
# UNIVERSITI TEKNIKAL MALAYSIA MELAKA

## DEVELOPMENT OF MOTORCYCLE SECURITY SYSTEM USING RFID AND GSM

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

by

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# DECLARATION

I hereby, declared this report entitled “PSM Title” is the results of my own research except as cited in references.

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# APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Electronic Engineering Technology (Telecommunication) with Honours. The member of the supervisory is as follow:

……

(Project Supervisor: Ahmad Sayuthi Bin Mohamad Shokri)

# ABSTRAK

Isu kes kecurian motosikal sudah lama berakr umbi dalam seluruh bandar dan malangnya phenomena ini telah menjadi sesutu perkara yang umum bagi rakyst Malaysia. Menuruti statistika dari PIAM, kes kecurian motosikal menduduki tempat pertama dalam jenayah harta benda. Terdapat beberapa faktor yang menyumabng kepda tragedi ini belaku. Antara faktor-faktor adalah ia lebih mudah dicuri disebabkan kebanyakan motosikal tidak dilengkapi sebarang sistem pencegahan kecurian motosikal. Walaupun terdapat pelbagai jenis sistem pencegahan dijual dalam pasaran, namun terdapat sebahagian sistem tersebut tidak mencapai tahap yang memuaskan dari segi ketahanan dan kecekapan. Selain itu, kos untuk sistem keselamatan yang bercanggih amat tinngi dan kebanyakan penunggang tidak mampu memiliki. Penyelidik sebelum ini telah memberi tumpuan dan percubaan kepada teknologi seperti *Bluetooth,* kod *QR* dan RFID untuk melaksanakan sistem keselamatan motosikal yang mampu memberi tahap keselamatan yang mantap. Dari hasil projek sebelum ini, ia terbukti RFID dan Sistem global untuk komunikasi (GSM) mamp memberikan tahap keselamatan terbaik pada motosikal. Oleh itu, tujuan projek ini adalah untuk mengkaji tentang RFID dan GSM dan merekabentuk sistem keselamatan motosikal yang berkos rendah. Sementara itu, Arduino Uno telah dipilih sebagai pengawal teras untuk projek ini berdasarkan segi kos yang rendah dan mesra pengguna. Selain itu, hubungan antara tindak balas masa GSM dengan jarak akan dikaji. Akhirnya, prototaip sistem yang menggabungkan RFID dan GSM berjaya dibinakan bersama-sama dengan sensor MPU-6050 dan buzzer. Analisis pada masa tindak balas terhadap jarak menunjukkan satu fakta penting bahawa jarak boleh menjejaskan prestasi masa dari segi menerima mesej. Adalah disyorkan bahawa penyelidik selanjutnya mewujudkan aplikasi mudah alih bersama-sama dengan Wi-Fi atau mengunakan sistem *Internet of Things* (IoT) .

# ABSTRACT

Motorcycle thief issue becomes a common problem in cities across the Malaysia. It has ranked the top property crime among others. There are several factors contribute to the pervasiveness of motorcycle theft where motorcycle is more attractive due to their expensive aftermarket parts. Moreover, motorcycle is easier to steal than other vehicles since it typically doesn't equipped any advance anti-theft devices. Even though there are various types of security system and yet some are not reliability and expensive in term of cost which not affordable by most of the motorcyclist. Past researchers have focused on Bluetooth, Quick Response (QR) code and RFID on implementing the motorcycle security system. From the past project results, it founds that RFID and GSM technology capable to give best possible of security level on motorcycle. Hence, the intent of this project is to study on radio frequency identification (RFID) and Global for Mobile Communication System (GSM) and aim to design a low cost anti-theft motorcycle security system. Meanwhile, Arduino Uno was preferred as the core controller for this project by virtue of the low cost and user friendly facts. Besides, this project aims to investigate the relationship between the GSM response times against time. The major finding of the research is that, passive RFID transceiver used electromagnetic coupling in the radio frequency to uniquely identify the transponder within a short range. In addition, the GSM serve as the communication protocol used by mobile phone to provide the owner an alert SMS message. Then, a prototype of motorcycle security combining the RFID and GSM was successfully developed along with MPU-6050 sensor and buzzer as an extra feature. The analysis on the response time against distance shows a significant fact that distance may affect the time performance in term of receiving message. At the nutshell, the prototypes able to function and the research information as the information derived is helpful to next researcher for improving near future. It is recommended that the further researcher able to demonstrated with creating mobile apps along with Wi-Fi or implementing with Internet of Things (IoT) system for the motorcycle security system.

# DEDICATIONS

This thesis is dedicated to:

My beloved family,

My Mother, Ling Choon Moi;

My Supervisors,

My Lectures,

And all my friends,

Thank you for the nice support and powerful encouragement.

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# LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

| | | |
|---|---|---|
| JPJ | - | Royal Transport Department |
| RMP | - | Royal Malaysia Police |
| GPS | - | Global Positioning System |
| RFID | - | Radio Frequency Identification Detection |
| PIAM | - | General Insurance Association of Malaysia |
| GSM | - | Global System for Mobile Communication |
| QR | - | Quick Response |
| BLE | - | Bluetooth Low Energy |
| NFC | - | Near Field Communication |
| ISO | - | International Organization for Standardization |
| EPC | - | Electronic Product Code |
| RO | - | Read Only |
| WORM | - | Write Once Read Many |
| RW | - | Read-Write |
| DoS | - | Denial of Service |
| RF | - | Radio Frequency |
| SE | - | Secure Elements |
| HCI | - | Host Controller Interface |
| GSMA | - | GSM Association |
| MIM | - | Man In Middle |
| TDMA | - | Time Division Multiple Access |
| MS | - | Mobile Station |
| BSS | - | Base-Station Subsystem |
| BTS | - | Base Transceiver station |
| MSC | - | Mobile Service Switching Center |
| NSS | - | Network and Switching Subsystem |
| HLR | - | Home Location Register |

| | | |
|---|---|---|
| VLR | - | Visitor Location Register |
| EIR | - | Equipment Identity Register |
| AUC | - | Authentication Center |
| GMSC | - | Gateway Mobile Switching Centre |
| OSS | - | Gateway Mobile Switching Centre |
| SMS | - | Short Message Service |
| OMC | - | Operation and Maintenance Center |
| IMSI | - | International Mobile Subscriber Identity |
| GPRS | - | General Packet Radio Service |
| PWM | - | Pulse Width Modulation |
| IDE | - | Integrated Development Environment |
| AT | - | ATTENTION |
| LCD | - | Liquid Crystal Display |
| EGSM | - | Extended Global System for Mobile Communication |
| DCS | - | Distributed Control System |
| SRAM | - | Static Random-Access Memory |
| EEPROM | - | Electrically Erasable Programmable Read-Only Memory |

# CHAPTER 1

# INTRODUCTION

## 1.0 Introduction

Motorcycle is one of the popular transportation for citizens in Malaysia. The reason motorcycle becomes the favourite due to convenience during the traffic congestion and also save cost in terms of fuel and maintenance. However, motorcycle rank at the top of the property crimes due to lack of security system and also the careless of the owners.

## 1.1 Background

Since from the last past century, transportation becomes a vital object that needed by humans. Historically, bicycle has been invented in 18$^{th}$ century by Pierre Michaux (Mary Bellis, 2014). But some of the brilliant scientist still keep trying so hard on development and searching the way to make a transport used on public roads that are more automated and faster to full fill what human needs. Basically, a transport which able to helps them to work more efficient, travel farther as well as explore more territory in daily are very important. Based on the objectives and goals in mind, finally the first steam-powered motorcycle was been invented at 1867. Nowadays, motorcycle has been one of the main popular transportation that broadly used in Malaysia. According to the statistic diagram (2011) showed by Road Transport Department (JPJ) where Johor Bahru, Kuala Lumpur, Penang are the top three state which have the largest population number of motorcycle among 13 states in Malaysia. Not surprisingly, motorcycle was the primary selection used during on

heavy traffic furthermore it save the cost in terms of fuel and maintenance compared to motorcar. Therefore, motorcycle has been the most preferable, convenient and affordable mode transport in most of the city in Malaysia.

Nonetheless, the motorcycle becomes properties that frequently target by the theft due to easily on trading and lack of security system (Ouyang et al. 2011). Based on New Straits Time (2016) reported that there are 12,216 motorcycles theft cases happened in last year 2016 moreover it recorded the highest quantity among others automobile. This criminal issue has attracted the attention of all the citizens in Malaysia and some of the motorcycle biker started worried about when their vehicle will becomes one of the victims. Our national Royal Malaysia Police (PDRM) has launched various operations in addressing the problem but the outcome not really convinced since the main problem probably due to personal such as negligent attitude and lack of their security systems on motorcycle. Therefore, development on the security systems is much more required to overcome this social issue (Wan Wafiy Iffat 2015). To protect the assets against from loss and crime, an excellent functionality security is very essential (Vishwanath et al. 2013) . Theoretically, anti-theft security system is divided in two categories which are active and passive. The main differences between active and passive anti-theft system is where the passive anti-theft system able to automatically lock when the ignition or mechanism has turned off and there is no additional is required. In other words, it prevents the motor engine to turn on unless there is a key or coded programmed key. While for the active anti-theft system, it needs some self-regulating or physical action such as pushing a button on the remote control or placing a “lock” in front of the motorcycle before there are been activate. Although, there are diverse mechanisms or active anti-theft systems that probably able to purchase at the market but mostly the costs are not affordable by the motorcycle biker (Nasir & Mansor 2011). For instance, the motorcycle with tracking systems using Global Positioning System (GPS) to locate the destination are mostly recognized by the bikers however the installation cost are expensive compared with others devices (Sriborrirux et al. 2015). While, the disc lock and U-lock is the most commonly and popular security device adopted by the motorcycle rider due to user friendly and low cost. It ordinarily used by only attached to the front wheel of motorcycle but the limitation was easily broken up by a spiky

cutter. Consequently, there should have one anti-theft system that are user friendly, high efficient and affordable for the motorcycle bikers.

The wireless radio wave communication is widely used and becomes one essential technology for transmission data from one point to another point in modern society (Phogat & Anand 2014). Radio Frequency Identification Detection (RFID) is a wireless technology which widely applied into the access control and security system (Jinaporn et al. 2008). Globally, RFID was rapidly emerge in Latin America since deployment of RFID technology allows reducing fabrication and transportation costs and time expanded on inventories as well as improves organization productivity (Rodríguez et al. 2012). Besides of that, RFID are getting promising in the anti-theft system for tracking and identifying authorize. The major components of an RFID system are tags and the reader which exchange data through the radio wave automatically (Shah & Singh 2016). While, GSM is greatly tends to utilize as the monitor and communicate device directly with the owner by sending the message during unauthorized access as well as reduce the personal risk (Ibrahim & Victor 2012).

## 1.2 Problem Statement

Nowadays, the growing numbers of property crimes give large impact on the overall of Malaysia crime index. As claimed by reporter Ani Shamira (2016), where the total crime index has been raised about 4.5 per cent which basically due to the escalating ratio of property crime. Among the categories in property crime, motorcycle theft is ranked at the top of crimes happened compared to others. There are 12,216 motorcycle theft cases has been reported in last year 2016 where an average of 33 motorcycles has been stolen every day across the country. The numbers shows that the motorcycle theft issue reached a critical level and become prime target for robber. Even though Royal Malaysia Police (RMP) has launched few strategies or programs to combat the issue however it seems like doesn't work effetely. This kind of cases happened mostly relate to some formidable factors such as high levels unemployment, high population density, low income and unstable of

economic. A study done by Zulkifli et.al (2015) where applying negative binominal regression model analysis on vehicle theft crime in peninsular Malaysia show that high population density such as Klang Valley, Johor Bahru and Penang having the highest crime rate of theft motorcycle. Other reasons, it might be also occurs due to lack of their security systems on motorcycle and also personal problem such as negligent attitude of the owners.

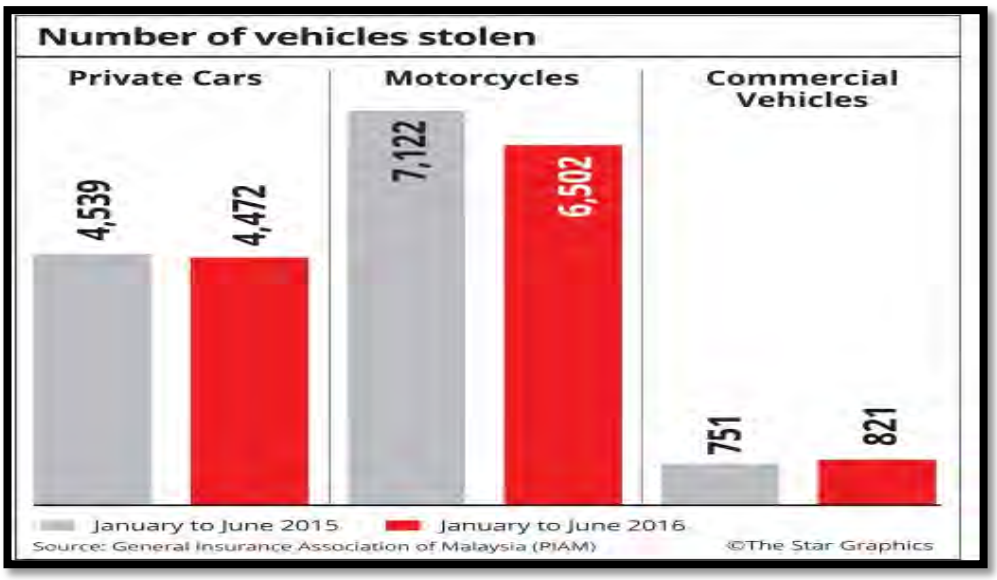


Figure 1.1: The number of vehicles stolen within January to June of 2015 and 2016. (Source: General Insurance Association of Malaysia, PIAM in 2016)

Due to this threat, many motorbike security system manufacturers are claiming to provide a better protection system. It's no doubt some are genuine while others are unreliable. Certainly, there are varieties of motorcycle security gadget sold in the market such as chain lock, disc lock, U-lock, alarm system as well as some wireless remote security device. However, there are some pros and cons in each of the anti-theft device. For instance, the lock systems having few limitations such as low durability, short life time span and not a corrosion resistant which probably will causes malfunction or stuck when exposed to weather elements. Furthermore, it is less portability because of heavy hence it's difficult and inconvenience to transport. Besides of that, stealing a motorcycle is more easily compared to motor vehicles since light weighted and easy for trade. Hence, motorcycle becomes a prime target for robbers. Therefore, an ideal anti-theft system should be alert or inform the

motorbike owner when there is some unauthorized approaching and attempt to steal or move your motorcycle. Conversely, some of people will ignore the alarm system as well as it is easy to disconnect from battery cable or been cutting down by the professional theft. Another problem that can't be overlooking is the overall cost of the anti-theft devices. Generally, the existence GPS tracker system provides advance security compared to the manual system. However, the main drawback was the high initial implementation cost. Majority of the motorcyclist are not affordable to install this luxury item. At the mean time, the maintenance cost and the efficiency also becomes one of the considerable points from the motorcycle owner (Baker.J., 2015).

## 1.3 Objectives

Based on the problem statements discussed above, the objectives of this study are:

i. To study motorcycle security system using Radio Frequency Identification Detection (RFID) and Global System of Communication (GSM) to give the best possible level of safety.
ii. To design an affordable anti-theft motorcycle security system.
iii. To examine the relationship between the response time of GSM technology against with the distance.

## 1.4 Scope

The scopes of this research work are established based on the objectives that mentioned. This security anti-theft system is built using the Radio Frequency Identification (RFID) as the authority detection purpose. Another essential point, the Global System of Communication (GSM) will be adopted as the communication devices between the owners through sending a short message to warn them. Lastly, Arduino Uno microcontroller will set as the core controller for governing the input and output for this project.

## 1.5 Organization

This project focuses on development a low cost and reliability of motorcycle security system by using RFID and GSM technology. This report consists of five chapters. First, a short introduction to the problem, objective and scope are given in chapter one. Then, follow by chapter two literature reviews on existing methods adopted and various technologies that implemented in previous project. In the mean times, the comparison regarding pros and cons will be discussed. Next, the components and methods description that planned to use will be explained in chapter three. Furthermore, a brief of overview flow of the project may show here. In the chapter four, the results including data tabulation and project analysis will be shown then discussed. Finally, conclusion and future recommendation will be emphasises in chapter five.

# CHAPTER 2
# LITERATURE REVIEW

## 2.0 Introduction

In this chapter, the purpose is to review previous studies that done by other researcher that relevant to the anti-theft motorcycle security system. In the mean time, the validity of previous research according will be discuss and determine. Similarity, literature that was investigated included the wireless technology adopted, features and analyzed on completeness regarding to their strength and weakness. Methods and results in previous papers will be compare and evaluate in order to produce good methodologies for the completion of this project

## 2.1 Related Works

### 2.1.1 PIC Based with GSM Motorcycle Security System

Nowadays, a high reliability anti-theft security system becomes more crucial to motorists in modern society due to the increasing number of motorcycle theft issue. Various research and numerous prototypes of motorcycle anti-theft system have been developed using various platform. Until now, a neither perfect nor reliable motorcycle security system haven't exists and engineer and technologist still finding the best way to develop a high reliable, greater features as well as lower in term of cost. Recent improvement in GPS, GSM, Quick Response (QR) code and several of