The utilization of Safe Parking Application (SPR) for motorcycle security using Global Positioning System (GPS) in Indonesia

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Abstract. This study aims to create a Safe Parking Application (SPR) using Rapid Application Development (RAD) and Global Positioning System (GPS) which will control and secure motorcycles. Vehicle theft cases increase from year to year in Indonesia’s big cities. This application will be a solution to vehicle theft prevention in Indonesia’s big cities. It will alert the owner when the motorcycle is moved from its parking position. The owner will receive some detail information about the motorcycle movement i.e. the vehicle location, the history, and the live GPS. In conclusion, the utilization of SPR is a solution to prevent the increase of motorcycle theft in Indonesia’s big cities. This application uses a low-cost device as a substitute for an alarm or transmitter.

1. Introduction
Motorcycles come with many advantages to support human activities. They not only have great maneuverability, but their fuel consumption is also much lower than that of a car. However, most often, their advantages tend to be the same disadvantages, making them highly susceptible to theft [1]. Without a doubt, the number of motor vehicles in Indonesia is increased more and more from year to year. Unfortunately, an increased number of motor vehicles is also followed by an increased number of motor vehicle theft in many of Indonesia’s big cities, such as Jakarta, Bandung, and Malang. Compared to other criminal cases such as forgery, fraud, embezzlement, motorcycle theft cases has a high rate from year to year, for example, the number of two-wheeled motor vehicle theft has a percentage of 99% of the data existing cases in 2012 and 2013 in Malang. One way that can be used to secure the vehicle from theft criminal act is to apply the Global Positioning System (GPS) on our vehicles [2]. GPS is globally used for tracking and navigation purpose (Figure 1ab). GPS is mainly used in the military, agriculture, civil, transportation, natural disaster [9], and commercial use around the world [3].
GPS tracking technology allows users to monitor the movements of people, motor vehicles, airplanes, ships, trains, packages, and other products (Figures 1a-b). Tracking enhances the efficient management of goods and services and reduces loss stemming from accidents, theft, malfunctions, or improper operation. GPS tracking also reduces response times and enables more efficient utilization of vehicles used by police departments, fire officials, search and rescue missions, and other emergency services [6]. Vehicle tracking systems were first introduced by the shipping company because they need to know the position of the shipping vehicles in a given time. Nowadays, a vehicle tracking system is used for tracking the vehicle location in real-time. Vehicle tracking systems are widely used throughout the world in different sectors such as smart traffic management systems, vehicle location tracking systems, Anti-theft vehicle tracking systems, parking management systems, fleet
management, and in the field of Intelligent Transportation Systems (ITS) or Smart transportation systems. GPS is a location system based on a constellation of about 24 satellites orbiting the earth at altitudes of approximately 11,000 miles (Figure 2) [7].

GPS was designed by the United States Government and military, which the design was intended to be used as surveillance. The GPS was invented as a collaborative effort by the United States Department of Defense and Dr. Ivan Getting as a means to create a satellite course-plotting system, primarily used for navigation purposes. GPS was originally intended for military applications, but in the 1980s, the government made the system available for civilian use. GPS works in any weather conditions, anywhere in the world, 24 hours a day. Using GPS we can able to identify the perfect (or) accurate location of the bike. GPS satellite circle the earth twice a day in a very precise orbit and transmit signal information to earth. GPS Receiver takes this information and uses triangular to calculate the user’s exact location. Uncorrected positions determined from GPS satellite signals produce accuracies in the range of 50 to 100 meters. When using a technique called a differential correction, users can get positions accurate to within 5 meters or less [3,5,7,8]. This study was designed to create a model of a motorcycle safety system using Rapid Application Development (RAD) and GPS for controllable and safety on motorcycles utilizing Safe Parking Application (SPR) as one of the solutions in preventing the vehicle loss that causes by theft or irresponsible person.

2. Research methodology

2.1. Algorithm analysis for GPS vehicle tracking system

The algorithm used for GPS location latching is based on a 3-time lock GPS status. So it has three for loops present.

*The algorithm is:*

Check No. of Satellites Visible = n  
If (N>3) then get the lat and long  
It checks this condition 3 times for getting confirms lock. So the time complexity of this algorithm is $O(n^3)$. The space complexity of this project depends on the data the client wants to store in the database. The more the duration of data the more is the space complexity (Figure 3ab).
Figure 3a. Use-Case diagram of Safe Parking Application (SPR).

Figure 3b. Activity diagram for Motorcycle Tracking System.

3. System specifications

3.1. Hardware and software requirements
In order to develop the application, there are several requirements in developing and also building the application details presented in Table 1.
Table 1. Safe parking application hardware and software requirements.

| Hardware used                  | Software used                              |
|--------------------------------|--------------------------------------------|
| Device and Operating System    | Operating System                           |
| Android, as the operating system of the smartphone. JDK Version 17, as the minimal version of the android operating system. | Windows 10, as the operating system to run the Safe Parking Application (SPR). |
| Device additional feature      | Program Development                        |
| Global Positioning System, as the feature of the smartphone to run the Safe Parking Application (SPR). | Android Studio Version 2.3.1, as the programming environment because of its stability in developing android applications. |
| Hard Drive Device              | Programming Language                       |
| 50 Megabyte, as the minimum requirement of device storage, or as the recommendation for the installation of Safe Parking Application (SPR). | Java programming language, as the programming language in the development of the android platform. |

A class diagram is the description of the system structure by showing all the system’s classes. The attributes, operations, and relationships are shown in a static diagram. Class diagrams are used for data modeling, its classes represent both the main objects, interaction of each class to be programmed. There are classes in the Safe Parking Application (SPR) class diagrams (Figure 4).

![Figure 4. Safe parking application class diagram.](image)

4. Conclusions and recommendations

4.1. Conclusions
There are three conclusions that could be gained from this paper:
Monitoring the user vehicle in real-time using smartphone devices and GPS with the internet connection and server in the application.

As a solution to prevent unwanted cases for the motorcycle using the low-cost device as the substitute of alarm or transmitter.

There are several components that become the deciding factor in the accuracy of the application which are network connection quality, the materials inside the motorcycle luggage, and the GPS Accuracy.

4.2. Recommendations

There are five recommendations that can be submitted from this research as follows:

- Adding sensors and transmitters. By adding sensors and transmitters to the vehicle could help the user as additional ways to prevent the vehicle from losing.
- Continuously take user location and graph. Displaying the graph of the movement of the vehicle to show the user about the movement of the vehicle and continuously take location to inform the user about the latest position of the vehicle.
- Placing the database server in hosting. To maximize the application in accessing the database, the database server of this application should be placed on a hosting server.
- Improve the user interface (UI) of the application. Improving the UI of the application to be an easy-friendly style, that will help the user to use the application.
- Adding multi-platforms. Android operating system is only the platform that works in this application. To reach the public market, the Apple operating system and Windows operating system should be added to maximize this application.

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