Security Device for Motorcycle Using Smartphone Android with Promini

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Abstract. According to the theft report received by Indonesian National Police in 2014, 9,112 motorcycles were stolen, the number of motorcycle thefts decreased by 43.87% in 2015. And in 2016, motorcycle theft again increased by 1.23% from the previous year. Due to this problem, an alternative solution is needed to improve motorcycle security. One way to improve the security of the motorcycle is to modernize the motorcycle security system from conventional way to high-tech by utilizing the development of information technology (IT). In this study, we explored ATMega328 microcontroller on Arduino Promini board which is controlled using a smartphone with Android platform to build a motorcycle security device. Controls made through the smartphone to activate or to disconnect the electric motorcycle circuit through the relay. We conducted tests to measure the effectiveness and the time required by the device to be active based on different distances. The results of this test indicate that the device took a longer time if it is turned on from a longer distance. As for turning on or off a motorcycle, the device took 0.5 seconds at a minimum distance of 1 meter and took 1.5 seconds at a maximum distance of 15 (fifteen) meters. It is also found that to turn on a motorcycle engine, it took 0.5 seconds at a minimum distance of 1 (one) meter and 3 seconds at a maximum distance of 15 (fifteen) meters, and it took 0.5 seconds at a minimum distance of 1 (one) meter and 4 seconds at a maximum distance of 15 (fifteen) meters. The results obtained shows that the proposed method can be potential motorcycle security as an alternative solution.

1. Introduction

The number of production and sales of motorcycles every year continues to increase. In 2014 the number of motorcycle production reached 7,926,104 units and sales of motorcycles reached 7,867,195 units. Total production and sales of motorcycles in 2014 increased from 2013 with total production reaching 7,736,295 units and sales of 7,743,879 units. [1].

The increasing number of production and sales of motorcycles is not followed by an increase in motorcycle security systems. Currently, motorcycles still use manual way to protect against thefts. Manual ways that can be used by motorcycle users such as the key handlebar, disc key, and so forth.

Some research on motorcycle security system using microcontroller has been done before. A study has been conducted on securing motorcycles using android based on AT Mega328 [2]. In the study, the author utilizes Android smartphone to control the microcontroller AT Mega328 on a prototype motorcycle. Another research on motorcycle security system was developed by using fingerprint [3].

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In that study, the authors utilized fingerprint recognition to improve motorcycle security controlled using ATMega328. Also, there are also researches on securing motorcycles based on microcontroller ATMega 8535 through Short Message Service (SMS) as a manager of fingerprint input [4].

In this study, the author uses SMS Gateway to control ATMega8535 in improving motorcycle security. We explored ATMega328 microcontroller on Arduino Promini board which is controlled using a smartphone with Android platform to build a motorcycle security device. Controls made through the smartphone to activate or to disconnect the electric motorcycle circuit through the relay. In this particular study, we designed and built a system to improve motorcycle security automatically by utilizing Smartphone based Android operating system and microcontroller type Promini. The purpose of this study is to validate the use of promini-based security device for a motorcycle.

2. Material and Method

2.1. General Architecture

General architecture aims to outline the overview of running systems and devices used in the system. The steps of the system of Figure 1 are explained as follows:

a. User Pairing Bluetooth from a smartphone with motorcycle security device to connect both devices. In this pair-to-pair process, the user uses the pairing code of motorcycle security device with input through the smartphone.

b. If connected, the user can control motorcycle security device using a smartphone. The controls that can be done by the user is to turn on the motorcycle, turn on the motorcycle engine and turn off the motorcycle using the timer.

c. In the process of turning on or off the motorcycle engine user pressing button on. At the same time, the smartphone will send char to the motorcycle security device via Bluetooth.

d. In the process of turning on the motorcycle engine, users use the starter button. At the same time, the smartphone sends a char starter to the motorcycle security device via Bluetooth.

e. In the process of turning off the motorcycle based on time using the timer button. At the same time, the smartphone sends a timer char to a motorcycle security device via Bluetooth.

f. Promini ATMega 328 will manage the signals received by Bluetooth to be converted into digital signals and then check the data received with those stored in by EEPROM.

g. If data is appropriate, that is data from Bluetooth output with data stored in EEPROM. Then promini will give the command to turn on Relay 1 or Relay 2.

![Figure 1. General Architecture](image)

2.2. Design of Motorcycle Security Device

Motorcycle security device is an enhancement mounted on the motorcycle to improve motorcycle security. Motorcycle security device using smartphone android to control the motorcycle security device itself.

This Security Device utilizes relays and transistors to disconnect or reconnect motorcycle electrical circuits on motorcycle electrical systems, namely the ignition key and motorcycle starter. By utilizing relays and transistors on ignition and motorcycle starters, the voltage from the battery does not flow
into the circuit. So that motorcycle users cannot turn on the motorcycle as usual. Promini serves giving orders to the relay to connect or disconnect by utilizing the electrical voltage results from Promini's output.

Figure 2 shows the process that occurs in the system controlling motorcycle security devices using smartphones with the Android operating system. For this process can be done, first smartphone and motorcycle security devices must be connected to each other by utilizing Bluetooth media.

The process of controlling motorcycle security devices using android application is explained in detail as follows:

a. User pair-to-pair android with motorcycle security device using Bluetooth.
b. In the pair-to-pair process, the user inputs the Bluetooth code of the motorcycle security device on the smartphone.
c. The Bluetooth code sent by Android smartphone will be processed by promini to be customized to connect to each other.
d. If the code sent, users using the smartphone accordingly, then the smartphone and motorcycle security devices will be interconnected.
e. Once connected, the user can control the motorcycle security device using a smartphone.
f. Users utilize the application to control motorcycle security device. The controls performed by the user is turning on a motorcycle, turning on a motorcycle engine and disabling a motorcycle based on time.
g. In this control, there are two types of signal utilization used, namely, analog signals and digital signals. Analog signals are used in the process of pairing between Bluetooth from smartphones and motorcycle security devices. While digital signals are used in the output generated by promini to the relay.

![Diagram of the process of controlling motorcycle security devices using a smartphone](image)

**Figure 2.** Diagram of the process of controlling motorcycle security devices using a smartphone

A system flowchart is a chart showing the workflow and the procedures used in its operation. In other words, the system flowchart describes graphically the procedures that make up a system. Figure 3 and Figure 4 show flowcharts of the motorcycle security device system. The stages in the system of motorcycle security devices according to the flowchart are:

a. When the device is powered on or powered on. The system will detect all devices connected to it. Such as Bluetooth, EEPROM, LED and Relay.
b. Once all devices are detected. The system will wait for the pairing command performed by the user using the smartphone.
c. If the pairing process is successful, then the motorcycle security devices and smartphones will be interconnected.
d. If the pairing process fails, the system will prompt the user to input the device code correctly.
e. This process will make the device motorcycle security with the smartphone connected.
Figure 3. Flowchart connectivity between smartphone and security device.

Figure 4. Flowchart system for controlling security device.
2.3. Application of Motorcycle Security Device

Application of the motorcycle security device is an application installed on Android smartphone. The user controls the motorcycle security device by several operations: to turn on or off the motorcycle, turn on the motorcycle engine and turn off the motorcycle engine using a timer. The design view of the application such as Figure 5.

![Design of Home Page Views](image)

**Figure 5.** Design of Home Page Views

3. Results

The display of the main menu of this application can be seen in Figure 6. On the main menu page, there are two main menus. Namely menu settings and menu GoApp. The settings menu for managing an app admin like Figure 7, while the GoAPP menu uses the motorcycle security control application apparatus as shown in Figure 8. This app can control motorcycle security devices as for the difference compared to the conventional way by using the application that can be seen from table 1. Table 2 shows action performed on a motorcycle using a Smartphone application. To test the effectiveness of this motorcycle security device, we conducted testing to see the time range that the device needs to be active at different intervals of distance. The test result can be seen in Table 3.
Table 1. Conventional act on a motorcycle

| No. | Act                               | Conventional way                      |
|-----|-----------------------------------|---------------------------------------|
| 1.  | Lock the motorcycle               | Entering the key                      |
| 2.  | Turn on motorcycle               | Rotate lock-on position               |
| 3.  | Turn on the motorcycle engine     | Pressing the motorcycle starter button|
| 4.  | Turning off the motorcycle        | Rotate lock to OFF position           |

Table 2. Smartphone application act on a motorcycle.

| NO. | Act       | Using application                     |
|-----|-----------|---------------------------------------|
| 1.  | Lock the motorcycle               | Enter key                             |
| 2.  | Turn on a motorcycle               | Rotate lock-on position               |
| 3.  | Turn on the motorcycle engine      | Pressing the ON button on the app     |
|     |           | Hit the STARTER button on the app     |
| 4.  | Turn off motorcycle                | Pressing the OFF button on the app    |
|     |           | Application Rotate lock to off position|

Table 3. Testing system

| NO | Act | distance (meter) | Time needed |
|----|-----|------------------|-------------|
| 1. | ON/OFF | 1-15             | 0.5 - 1.5 s |
| 2. | Starter | 1-15             | 0.5 - 3 s   |
| 3. | Timer  | 1-15             | 0.5 – 4 s   |

4. Discussion
Motorcycle manufacturers today still rely on the manual way on motorcycle security system. The manual security devices such as handlebar lock, padlock discs and so forth are considered to be not secure enough nowadays. Motorcycles are still often used as an object of theft by criminals. The high number of criminals that make the motorcycle as its object is an indication to further improve the motorcycle security system today. To that end, the modernization of the motorcycle security system from the manual system to the automatic system is needed to be applied to further improve the security of the motorcycle itself.

Modernization of motorcycle security devices is done by utilizing the development of information technology. Here in this study, the modernization of motorcycle security system was developed using Smartphone with Android operating system version 4.3 in controlling Promini to improve motorcycle security using CDI AC 12 volt.

The device takes longer time if it is activated from a longer distance. To turn motorcycle on or off, the device took 0.5 seconds at a distance of 1 meter and 1.5 seconds at a distance of 15 meters. To turn on a motorcycle engine, the device took 0.5 seconds at a distance of 1 meter and 3 seconds at a distance of 15 meters. And to use the device timer took 0.5 meters at a distance of 1 meter, and 4 seconds at a distance of 15 meters.

5. Conclusion
A promini-based security device for a motorcycle can be used to modernize the motorcycle security system. Bluetooth technology was proven to be sufficient to control the motorcycle security device remotely. The results of this test indicate that the device took longer time if it is turned on from a longer distance. This system can be used as an alternative way to improve motorcycle security.
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