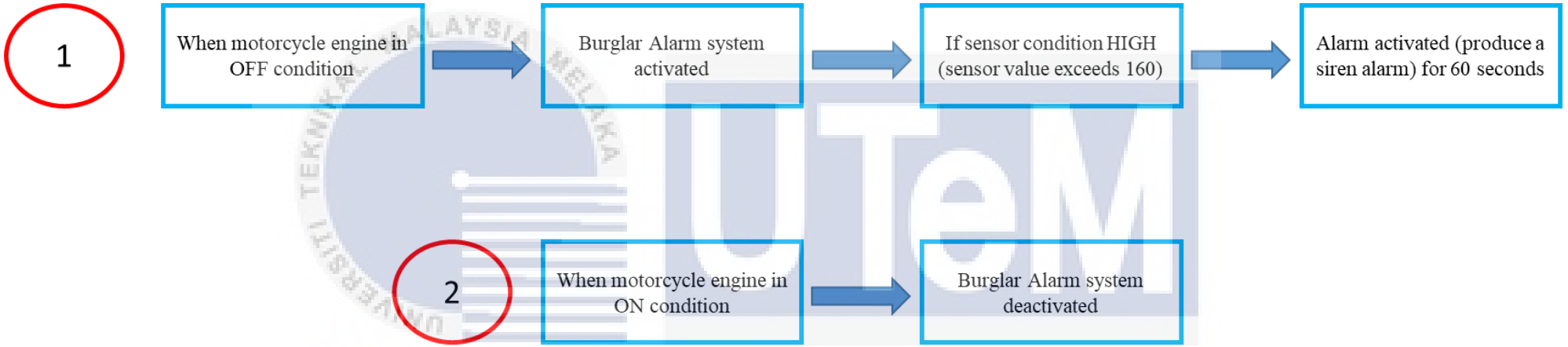


Figure 4.5: Work System of Burglar Alarm

Burglar alarm is a critical component in increasing motorcycle safety. When the piezoelectric transducer detects a vibration or applied pressure greater than 160, the warning alarm will activated. The warning alarm will sound for 60 seconds in this circumstance. The value produced (160) by the piezoelectric transducer is the measurement of time "Read a pulse" either HIGH or LOW on a pin, according to several Arduino tutorial websites. If value is HIGH, for example, pulseIn() waits for the pin to hit HIGH before starting timing, and then waits for the pin to go LOW before stopping timing. It returns the pulse length in microseconds (refer Figure 4.6 below). In other words, the piezoelectric transducer does not take any measurements. The graph in Figure 4.7 below shows the time in microseconds that the sensor's output becomes HIGH. As a result, no units are labelled on the graph's y-axis. Finally, the burglar alarm system produced has been successfully done without any issues.


```
}
void loop(){
  long measurement =vibration();
  delay(50);
  Serial.println(measurement);
  if (measurement > 160){
    risefall(); //alarm activated
  }
}
```

```
long vibration(){
  long measurement=pulseIn (sensor, HIGH);  //wait for the pin to get HIGH and returns measurement
  return measurement;
}
```

Figure 4.6: Important Part of Arduino Program for Burglar Alarm

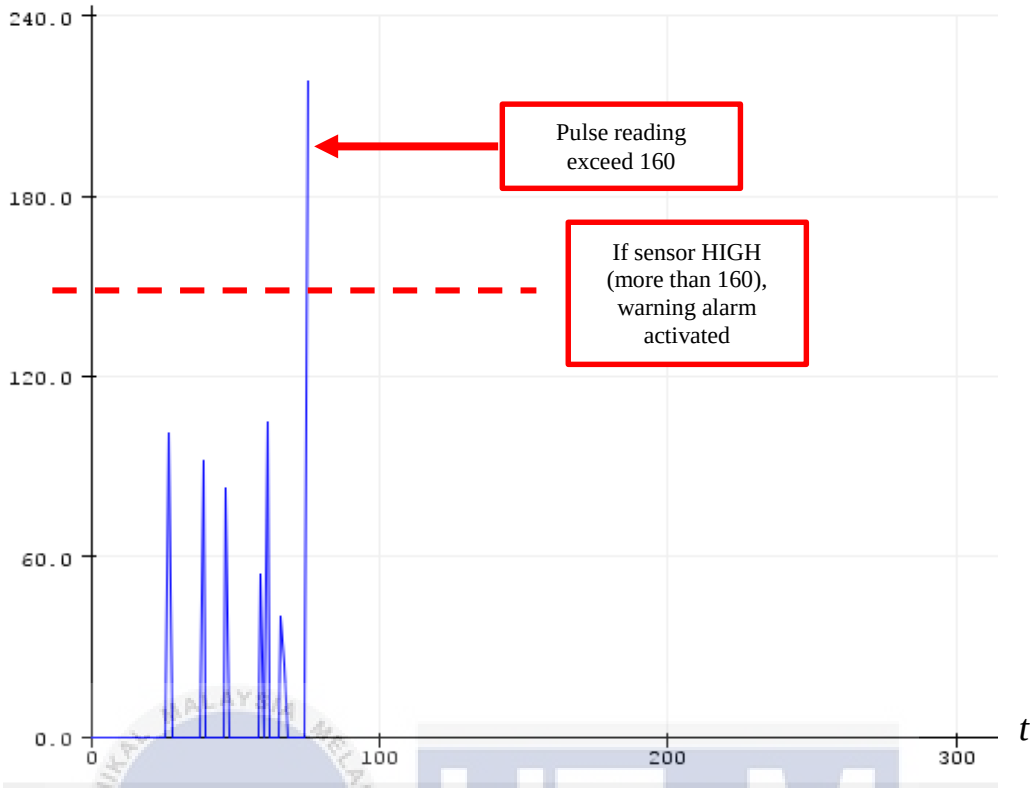


Figure 4.7: Pulse produced by Piezoelectric Transducer

4.3.3 Tracking System

Tracking system The SIM808 GPS/GSM tracking device has allowed consumers to keep track of their motorcycle at all times. Unlike burglar alarms, the SIM808 GPS/GSM will always be operational for 24 hours non-stop. The user will receive a SMS with the motorcycle's location (in the form of a Google map link containing coordinates). The owner can request the location of his motorcycle by typing "Get Location" into the input box, and an SMS with the motorcycle's location will be delivered to him in a few seconds (refer Figure 4.8 below).

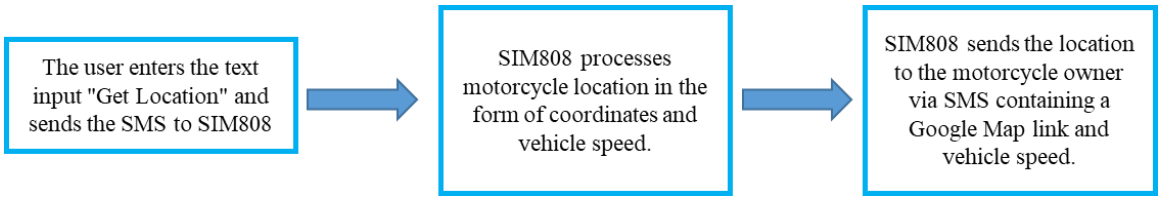


Figure 4.8: First method to obtain the motorcycle's location

The second way (as shown in Figure 4.9) is, the owner himself will receive an SMS of the location of the motorcycle from SIM808 after the burglar alarm system triggered (as a result of an unwanted event that occurred on the motorcycle).

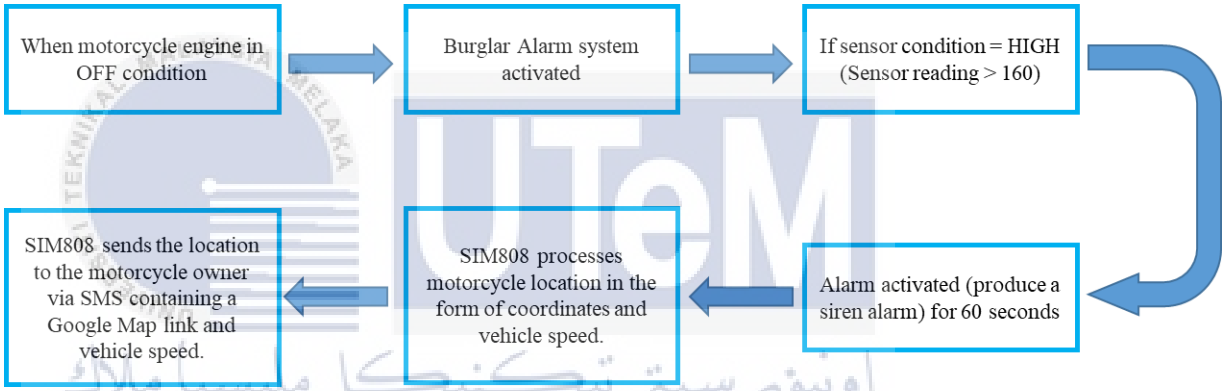


Figure 4.9: Second method to obtain the motorcycle's location

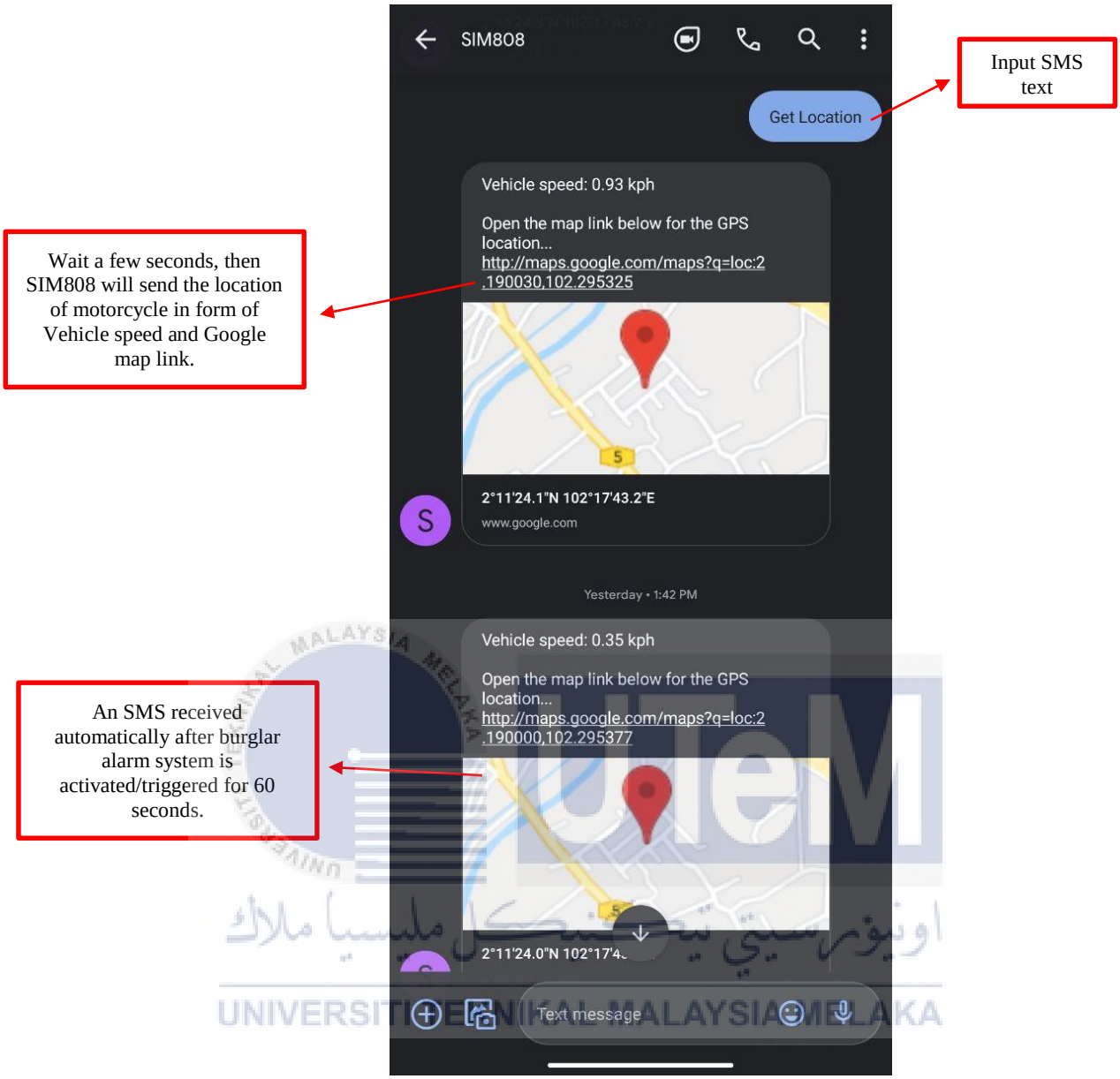
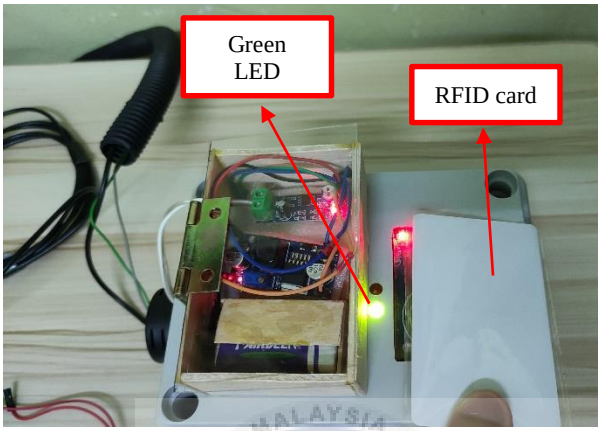
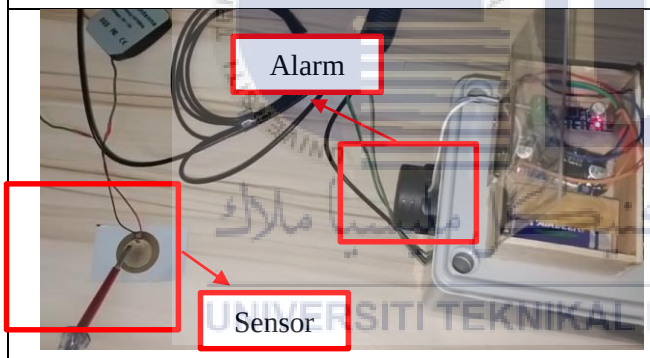
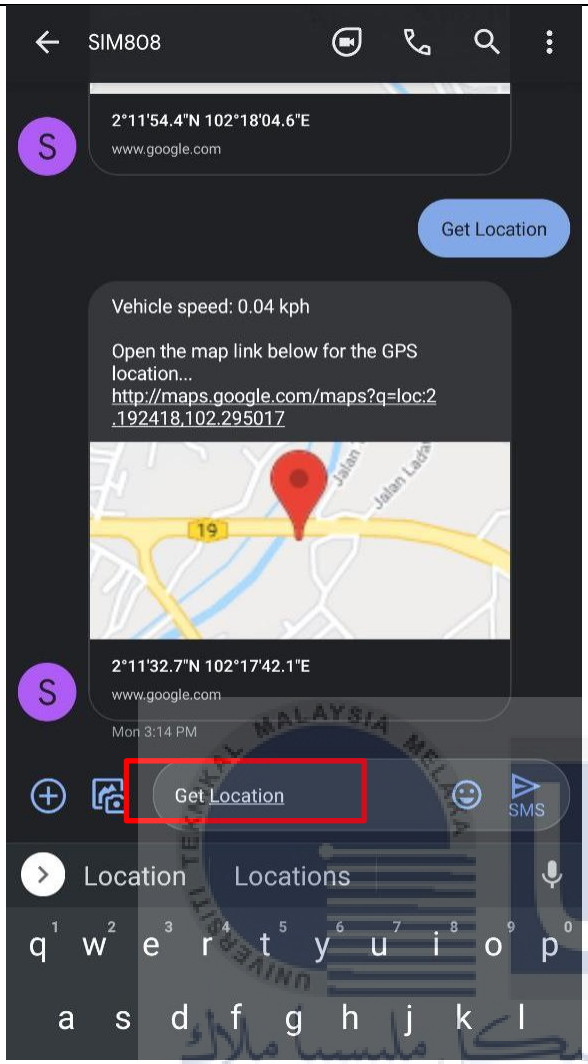


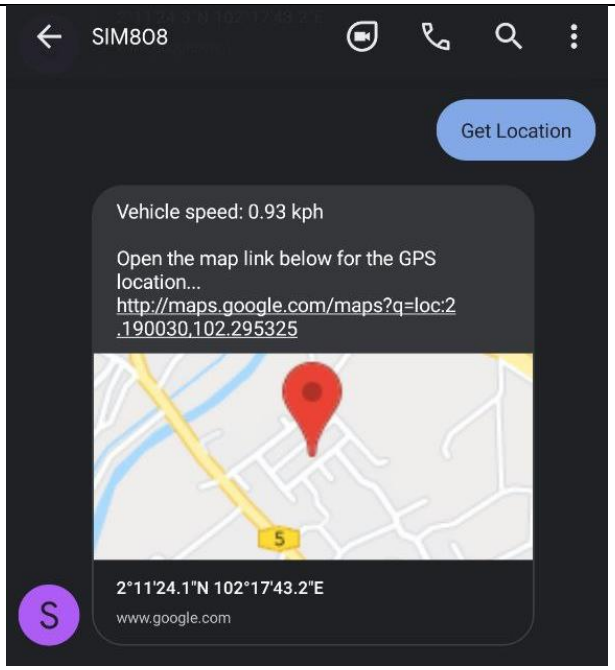
Figure 4.10: Result of tracking system

4.4 Results and Analysis: Riding the Motorcycle

Table 4.1: System process while riding the motorcycle

	To start motorcycle engine, RFID card needs to touch the scanner. After touched it, the green LED lighted up to indicate the engine motorcycle can be turned on.
	Once the green LED is on, the burglar alarm system will not be active (OFF mode). If the user touches the sensor repeatedly, the alarm will not response or not produce any sound.
	The user can request the motorcycle's location via SMS to the SIM808 GPS/GSM module by typing "Get Location".



	After a few seconds, the motorcycle's location SMS is received.

The data has been taken repeatedly through this activity to ensure the system works smoothly:

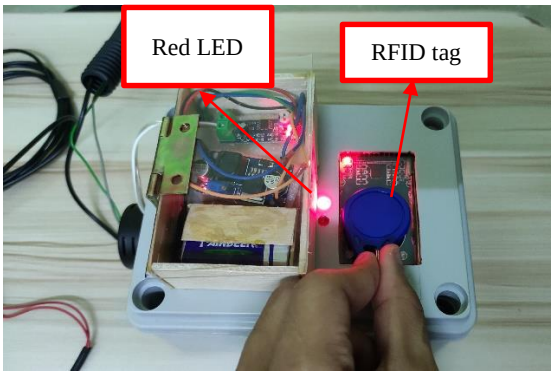
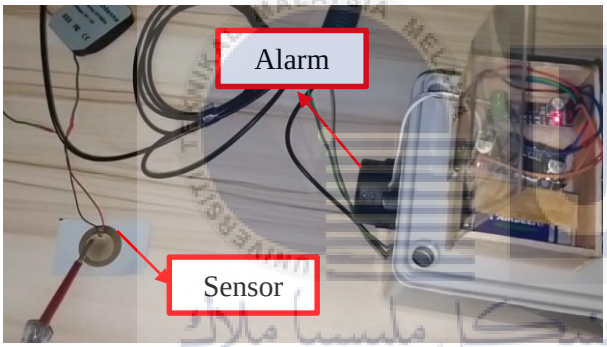
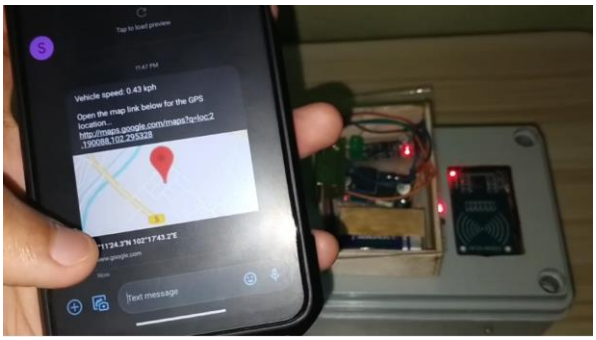
Table 4.2: Data result

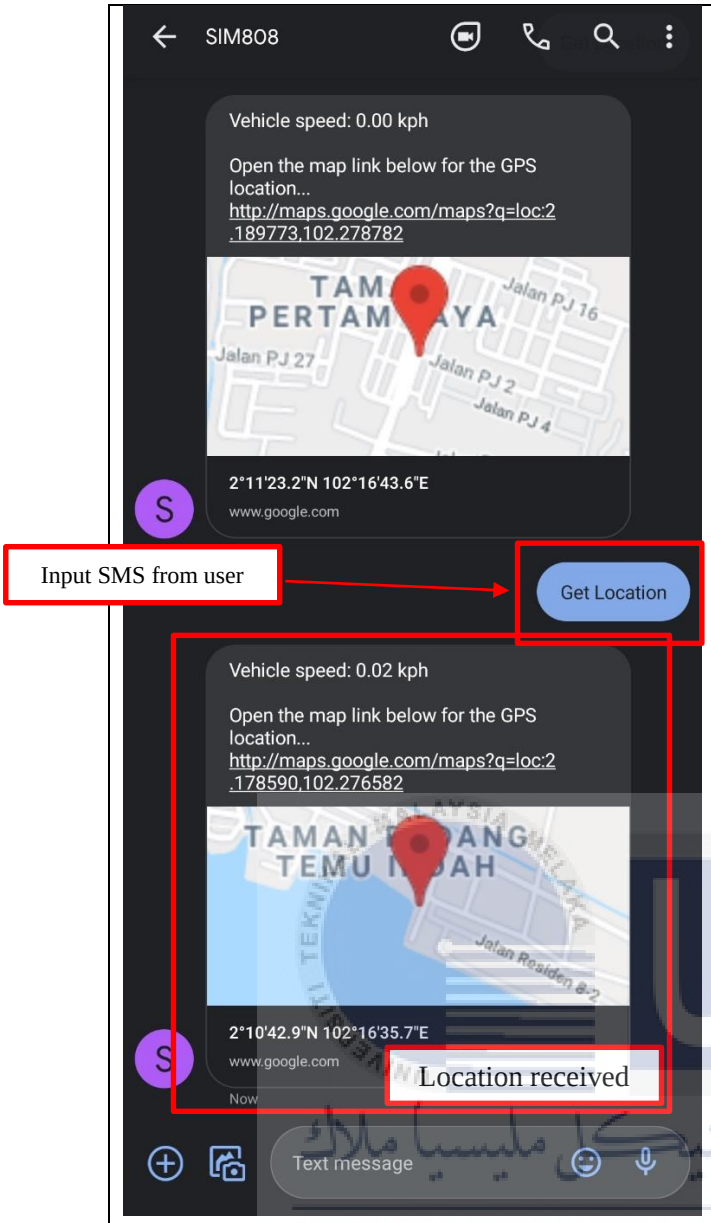
Activity / Attempt	Is green LED ON after RFID card touched scanner?	Is alarm ON after sensor condition is HIGH? (sensor reading value exceeds 160)	Received correct location after "Get Location" input sent to SIM808?
1st attempt	Yes	No	Yes
2nd attempt	Yes	No	Yes
3rd attempt	Yes	No	Yes
4th attempt	Yes	No	Yes
5th attempt	Yes	No	Yes

Based on Table 4.2, the testing process was conducted within 1 day on 27th December 2021. Five attempts were carried out to meet the three criteria or activities listed in the table above. As a consequence, all five attempts met the requirements outlined in Chapter 3: Methodology. The three activities listed in the table are described and chosen because it is important for motorcycle users to determine the effectiveness of this safety system while remaining alert about their motorcycles' safety.

4.5 Results and Analysis: Leaving motorcycle without supervision

Table 4.3: System process when leaving motorcycle alone

	To stop motorcycle engine, RFID Tag needs to touch the scanner. After touched it, the red LED lighted up to indicate the engine motorcycle is turned OFF.
	Once the red LED is on, the burglar alarm system is activated (ON mode). If the user touches the sensor repeatedly (sensor reading is more than 160), then burglar alarm produces like a siren alarm for 60 seconds.
	After 60 seconds, user will receive location of motorcycle via SMS automatically.
	In the same time, the user also can request the motorcycle's location via SMS to the SIM808 GPS/GSM module



by typing "Get Location". After a few seconds, the motorcycle's location SMS is received.

The data has been taken repeatedly through this activity to ensure the system works smoothly:

Table 4.4: Data result

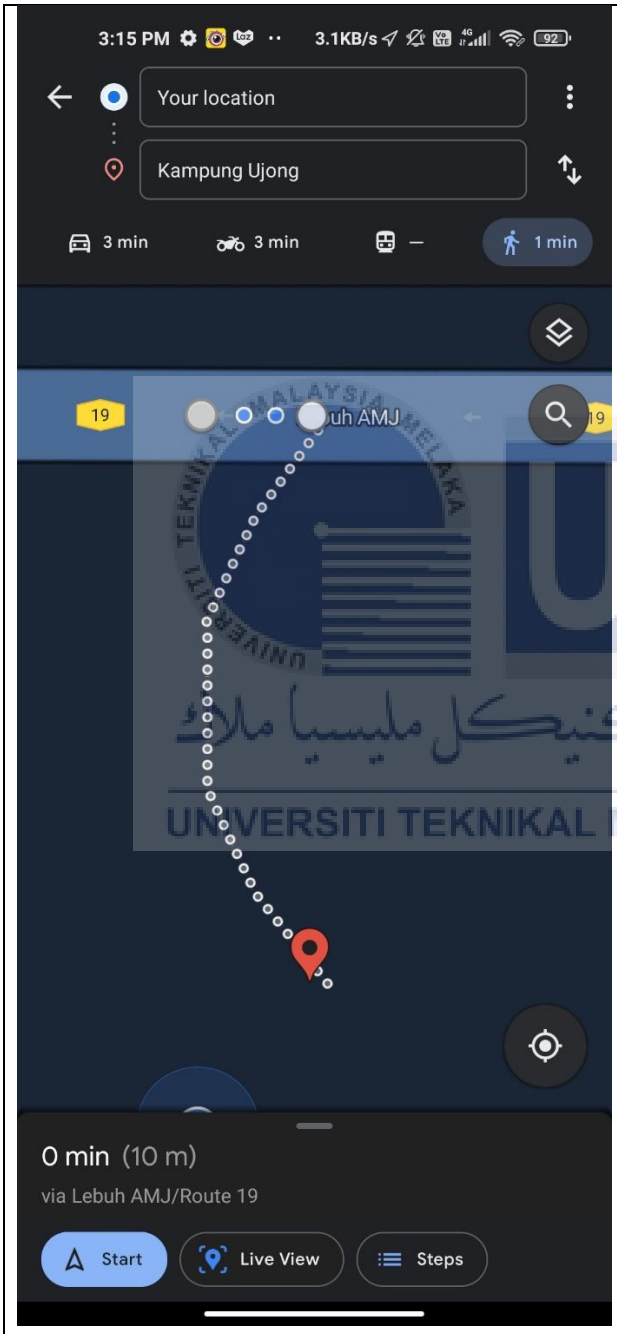
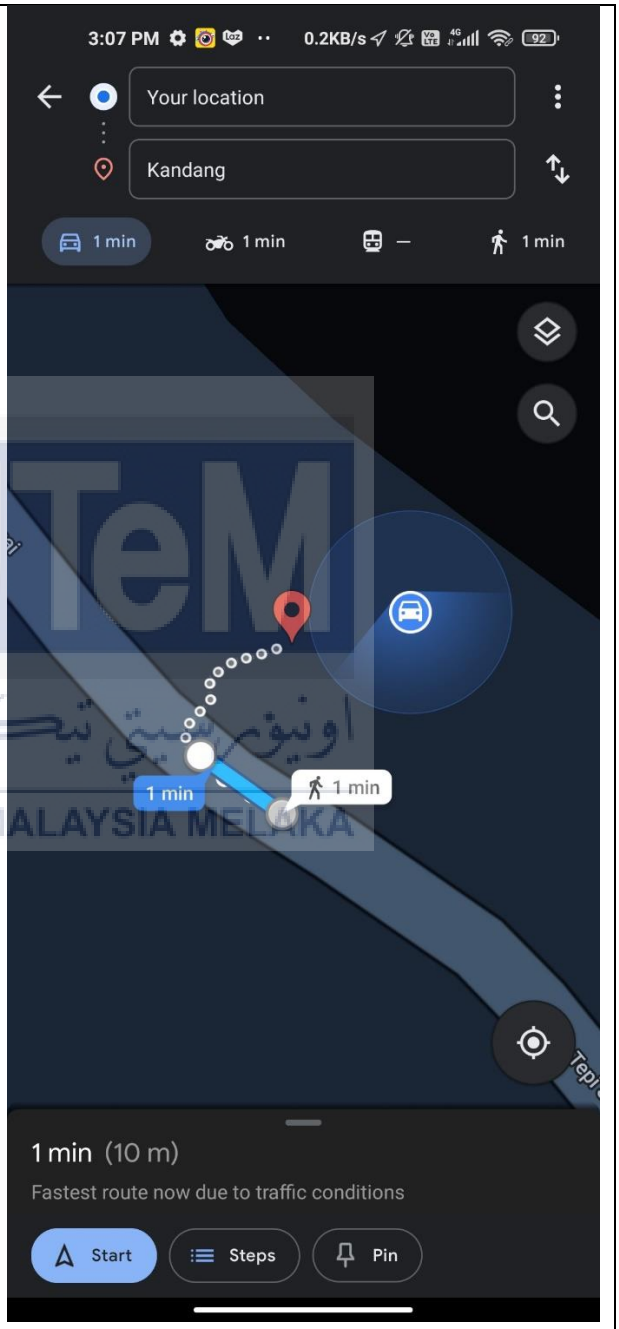
Activity / Attempt	Is red LED ON after RFID tag touched scanner?	Is alarm ON after sensor condition is HIGH? (sensor reading value exceeds 160)	Received location after 60 seconds?	Received correct location after "Get Location" input sent to SIM808?
1st attempt	Yes	Yes	Yes	Yes
2nd attempt	Yes	Yes	Yes	Yes
3rd attempt	Yes	Yes	Yes	Yes
4th attempt	Yes	Yes	Yes	Yes
5th attempt	Yes	Yes	Yes	Yes

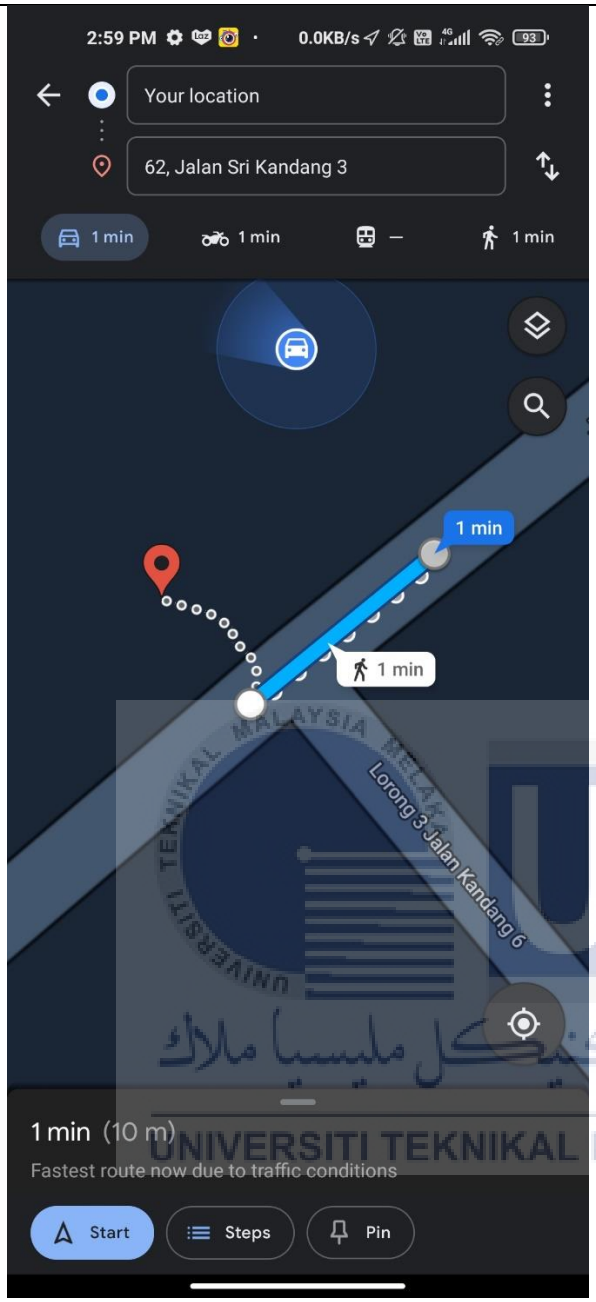
Based on Table 4.4, the testing process was conducted within 1 day on 27th December 2021. Same as previous Table 4.2 result, five attempts were carried out. But these attempts were carried out to meet the four criteria or activities listed in the table above. As a consequence, all five attempts met the requirements outlined in Chapter 3: Methodology. The four activities listed in the table are described and chosen because it is critical part for motorcycle users to determine the effectiveness of this safety system while remaining alert about their motorcycles' safety.

4.6 Location Data

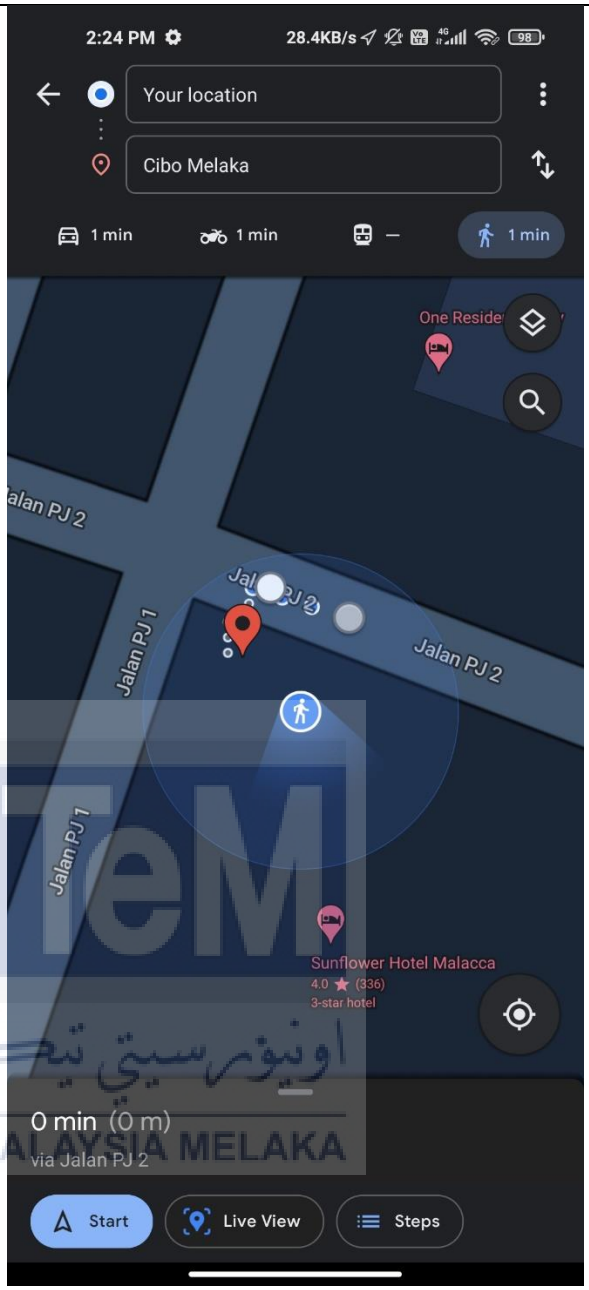
There are several locations have been recorded to test the accuracy of the distance between the motorcycle and the owner of the motorcycle:

Table 4.5: Location Data Result

	
Location 1	Location 2



Location 3



Location 4

Based on the information gathered, it was found that all distance location data had errors ranging from 0 to 10 meters. This means that, even though the motorcycle owner has not yet arrived at his destination, the information on the Google Map indicates that the motorcycle owner has arrived (i.e. his motorcycle). However, the data obtained are still acceptable.

4.7 Summary

The purpose of this chapter is to show how a system can be used to increase the safety of consumer motorcycles. On the motorcycle, this system has been mounted. However, one of the three systems employed in this thesis, the Smart Motorcycle Starter, was not successful. This circumstance arose as a result of communication issues between the Arduino Mega and the motorcycle. Although this was successful during circuit simulation, it did not work when linked to the motor. Despite its failure, this system is still required since it has the ability to impact on other systems. Other systems, such as burglar alarm and a tracking system, have been implemented effectively. After that, all of these systems are merged to create the desired output in two situations: "When riding the motorcycle" and "when leaving the motorcycle alone without supervision". The output data from the two conditions was good, and there were no issues (as shown in Table 4.2 and Table 4.4).

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This research presents a development concept for reducing motorcycle thefts by implementing a smart motorcycle starter with a safety and tracking system. Three systems assure the safety of the user's motorcycle using this smart motorcycle starter with safety and tracking system. Among of them are smart motorcycle starter with ID authentication (RFID module), burglar alarm system (piezoelectric sensor and speaker), and tracking system with SIM808 GPS/GSM module. After conducting some research on previous project research conducted by the authors, the idea to improvise this project has been emerged. Following that, a flow chart for project implementation was created to ensure that all projects completed over the course of a year went well. Simultaneously, a flow chart describing how the project works has been created, ensuring that when the project is tested, all of the desired outputs are produced.

Overall, the production of this project was not completely successful as stated in the objectives section. The first objective is to provide extra security to motorcycles has been accomplished. If an unwanted event occurs on the motorcycle when the motorcycle owner is close to his or her motorcycle, the burglar alarm will be activated and then the location of the motorcycle will be sent via SMS to the owner. If the owner is away from his or her motorcycle, the motorcycle owner is still able to find out the condition of his or her motorcycle by receiving a motorcycle location SMS.

The second objective which is to develop a new method to turn on motorcycle engines and at the same time it can increase motorcycle safety, was not achieved. After the key is

inserted into the ignition key and the RFID card is touched with the RFID scanner, the motorcycle engine should turn on. However, because of communication issues between the Arduino Mega and the motorcycle, this application was not successfully implemented on motorcycles in practice. This system was only successfully tested on breadboard simulations, where a 3.3V DC Motor output was utilized as the motorcycle engine.

The third objective, which is to develop a system to track down the loss of a motorcycle, has been successfully achieved. The SIM808 GPS/GSM module plays a very important role in ensuring that the location of the motorcycle in the form of coordinates is sent to the user via SMS. There are two ways to find out the location of a motorcycle. The first is the user can send an SMS to the SIM808 GPS/GSM module to request the location of the motorcycle. The second option is to wait for the SIM808 GPS/GSM module to provide the motorcycle's location through SMS on its own (rather than asking it from the SIM808 GPS/GSM module).

Although the smart motorcycle starter system is not successful, however, it is still required because it will have an impact on other systems. As a result, the results obtained in Chapter 4 fulfil the specified requirements as well. The system works well in two phases: when riding the motorcycle and when leaving the motorcycle without supervision. The proof is that each phase was tested five times and each time it was successful.

Despite the fact that this project was not fully successful, the concept behind it is ideal for use by all motorcyclists who are always concerned about the safety of their vehicles. It is guaranteed that with this security system, the rate of motorcycle theft will be reduced in a short period of time.

5.2 Recommendations/Future Works

Smart motorcycle starter with safety and tracking system, there are still many aspects that can be enhanced for future use from multiple angles:

i) Because smart motorcycle starters with ID authentication have failed to work on motorcycles due to communication issues between the Arduino Mega and the motorcycle, more learning and research on wiring and motorcycle systems is required.

ii) Make sure the project is not exposed to elements that could cause it to fail or be damaged, such as rain. According to figure in Table 4.2 and Table 4.4 (Chapter 4), various components such as speaker and LED indicators, are not entirely covered.

iii) On the motorcycle, each system and circuit should be fitted in the proper location. For example, the smart motorcycle starter can be fitted near the motor's ignition key, and a SIM808 GPS/GSM and burglar alarm system can be installed inside the motorcycle's body. This is because, as shown in Figure 4.1 and Figure 4.2 (Chapter 4), all circuits and systems in this project were put in a single casing box. It doesn't appear to be very interesting.

iv) Apply this project's concept to various types of vehicles, such as cars, trucks etc. Even though these vehicles have some of the lowest vehicle theft rates in the country, but these vehicles theft cases still occur.

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APPENDICES

Appendix A: Full project coding

```
#include <SoftwareSerial.h>
#include "LowPower.h"
#include <SPI.h>
#include <MFRC522.h>

#define RST_PIN         49          // Configurable, see typical pin
layout above
#define SS_1_PIN        53         // Configurable, take a unused pin,
only HIGH/LOW required, must be diffrent to SS 2
#define SS_2_PIN        48          // Configurable, take a unused pin,
only HIGH/LOW required, must be diffrent to SS 1

#define NR_OF_READERS   2

const int sensor = 24;
byte ssPins[] = {SS_1_PIN, SS_2_PIN};

MFRC522 mfrc522[NR_OF_READERS];   // Create MFRC522 instance.
int ledRed = 28;
int rly = 45;

const int ledGreen =  30;
int ledState = LOW;

////////////////////////////////////////////////////////////////////
//Speaker

int beep_pin=26;

SoftwareSerial sim808(10, 11); //Arduino(RX), Arduino(TX)
//Arduino(RX) to SIM808(TX)
//Arduino(TX) to SIM808(RX)
char phone_no[] ="+601173029768";// replace this with your phone no.
String data[7];
#define DEBUG true
```

```
String state,timegps,latitude,longitude,atmsg,msgi,gspeed;
bool bAdmin,bGetloc,bHelp,bClrmsg=0;

//////////////////////////////////////////////////////Shock sensor



unsigned long currentMillis;
unsigned long previousMillis = 0;

int flg=0;

void setup() {

  sim808.begin(9600);
  Serial.begin(9600);
  delay(100);
  sim808.print("AT+CMGF=1\r");//configure SIM to TEXT mode
  delay(500);
  sendData("AT+CGNSPWR=1",1000,DEBUG);//Turn on GPS(GNSS - Global
Navigation Satellite System)
  delay(500);
  sendData("AT+CGNSSEQ=RMC",1000,DEBUG);
  delay(500);
  sendData("AT+CGPSSTATUS?",1000,DEBUG);//this will check your GPS
status. A working GPS should get either a 2D or 3D fix location
  delay(500);
  //sendMessage("Hi, have a nice day!");

////////////////////////////////////////////////////////Speaker

  pinMode(beep_pin, OUTPUT);

/////////////////////////////////////////////////////////Vibration
sensor
  pinMode(sensor, INPUT);

//////////////////////////////////////////////////////////////////RF
ID
```

```
  pinMode(ledRed,OUTPUT);
  pinMode(ledGreen,OUTPUT);
  pinMode(rly,OUTPUT);
  SPI.begin();        // Init SPI bus
  digitalWrite(rly,LOW);
  digitalWrite(ledRed,HIGH);
  for (uint8_t reader = 0; reader < NR_OF_READERS; reader++) {
    mfrc522[reader].PCD_Init(ssPins[reader], RST_PIN); // Init each
MFRC522 card
    mfrc522[reader].PCD_DumpVersionToSerial();
  }
}

int i =0 ;
char arry2[5] = {0x12,0x55,0xDA,0x34,0}; // put your cards ID here. for
example my card ID is 06,F8,51,1B so write it by this
way{0x06,0xF8,0x51,0x1B,0}
char arry[5] = {0};

void loop() {

  if (Serial.available()>0){sim808.write(Serial.read());}
  if (sim808.available()>0){Serial.write(sim808.read());}
  atmsg = sim808.readString();
  if(atmsg.indexOf("+CMTI: ") >=0) {
    Serial.println("Message received: \r" + atmsg);
    msgi = atmsg.substring(atmsg.indexOf(",")+1);
    sendData("AT+CMGR="+msgi,1000,DEBUG);
    delay(500);//  delay(50);
  }
  //if (bAdmin ==1 && bHelp ==1){sendMessage("Here are the list of
Keywords:\n1. Get Location\n2. Clear Messages\n3. Help");bAdmin = 0;
bHelp =0;}
  if (bAdmin ==1 && bGetloc ==1){getGPSLocation();bAdmin = 0; bGetloc
=0;}
  //if (bAdmin ==1 && bClrmsg ==1){clearMessages();bAdmin = 0; bClrmsg
=0;}

//////////////////////////////////////////////////////////////////
```

```
  readTag();
              if(strncmp(arry2,arry,4) == 0)
                 {

                  digitalWrite(rly,HIGH);
                  digitalWrite(ledRed,LOW);
                  digitalWrite(ledGreen,HIGH);
                  goto label2;

                 }
             if( flg==1 &&(strncmp(arry2,arry,4) != 0))
             {
               digitalWrite(rly,LOW);
               digitalWrite(ledGreen,LOW);
               digitalWrite(ledRed,HIGH);
               goto label1;

                memset(arry,0,5);
                flg=0;
                 }

label1:
long measurement =vibration();
   if (measurement > 160){
   risefall();
   getGPSLocation();
   }

label2:
long maesurement=0;
}

////////////////////////////////////////////////////////////////////////
////

void clearMessages(){
  sendTabData("AT+CMGD=1,4",1000,DEBUG);
  delay(1000);
  sendMessage("Messages cleared!");
```

```
}

void getGPSLocation(){
  sendTabData("AT+CGNSINF",1000,DEBUG);//Get GPS info(location
  if (state !=0) {
    Serial.println("State  :"+state);
    Serial.println("Time  :"+timegps);
    Serial.println("Latitude  :"+latitude);
    Serial.println("Longitude  :"+longitude);
    sim808.print("AT+CMGS=\"");
    sim808.print(phone_no);
    sim808.println("\"");
    sim808.print("\nVehicle speed: ");
    sim808.print (gspeed);
    sim808.print(" kph\n\n");
    sim808.println("Open the map link below for the GPS location... ");
    sim808.print("http://maps.google.com/maps?q=loc:");
    sim808.print(latitude);
    sim808.print(",");
    sim808.print (longitude);
    delay(50);
    sim808.println((char)26); // End AT command with a ^Z, ASCII code
26
    sim808.println();
    sim808.flush();
  }else{
    Serial.println("GPS Initializing…here are the items to check: power
supply should be 12v 2A; antenna should be facing the sky or near the
window; wiring should be correct.");
  }
}

void sendTabData(String command , const int timeout , boolean debug){
  sim808.println(command);
  long int time = millis();
  int i = 0;
  while((time+timeout) > millis()){
    while(sim808.available()){
      char c = sim808.read();
      if (c != ',') {
```

```
        data[i] +=c;
        delay(2);//  delay(100);
      } else {i++;}
      if (i == 7){
      delay(100);
      goto exitL;
      }
    }
  }
exitL:
  if (debug){
    state = data[1];
    timegps = data[2];
    latitude = data[3];
    longitude =data[4];
    gspeed =data[6];
    memset(data, 0, sizeof(data));
  }
}

String sendData (String command , const int timeout ,boolean debug){
  String response = "";
  sim808.println(command);
  long int time = millis();
  int i = 0;
  while ( (time+timeout ) > millis()){
    while (sim808.available()){
      char c = sim808.read();
      response +=c;
    }
  }
  if (debug){
    if (response.indexOf(phone_no)>=0){bAdmin=1;}
    if (response.indexOf("Get Location")>=0){bGetloc=1;}
    if (response.indexOf("Help")>=0){bHelp=1;}
    if (response.indexOf("Clear Messages")>=0){bClrmsg=1;}
    Serial.print(response);
  }
  return response;
}
```

```
void sendMessage(String msg){
  sim808.print("AT+CMGS=\"");
  sim808.print(phone_no);
  sim808.println("\"");
  sim808.print(msg);
  delay(50);
  sim808.println((char)26); // End AT command with a ^Z, ASCII code 26
  sim808.println();
  sim808.flush();
  Serial.println(msg);
}

////////////////////////////////////////////////

long vibration(){
  long measurement=pulseIn (sensor, HIGH);  //wait for the pin to get
HIGH and returns measurement
  return measurement;
}

////////////////////////////////////////////////

void risefall()
{
 for (int count=1;count<=99;count++){
  float rise_fall_time=180;
  int steps=50;
  float f_max=2600;
  float f_min=1000;
  float delay_time=rise_fall_time/steps;
  float step_size=(f_max-f_min)/steps;
  for (float f =f_min;f<f_max;f+=step_size){
    tone(beep_pin,f);
    delay(delay_time);
  }
   for (float f =f_max;f>f_min;f-=step_size){
    tone(beep_pin,f);
    delay(delay_time);
  }
```

```
  noTone(beep_pin);
 }
}

void readTag()
{
  for (uint8_t reader = 0; reader < NR_OF_READERS; reader++) {
    // Look for new cards

    if (mfrc522[reader].PICC_IsNewCardPresent() &&
mfrc522[reader].PICC_ReadCardSerial()) {

      dump_byte_array(mfrc522[reader].uid.uidByte,
mfrc522[reader].uid.size);

      for(i = 0;i < 4;i++)
      {
       arry[i] =  mfrc522[reader].uid.uidByte[i];
      flg=1;
      }

      for(i = 0;i < 4;i++)


      MFRC522::PICC_Type piccType =
mfrc522[reader].PICC_GetType(mfrc522[reader].uid.sak);

      // Halt PICC
      mfrc522[reader].PICC_HaltA();
      // Stop encryption on PCD
      mfrc522[reader].PCD_StopCrypto1();
    } //if (mfrc522[reader].PICC_IsNewC
  } //for(uint8_t reader
}

void dump_byte_array(byte *buffer, byte bufferSize) {
  for (byte i = 0; i < bufferSize; i++) {
  }
}
```

Appendix B: Project casing box

Appendix C: Project installation on motorcycle