

DESIGNING A LOCATION TRACKING DEVICE FOR VEHUCLE



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Submitted by:

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DESIGNING A LOCATION TRACKING DEVICE VEHICLE

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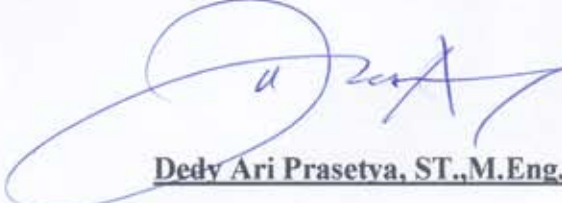
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CERTIFICATION SHEET

DESIGNING A LOCATION TRACKING DEVICE FOR VEHICLE

Final Project

By:

AHMAD SAID AHMAD AL-NSHAH

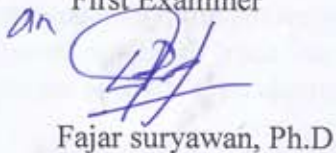
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This final project accepted in partial fulfillment of requirements
for achieving S-1 graduate degree of electrical engineering


Surakarta July 2017

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DECLARATION

Hereby I am as the author declared that this Final Project is prepared and presented by myself, except the quotations and summaries that I have explained from all the sources and put on the bibliography.

If it is found there is untruth in my statement above, then I will fully accountable.

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Surakarta, ... 2017.



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DESIGNING A LOCATION TRACKING DEVICE FOR VEHICLE

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Abstract

Location tracking device for vehicle is a device that provides location information to the owner of a vehicle. The development of this project is based on GPS (Global Positioning System) information that is provided by satellites. To capture that information, we need a GPS module component. The users of this device will not automatically get the location information of their vehicle. This device must be manually asked by sending SMS (Short Message Service) to it. By using SMS system in this device, the location of the vehicle can be tracked whenever and wherever the user wants. The combination of this GPS tracking and SMS system is not completed enough for some users. Adding a security control is one of the solution to a condition when the vehicle is going to be stolen. So, this device is equipped by automatic switch or relay to secure the vehicle by switching off or on the electrical system. To know if the vehicle is stolen or not, we attached a movement sensor to the device. The big idea of this device is trying to prevent vehicle thievery. The movement of the vehicle when the owner is not there is the main parameter. When the vehicle is moving unexpectedly, the device will send an SMS text to the owner's phone. Then the owner is able to track the location of the vehicle and can send an order to the device to switch the electrical system off.

Keywords: *Location Tracker, arduino, security system.*

1. INTRODUCTION

Car and motorcycle are very important for human in this modern era. Those can transport us from a point to another point in an easy way. Some people spend their precious money to buy one of those vehicle, even having a car or motorcycle is a dream for them. Many kinds of security systems are offered and used by consumers, including both non electric and electric security system, such as handlebar locks, disassembled mounted lock, a lock which is mounted on the right hand brake that is attached to handlebar, key for covering the contact, alarm, this alarm sounds through a loudspeaker (speakers) mounted on a motorcycle that serves to provide information to the owner of the motorcycle and the environment surrounding the unsafe vehicle conditions, electric padlock mounted on motorcycle disc, when the lock does not match, the alarm that inside the padlock is activated to provide information to the surrounding people.

However, in today's motorcycle security equipment with such working system still can not be relied by the owner of the motorcycle, because if the owner is far from the parking lot of the motorcycle then the owner can not monitor the state of his motorcycle. And the use of a standard alarm, if the alarm can be turned off then there is no longer an indicator that is used to provide information about the state and condition of the motorcycle. And after that motorcycle engine can be freely operated by thieves. In these conditions, a safety that uses only the non-electric alarm or key as described above is not effective enough if the owner of the motorcycle is far from the motorcycle and outside the range of the alarm sound produced. This is a problem for a motorcycle security system.

The usage of GSM (Global System for Mobile Communications) in this device is an advantage for the the user. The advantage of using this technology is that most of people are using this technology. Also the coverage, all GSM providers on whole world are expanding their coverage. In this case, the device that was made is fully maximize the usage of SMS service. Chen Peijang and Jiang Xuehua (2008) on their journal "*Design and Implementation of Remote Monitoring System Based on GSM*", said that the usage of GSM module on a form of SMS that used as a long distance tracking system is effective and has some advantages and more user friendly.

Based on the mentioned problems, it is necessary to make a security system that can prevent theft. In this research a location tracking device is made and used. Not only tracking the location, but also giving an alarm via SMS text to the owner. By this technique, the owner will be alarmed when the vehicle moves. Then the owner can decide to switch the vehicle off by sending an order to the device via SMS too. In this point, the owner can track where the vehicle is. These two technique effectively work because, it directly gives warning alarm when the vehicle moves and tracks the location. And the location that is tracked will be displayed visually trough google map website. So, the owner can directly ask the fastest way to the vehicle location.

2. RESEARCH METHODS

This work started in June 2017 as an undergraduate final-year project, and took place at Universitas Muhammadiyah Surakarta.

In the preparation of this final project, there are several steps that are observation and literature study, device design tool, tool making, and test results. Observation where the method is done by way of direct descendance to obtain the necessary data, literature study which is a step to get reference materials from books, papers, papers, journals, or articles related to Arduino, GPS (Global Positioning

System), GSM (Global System for Mobile) module, Relay and some other references that can support in making this Final Project. Making the tool that is implementing the results of Literature, Consultation, and Discussion to design and make a tool motorcycle security system. In the manufacture of this tool there are 2 principal design of the design of hardware (Hardware) and software design (software).

The final product was constructed using the following materials:

- Arduino UNO
- GSM Module SIM900A
- GPS Module
- DC to DC step down converter
- Relay
- 11 Volts Lipo Battery
- Jumper Wires
- A Piece of Box
- PIR Sensor
- Smartphone

The system block diagram as shown in Figure 1 shows the relationship among the main components on the built device. When we are going to make this device, we need to consider how the components interaction is. By looking the Figure 1 below, the block diagram shows that the Arduino is the main processor that handle all of the inputs and outputs. The smartphone acts as input system according to the GSM module, in this section, the smartphone is a monitoring device for tracking the location. Also, the smartphone acts as input to GSM module when the user is trying to give an order to the system. The GPS module acts only as input to arduino that is providing latitude and longitude data. The Relay is an output that handle the engine switching mechanism. As the warning parameters, PIR sensor acts as input to give the movement detection value to arduino.

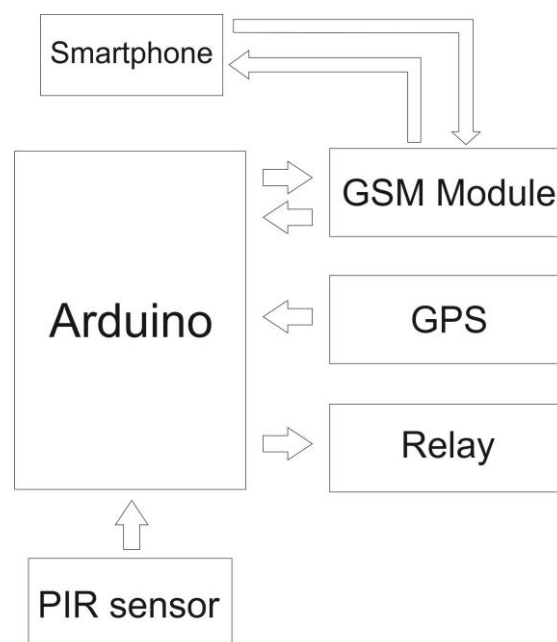


Figure 1. System Block Diagram

The Figure 2 and 3 below shows the flowchart of the whole system. And shows only the big idea of how the system flows. But we divide it into two flowcharts, the Figure 2 shows the flowchart of monitoring system. And Figure 3 shows the controlling system.

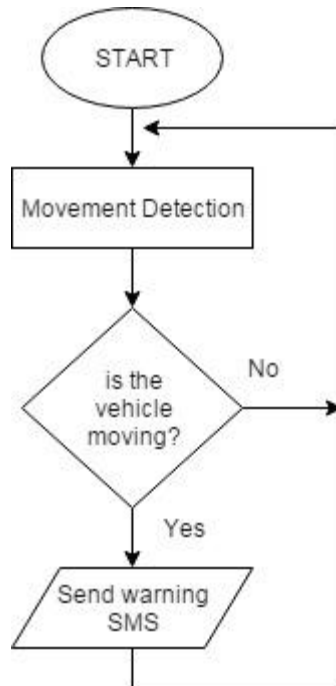


Figure 2. Monitoring System Flowchart

Figure 2 above shows how the monitoring system flows. When the device is started, then the system always check is there any movement occurs from the vehicle. When there is a movement, the device system will send warning SMS to the owner's smartphone. And when there is no movement, the system will just check in infinite loop.

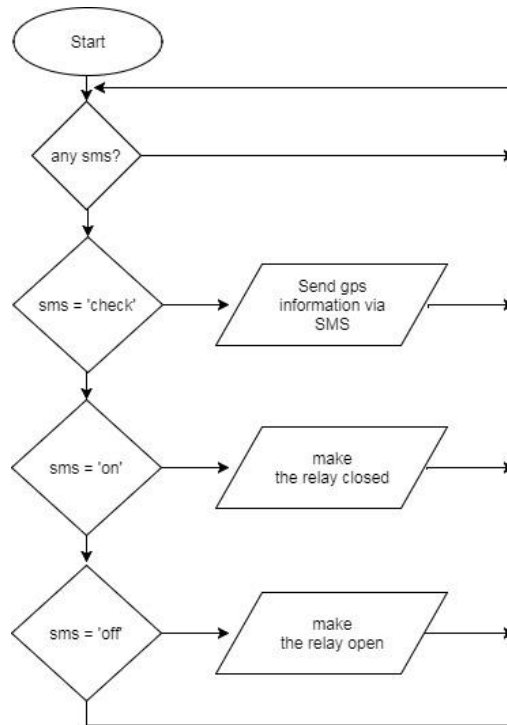


Figure 3. Controlling System Flowchart

In Figure 3 is shown that the controlling system is about asking some orders to the system. So when the system is started, beside doing the monitoring system, it also checking if there any SMS that is sent to the system. There are some order that are applied on the system. The first is 'check' order, this order means when a 'check' word is received via SMS, so the system will send back a text in the form of a Google Map web link address and the longitude and latitude point of the vehicle. The second is 'on' order, this order is used to make the relay closed. And the last order, which is 'off', is to make the relay open.

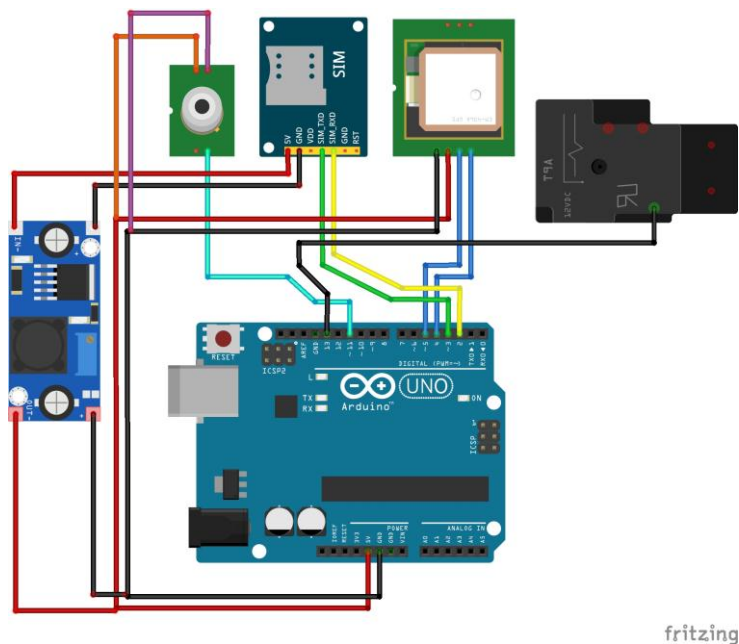


Figure 4. Circuit of the device

As shown in Figure 4, this device uses some components such as arduino, voltage regulator, movement sensor, sim card module, GPS module and relay. The circuit is centralized on arduino Uno as the main brain of the device. SIM Card/SMS module is used as a bridge between the device and the user's smartphone, which is SMS communication between both. A movement sensor that is used, is for monitoring the movement towards the device (vehicle). The GPS module in this device collects longitude and latitude data about the location of the vehicle, so the data will be sent to the Arduino to be proceeded. And the Relay is used to connect or break the electrical circuit on the vehicle.

3. RESULT AND DISCUSSION

This device has two big ideas, the first idea is monitoring system and the second is control system. The monitoring system consists two features, movement monitoring and location monitoring. And control system consists two features, on-and-off control. Table 1 shows the table of features that we have on the device.

Table 1. Device Features

System	Feature
Monitoring	Movement Monitoring
	Location Monitoring
Control	ON-Control
	OFF-Control

Here is the explanation of each feature:

a. Movement Monitoring

This feature provides us the condition of the movement if the vehicle moves or not. When the motor is not moving, user will not get any SMS message from the device. But, when it moves, the device will warn the user via SMS message. The text of warning is "A MOVEMENT HAS BEEN DETECTED", this text will be sent automatically by the device without any order when a movement is detected. Figure 5 below shows how the device warns the user.



Figure 5. Movement Warning Text

b. Location Monitoring

Location monitoring feature in this device is used to do when the user tries to track the location of the vehicle. This feature will be activated when the user sends a "check" text to the device. When the "check" text is received by the device, the device will send a location data of the vehicle in the

form of longitude and latitude. This data then combined with Google Maps website address, so the user will know visually where the motor is by clicking the link that is sent to the user's smartphone. Figure 6 below shows one of the location data that was sent to the user via SMS.

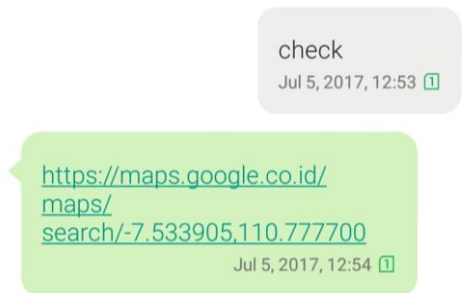


Figure 6. Location Information Text

Figure 6 shows us one of the location information about where the vehicle was. The longitude and latitude data will be shown visually when we click the link, as shown on Figure 7 below.



Figure 7. Location Information Text

When we got this kind of link (Figure), and open it, we will go to Google Maps address. Then, when we decide to make a direction assistant, we can do it by Google Maps, it means we can follow our stolen vehicle periodically as shown on Figure 8 below.

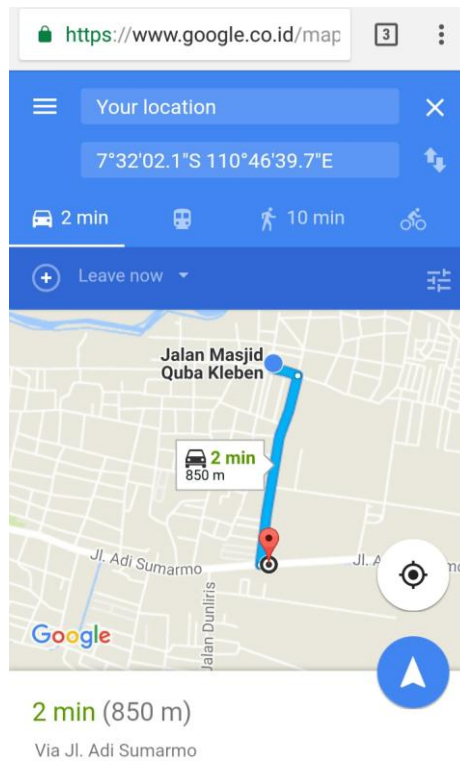


Figure 7. Google Maps Tracking System

c. ON-Control

ON-Control feature is used to close the electrical circuit on the vehicle. This feature will be activated when the user send “on” text via SMS to the device. When it is sent and succeeded to close the circuit, the device will send the succesful process to the user’s. smartphone.

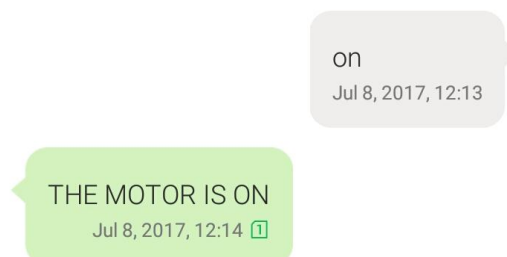


Figure 8. ON-Control Feature Text

d. OFF-Control

When the user wants to make the stolen vehicle not working, this feature is used. By sending “off” text to the device via SMS, the device will break the electrical circuit on the vehicle. So the person who steal the vehicle cannot make the vehicle fired up. After the process is succesfully done, the device will tell the user that the vehicle is off.

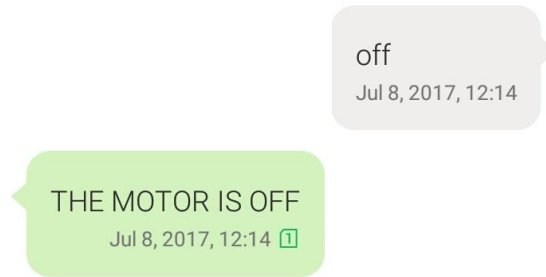


Figure 9. OFF-Control Feature Text

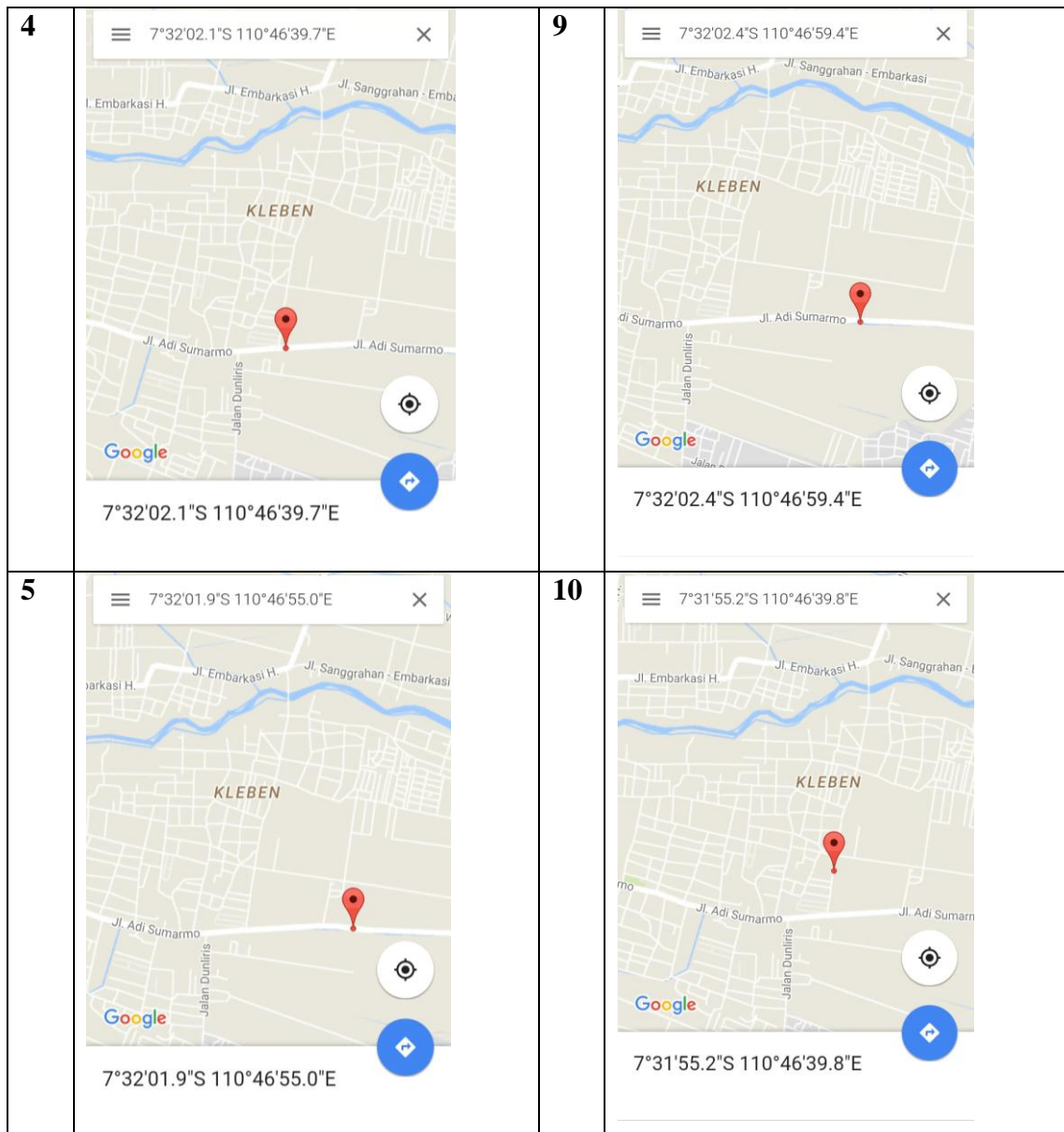
3.1 Location Tracking

In this experiment, we have conducted Location Tracking experiment at the area of Colomadu, Karangayar. We collect GPS data for around 10 minutes, and randomly check the GPS data via SMS. The idea of the experiment is, we pretend that our motorcycle was being stolen by a thief. Then we were warned by the device, and started tracking the motor since the point when the motorcycle was stolen. Table 1 below shows how we tracked the motorcycle location.

Table 1. Google Maps Data

No	Google Maps	No	Google Maps
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<p>1</p>	<p>7°31'38.7\"S 110°46'40.1\"E</p>	<p>6</p> <p>7°32'02.5\"S 110°47'08.9\"E</p>
<p>2</p>	<p>7°31'40.8\"S 110°46'43.0\"E</p>	<p>7</p> <p>7°32'03.7\"S 110°47'21.3\"E</p>
<p>3</p>	<p>7°31'49.6\"S 110°46'40.6\"E</p>	<p>8</p> <p>7°32'03.9\"S 110°47'21.2\"E</p>



3.3 SMS Response Delay

This SMS response delay experiment aims to observe the amount of time that we need to ask the device to do a task such ON-and-OFF task. In this experiment we use three different SIM card providers, 3, Telkomsel and XL.

Table 2. SMS Response Delay

No	Delay (second(s))		
	3	Telkomsel	XL
1	16	19	20
2	18	20	17
3	17	16	18
4	19	19	20
5	15	19	18
Average	17	18.6	18.6

3.4 Analysis

a. Location Tracking

This experiment was conducted on 10 minutes of location tracking. During that 10 minutes, we checked 10 locations differently on random interval of time. To prove those were precise locations, we must ask the person who drove the motorcycle. So we asked the person, and he said he went to the most far location that we got visually on Google Maps website. Also he said, the street that he passed is exactly the same as the locations data that we got on the smartphone via SMS. The pattern of the location tracking is shown on Figure 10.

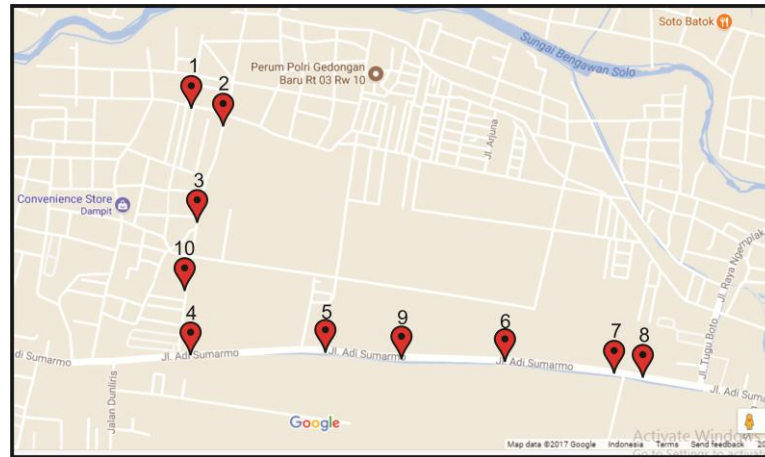


Figure 10. Location Tracking Pattern

The GPS module that we use is GY-NEO6. In this GPS module version, it is written on the product datasheet that the precision of the acquired data maybe misses around 2 to 10 meters. So we can decide the tolerance of this device data on location is around 2 to 10 meters. And for location tracking, some users will tolerate that fact. Because it is a short range missing distance of the actual position.

b. SMS Response Delay

The fact that SMS service always be delaying even it is only short period of time is true. In this experiment, we got longer delay than usual SMS texting activity as shown on Table 2 above. This is caused by the more process that we have on the whole system of the device. We tested two provider in this experiment, 3, Telkomsel, and XL. And the result is almost the same on average. Testing 5 times trial to send orders to the device, we got the fastest response on provider 3, which is 15 seconds. And the longest time is 20 seconds from provider Telkomsel and XL. The range of the whole this response experiment is 15 to 20 seconds.

4. CONCLUSION

A security system on a vehicle is a crucial part. So we need an effective addition that acts to protect our vehicle from a theft. Some security systems are non-electrical device that behave passively. Means, this non-electrical device can not be controlled by the owner of vehicle. This will make an easy way for the thief to steal the motor. Even some electronic devices only warn the surrounding environment. So, the device that we made, maybe a good solution for this problem. The owner can fully control the state of the vehicle, also track the location of motor, as long as the thief doesn't know that the vehicle is using this device.

We can conclude that this device can provide us a visual information via Google Maps website. This device's ability will make the owner of the vehicle to track and follow the stolen vehicle. Also, ON-OFF feature that we have on the device will prevent the thief to go far from the owner. The another feature is movement monitoring system, having this feature is an advantage for the owner. Because at the first time of the action of the thief, the device will warn the owner that the vehicle is moving.

This features combination will effectively work for a vehicle theft chase. And make the owner feel safe about the vehicle. Also the budget of making the device is not expensive, so the people can afford it.

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