Motorcycle Security System using GSM and RFID

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Abstract – *This paper is designed to create a model of motorcycle safety system using Radio Frequency Identification (RFID) and Global System of Communication (GSM) for controllable and improve safety on motorcycles. According to the latest crime rate index, motorcycle theft crime record were high compared with the criminal cases of other types of vehicles such as cars. RFID is a new method in a very efficient security system for smaller areas and limited to a certain distance communication. Basically this system will be detected by an identification tag that was created specifically to these tools while with added some mobile phones and GSM as an intermediate device that connects to a device microcontroller. This system provides the best possible level of safety for motorcycle users from hackers or thieves. It has the sound of the alarm system each time the system is compromised or the occurrence of robbery. Noise will be generated automatically once the user motorcycles will be notified via text message alert messages (SMS) when the events that occurred during the invasion or burglary. This research uses Passive RFID as a second key to turn on the motorcycle and also using microcontroller as a medium to control the function of the whole system. As a prototype, push button also needed in this type of security to show that if any movement interrupted happen to motorcycle.* **Copyright © 2015 Penerbit Akademia Baru - All rights reserved.**

Keywords: Security System, RFID, GSM, Anti-Theft

1.0 INTRODUCTION

Motorcycle theft crime index still recorded the highest crime in our country with many cases of losses reported at the police station. This happens due to lack of their security systems on the vehicle. Other reason is due to the negligent attitude of the owner of the security measures taken charge of the vehicle and the attitude of the owner's. The purpose of this paper is to build an increase security system for motorcycle using a Radio Frequency Identification (RFID) and also Global System for Communication (GSM).

RFID is used to identify and track the tags attached to objects automatically in the event of contact with the object and it also non-contact use wireless radio frequency electromagnetic fields to transmit data. RFID is a tool that potential successor to the technology of the bar code. Systems RFID has a features which is it can withstand, rugged environments and can be read through a variety of visual materials that challenge with remarkable speed. Three basic components consists in RFID is readers, namely and tags.

According to E. Ergen et al, [1], Tracking Components and Maintenance History within a Facility Utilizing Radio Frequency Identification Technology, RFID reader is a device used to perform the interrogation of RFID. The tag reader has an antenna that works for radio waves

emitting and the tag will respond by sending back data. There are some factors that can affect the distance at which a tag can be read. The factors are as follows: the frequency used for identification, antenna gain, orientation and polarization of the reader antenna and transponder antenna, also the placement of the tag on the object that is to be recognized. All these factors mentioned will have an impact on a variety of reading RFID system.

K. Sushma et al [2], created and designed reservations Based RFID Vehicle Parking System Using GSM and RFID technology. Radio frequency identification (RFID) is an automatic identification method where there is information stored in the RFID tag. The RFID tag is a device to recognize and locate the desired items by using radio waves. Tags can be detected from several meters away. This tag consists of electronically stored information data which can be read up to several meters away. RFID system has three major components of tags. One is used for transponders, then, RFID reader is used for transceiver and third, protocol set used for the information transmitted.

Manjusha Patil et al, [3], Created a project of Wireless Sensor Network and RFID for Smart Parking System. They did some research and conclude that RFID and WSN is the best solution for this project to recently turned to applying technologies for organization of parking area. It is realized that this simple development could be applied to monitor and handle vehicles parking. System will inform the user which means drivers about the situation of the parking area is available and which area should the driver should be direct to. This kind of system helps to minimize traffic congestion problems and driver's frustration while finding a vacant space in a crowded parking garage.

Raghu Ram Gangi [6], created about Locker Opening and Closing System Using RFID, fingerprint, password and GSM. The most important function in the RFID system is the ability to identify plus the capable of tracking the location of tagged items. Based on the power source, RFID tags have three main categories such as active tags, passive tags, and semi-passive tags or semi-active tags. Active tags contain both a radio transceiver and the battery used to power the transceiver. Active tags are usually more powerful than those passive tags / semi-passive tags. RFID tags can also be classified into two categories which is the tag with memory read or write and second is the tag with read-only memory.

GSM is a cellular digital system standard phones which are widely used in advanced technology industries. First named after the frequency band around 900 MHz, GSM -900 provide the basis for several other networks using GSM technology, usually GSM networks operating at frequencies band around 1800 MHz and 1900 MHz GSM network technology it has become a largest source of industrial technology for and the communication protocol that allows the transmission of text messages between phone devices and sending short message.

Harshadbhai Krishna Patel [5], From the Designs of GPS and a GSM Based Vehicle Location and Tracking System, he illustrated that the GSM modem is a specialized type of modem that accepts a SIM card, and operates a subscription to mobile operators, such as mobile phones. GSM uses a communication process known as circuit switching which allows two devices to communicate to each other. When both devices are connected, a constant stream of digital data will be transmitted. The GSM network consists of the main system, Switching System (SS), Base Station (BSS) and Mobile Station (MS). GSM module is used to transfer data from wide distance. It also can identify the data being transmitted. It usually supports AT commands. SIM300 can be integrated with a variety of applications.

N. Suthanthira Vanitha, et al [7], created the Vehicle Tracking and Locking System Based on GSM and GPS stated that the GSM modem is a specialized type of modem that accepts SIM cards on mobile numbers of customers through a network, such as mobile phones. MAX232 logic is used to convert TTL logic levels to RS232 converter which is usually used between the microcontroller and the board GSM.GSM Modem is the RS232-compatible logic because it takes-3V to-15V logic high and +3 v to +15 as low. The signal at pin 11 micro-controller sent to GSM modem through max232 pin 11 signal. It is a cell phone without a display.

Nurul Nadia Yahiya [7], stated that the RFID is coming into an increasing wide use in the industry as an alternative type to the bar code preference. Furthermore, radio frequency identifier (RFID) is also a generic term which is currently used to describe a system that transmits the identity of an object or person wirelessly, that is by using radio waves. It falls into the broad category of automatic identification technologies. Bar codes are frequently seen as a single word, consists of Barcode small lines (bars) and spaces affixed to retail store items, identification cards, and postal mail to identify a number of specific product, person, or location. This code uses a sequence of vertical bars and spaces to represent numbers and other symbols too.

2.0 METHODOLOGY

2.1 Software Design

Basic process of writing the software for motorcycle security system is illustrated in the flow chart as shown in Figure 1. System is totally secure when in the Secure Mode. Firstly, the system will check either the system receive the ID number from the RFID reader or not. If ID number received, system will compare it with the preprogram ID number. If the number matched than the secure mode will be deactivated and user can used the motorcycle as usual. But if number does not match, the system will trigger an alarm and the owner will be automatically informed via mobile phone.

2.2 Hardware Design

Figure 2 show the final circuit diagram that was used in this system. This circuit diagram was draw by using Proteus software. After simulation, it was build using actual electronic component. This circuit have been test by using a several method and referring to data sheet of all components to complete the whole connections after testing of this system.

Microcontroller PIC16F877A was use in this security system as a brain to read and process the data receives. It will control and verify all the data coming from input device such as RFID reader, sensor and switch. Table 3.1 shows the port and description of PIC16F877A that have been used in order to build the security system. Electronic box casing was used for storage a main electric circuits which are SK40C, relay, battery and GSM was placed inside the box with provided hole fixing screw based on figure 3. RFID reader has been screw on the top of electronic casing box.

The final design of the security system is describe in the block diagram as shows in Figure 5. The function for each component is very important to make sure a security system will be operating smoothly without any corruptions. The complete box casing circuit has been fabricated in this project is shown step by step before it completely done for whole project.
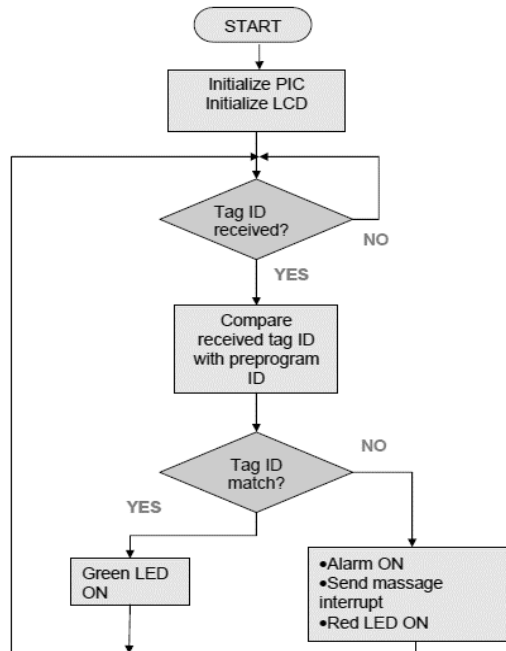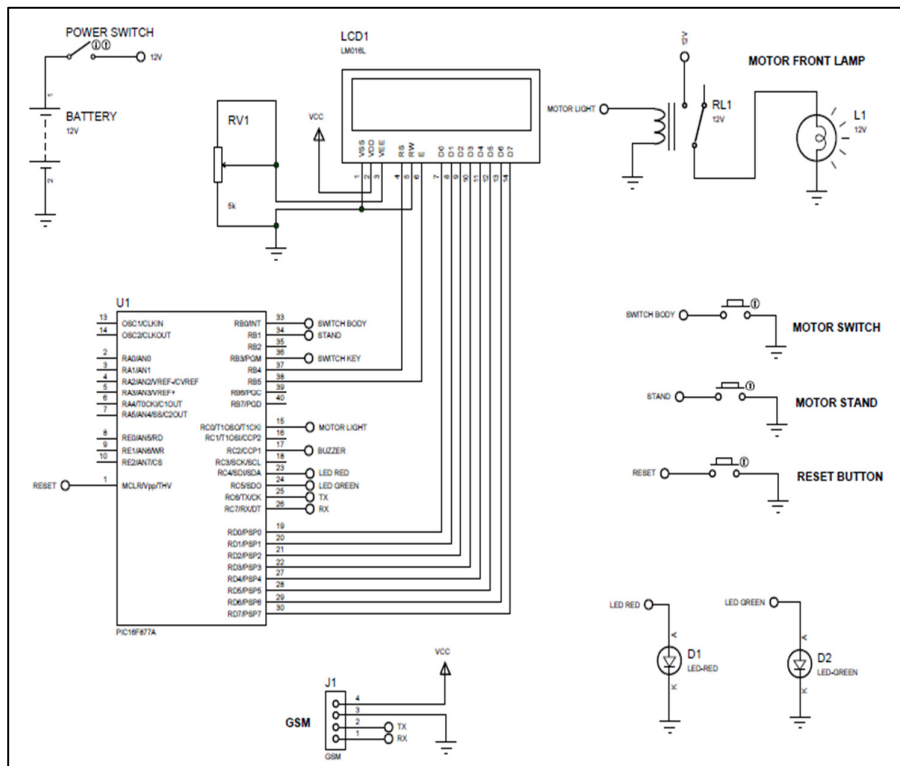
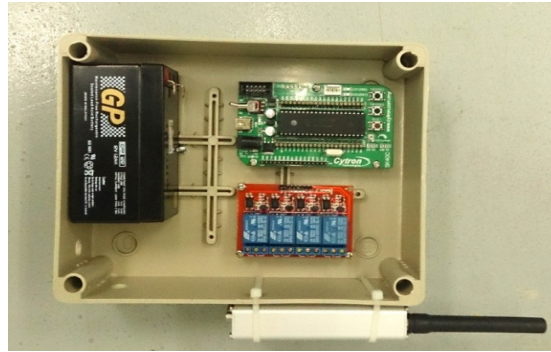**Figure 1:** Software design flow chart

Figure 2: Schematic of the system

Figure 3: Storage box
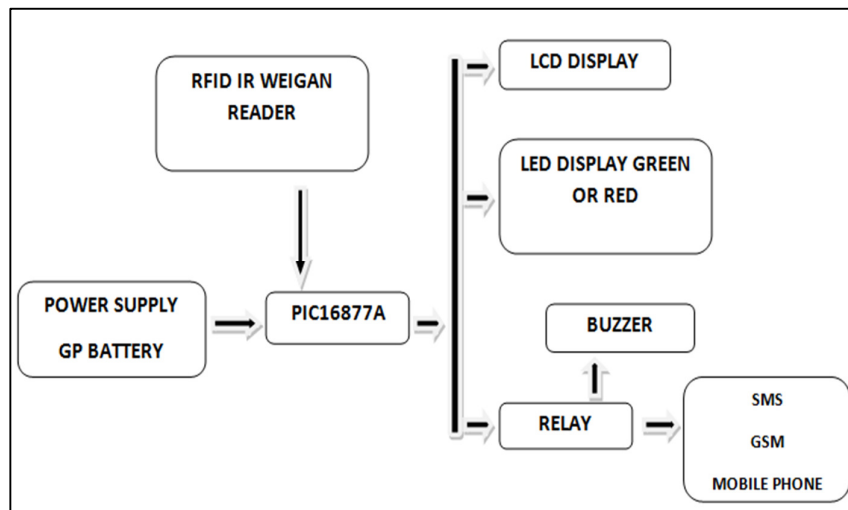

Figure 4: Connection circuit

Figure 5: Final Design

3.0 RESULTS AND DISCUSSION

This security system is successfully built to have a two way communication with the user. If the motorcycle is intruded by someone, the systems will automatically sending SMS to the user. User will receive the SMS as show in Figure 6.
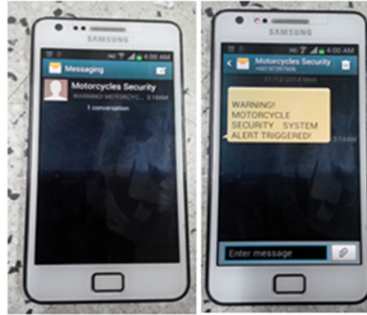
Figure 6: SMS alert system

Condition failed from the security box have showed as in figure 7 means system was interrupt or wrong tag of RFID has been attach. In this condition the user will be inform by SMS from GSM modem and buzzer will beeping non-stop based on the command that has been programmed until user reset the whole system either by using a red reset button or reset via Smartphone (By sending SMS code). This is the main point to reach the objective as a security system. While the red LED is an indicator to show that the false RFID tag have been attached. When the right RFID tags have been attached, LCD will display a successful condition. The green LED will indicate that the security have read a right RFID tag and the system under secure of owner motorcycle.

Figure 7: Security box failed condition

Interfacing the GSM Modem with PIC circuit is to ensure these devices are responding to spin program that is used in the microcontroller. The Spin Compiler scanned the program and does not detect any error in the program. The GSM modem is connected to the PIC 16F877A microcontroller circuit via RS-232 serial to microcontroller circuit as shown in figure below. The voltage supply and grounding for both circuit is connected to the voltage regulator circuit. Troubleshooting was done on the circuit as the cause of the problem comes from the circuit. Finally the problem was solved through some research where RS232 null modem with loop back handshaking is used. Tx and Rx connections were swapped on the DB-9 connector and Clear To Send (CTS) and Request To Send (RTS) pins were short circuited. Besides that, the Data Carrier Detect and Data Terminal Ready pin also has to be short circuited in order for the

system to work as programmed.

Table 1: Signal User sending to GSM

No	Distance (m)	Time (s)
1	50m	3.0
2	100m	3.1
3	150m	3.6
4	200m	4.7
5	250m	5.2
6	300m	5.0
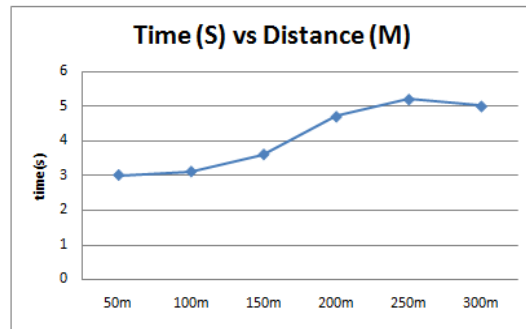
Figure 8: Signal User to GSM Modem

Table 2: GSM sending to User

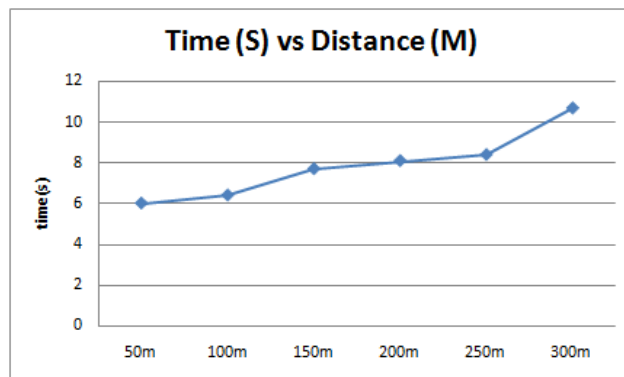| No	Distance (m)	Time (s)
1	50m	6.0
2	100m	6.4
3	150m	7.7
4	200m	8.1
5	250m	8.4
6	300m	10.7

Figure 9: Signal GSM Modem to user

Figure 8 and 9 show graph result communication from user to GSM modems and also from GSM modem to user depends on signal. These results have been tested by doing some distance and delay time testing between security system box and Smartphone.
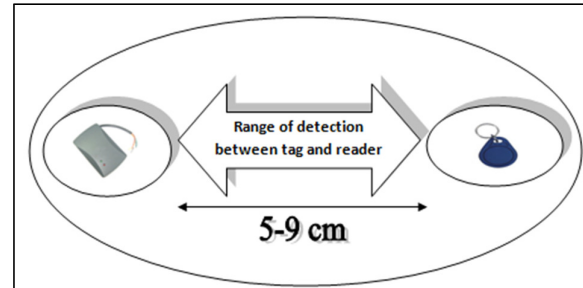

Figure 10: Range of Detection

There are two types of RFID tags, passive tag and active tag. This type of tag has a different specification of their attributes, passive tag did not have a battery as a power source to operate because energy transferred from this passive tag type is using the radio frequency from reader, which mean it required a signal strength to tag from RFID reader. Reader will send out the radio frequency signal to RFID tag for range of detection, passive tag usually less only detect up to 5 or 9 cm of their range detection attach to reader. Second type of RFID tag is active tag, active tag required a battery as a power supply to operate which mean this type need a power supply to recognize a RFID reader as their operation. Active tag is required very low signal strength to tag because these types of tag have their own power supply and about range of detection active tag is much better than passive tag it is because range of detection up to 100m. As a discussion of this project, passive tag is suitable for this type of security because it required a range than the system needed if using an active tag for this type of security it not suitable because it required a long range to detect and it cannot guarantee for safety of motorcycle.

4.0 CONCLUSSION

This paper was discus about the motorcycle security system using RFID technology and GSM method as a main control security system. This system is implemented using PIC16F877A which was programmed by using the C Language to control the motorcycle security system. The system was effectively built and tested as specified by the objective. Through the progress development of the project, several skills have been acquired such as testing component, mechanical part construction and interfacing hardware and software in computer. The ability of system is to analyse the RFID tag and send SMS shows the successful of the project.

ACKNOWLEDGEMENT

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