



## An Analysis of Effect GSM Signal Type on Android-Based Vehicle Injector Response Time

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### ABSTRACT

The crime of motor vehicle theft is increasing, the automotive industry continues to develop security systems to reduce the number of thefts that occur in Indonesia through the development of sophisticated features. The addition of a global positioning system (GPS) feature on a vehicle is an alternative to supporting a security system by providing vehicle location information when theft occurs. GPS provides location information by providing microcontroller input data. GPS on the vehicle becomes very important because with the GPS module the vehicle can be found by knowing an accurate location. However, the addition of a GPS module is often difficult to find because the distance changes frequently and it takes a long time to find it. The purpose of this paper is to detect vehicle position accurately using GPS U-Blox NEO 6M and to analyze the effect of GSM signal type on the response time of long-distance vehicle injectors based on android. The research method is data analysis to make conclusions, namely the two-way factor quantitative experimental method. The independent variables used are (1) different signal types, and (2) the distance from the signal source to the gasoline engine injector response time. The conclusion obtained is that vehicle position detection using GPS U-Blox NEO 6M is accurate with the results of data analysis shifting 8.3113 meters and the interaction between distance and GSM signal types has no significant effect with the results of data analysis from the three types of Telkomsel GSM signals which are the fastest with a distance of 200 meters from the signal source with a response time of 4.956 seconds and the slowest is XL at a distance of 500 meters from the signal source with a response time of 8.5 seconds.

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### INTRODUCTION

Technological progress is a need that is needed by humans to make their life easier. Technology from year to year continues to be developed, especially in the automotive sector. Automotive technology was developed to increase comfort, safety while driving. With the increasing production of automotive technology in Indonesia, the crime rate against vehicles is increasing. With the increasing production of vehicles, the greater the number of vehicle users, this has an impact on the increasing crime rate of motor vehicle theft.

From the above problems, automotive manufacturers continue to develop security systems for vehicles. Then a vehicle detection device with GPS was created to make it easier to detect the location of a vehicle which was taken from a GPS signal that was sent directly to a personal computer and displayed the location on a personal computer screen using an application. sent can still reduce the accuracy of the location. From these problems, a tool was developed to detect the location of the vehicle and control the injector based on a microcontroller using a GSM module and a GPS module to make it easier for owners to quickly find out the location of the car and cut off the flow of injector current on a car engine using Android. the injector to turn the vehicle engine off and Arduino as a control device. This research aims to be able to help and accelerate the discovery of vehicles.

**METHOD**

This study will discuss the remote vehicle safety system with injector control on an Android-based gasoline engine. The signal will be sent to the GSM module via BTS with radio waves as the input signal to be processed by the microcontroller, then it will be processed as a command, which is to turn off the relay connected to the injector current flow. This study also examines the coordinates of the location using a GPS module which will send information from the satellite then to the GPS receiver then the signal will be processed by the microcontroller and then sent via GSM module to the android application via BTS. The GSM module is affected by the BTS distance, so the closer the BTS is to the device, the faster the injector response speed and the more precise the location coordinates.

This research was also conducted with the experimental method. The experimental method is a method of collecting data through direct observation of the object of study within a certain period of observation. The experimental method cannot be carried out if the researcher does not directly examine his research in the field, because the data sought will be obtained during direct and careful observation.

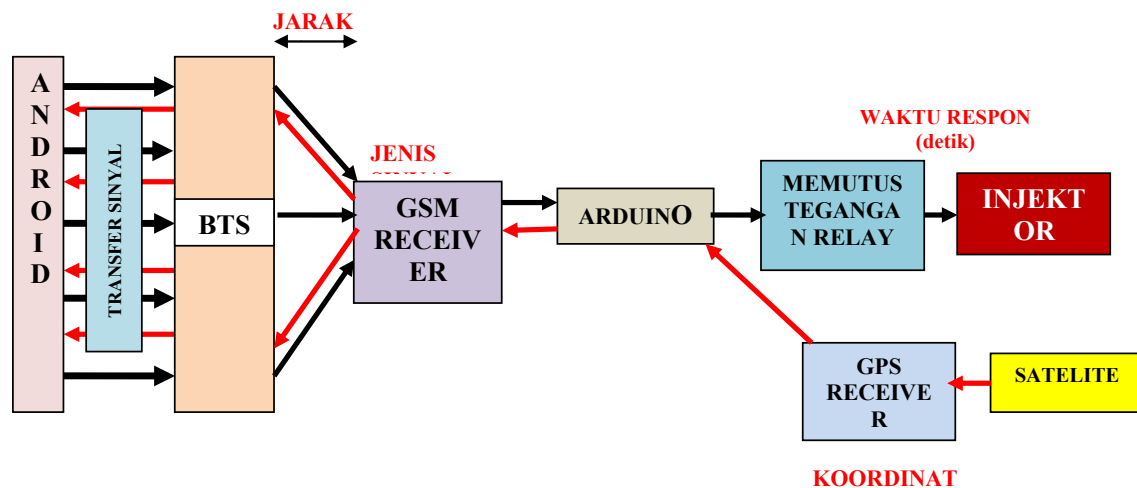


Figure 1. Remote Injector Control System and Location Coordinate Information Delivery

**Basic Concepts of Research**

In this study, data collection will be carried out according to the independent variables, namely: GSM signal type and GSM signal distance used, and there are 5 signal distances, namely: 100 meters, 200 meters, 300 meters, 400 meters, and 500 meters and there are 3 types of signals, namely: Telkomsel, Indosat, and XL. While the dependent variables are: Injector response time and location coordinates that will be generated by the GPS module.

By making changes to these independent variables, it will be analyzed how much influence they have on the dependent variable of the injector response time and the resulting coordinates. The closer the distance between the BTS and the GSM receiver on the device, it will optimize the performance of the device so that the response time and coordinates can be achieved. (Picture of the basic concept of research can be seen in Figure 1)

**Research variable**

In a study, research variables are important in conducting research and collecting research data. Control variables are variables that are made the same in each experimental medium and are controlled. The independent variable is a variable that is made independent, varies, and will affect the dependent variable. The dependent variable (dependent variable) is a variable that is influenced by the independent variable. The explanation of the independent variable and the dependent variable is as follows: 1. The independent variable (independent variable). The independent variables in this study were the type of card (Telkomsel, Indosat, XL) and the distance of the device from the BTS (100m, 200m, 300km, 400m, and 500m). 2. The dependent variable (dependent variable)

The independent variables in this study were the injector response time (seconds) and the coordinates of the vehicle location.

**RESULT AND DISCUSSION**

**Tool Working Principle**

The working principle of the vehicle position detection device and remote injector controller can be explained in the block diagram as follows:

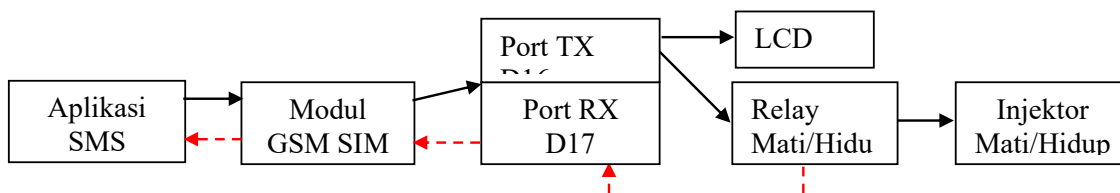


Figure 2. Block Diagram of Remote Injector Control Working Principle

The working principle of the block diagram of the remote injector control device starts from pressing the button on the SMS application with "engine on" the relay will turn on meaning the injector is active, "engine off" the relay will turn off meaning the injector is off, and "check location" will send coordinates of the position at which the device was located. The signal from the smartphone will send to the GSM SIM 800L module and send a signal to the Arduino via the RX port and be received by the Arduino Mega 2560 via the TX port then it will instruct the relay to turn off or on and the injector turns off or on. When the relay is working, it will send a signal to the Arduino Mega 2560 to send information to the smartphone whether it has been successfully turned off or turned on via the GSM SIM 800L module.

### Testing Tool

Tool testing is intended to ensure that the tool can work properly after being assembled and used to collect data. Data retrieval using a comparison method with measuring instruments to test the accuracy of the GPS U-Blox NEO 6M and the method of collecting data on the injector response time using a timer pad for initial delivery and arrival at the device. Testing tools on vehicles are as follows:

Testing the response of the performance of the gasoline motor injector control device.

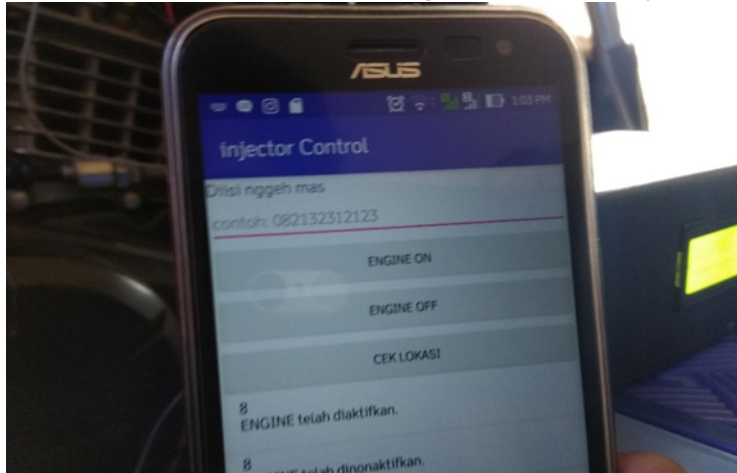


Figure 3. Android SMS Application

Control is carried out through the SMS application by using the engine on the button to activate the relay so that the injector is active, and the engine off to turn off the relay so that the injector is not active.

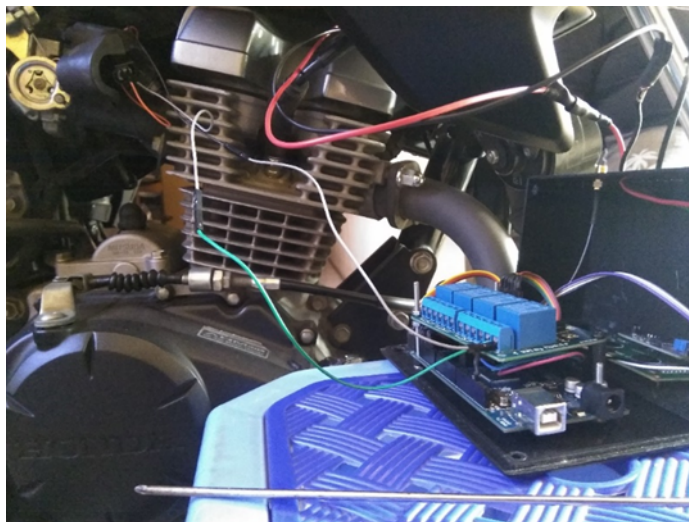


Figure 4. Testing Tools on Motorcycles



**Figure 5. Testing Tools in Cars**

This test is intended to ensure that the tool can be used directly on vehicles, both motorcycles, and cars that already use the EFI system. In this tool, the GSM SIM800L will control the relay which will disconnect the ground line from the injector, so that if there is a command from the GSM SIM800L, the vehicle will die and cannot turn on.

Data Analysis Result of Effect of GSM Signal Type and Distance on Gasoline Motor Injector Response Time

Analysis of data from the results of a remote injector control device with the effect of distance and GSM signal type on the gasoline injector response time by analyzing it using an experimental two-way factor design method using SPSS statistics software. From the results of the data in the descriptive statics table that has been processed, the total population for all respondents taken is 75 respondents, with each type of GSM signal having 25 respondents, and for each distance, the same number of respondents is 15 respondents.

**Table 1. Results of Analysis of the Effect of Distance, GSM Signal Type, and Interaction of Distance and Type on Response Time**

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	121.970 <sup>a</sup>	14	8.712	13.989	.000
Intercept	3307.782	1	3307.782	5311.198	.000
Jenis	111.871	2	55.935	89.813	.000
Jarak	7.628	4	1.907	3.062	.023
Jenis * Jarak	2.472	8	.309	.496	.854
Error	37.368	60	.623		
Total	3467.120	75			
Corrected Total	159.338	74			

Based on the test table for the effect of type, distance and type and distance above, it can be concluded that:

1. Since Fcount is 89,813 with a significance value of 0.000 is  $<0.05$ , then reject the null hypothesis, meaning that there is a significant difference in the effect of GSM signal types on the response time of gasoline motor injectors.
2. Because Fcount is 3,062 with a significance value of 0.000 is  $<0.05$ , then reject the null hypothesis, meaning that there is a significant difference in the effect of distance on the gasoline injector response time.
3. Since Fcount is 0.496 with a significance value of 0.854 is  $>0.05$ , then accept the null hypothesis, meaning that there is no significant difference in the effect of interaction between GSM signal types and distance on the gasoline injector response time.

Effect of GSM Signal Type, Distance and Response Time

Tabel 2. Average Time Respond

Jenis	Jarak	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Telkomsel	100	5.008	.353	4.302	5.714
	200	4.956	.353	4.250	5.662
	300	5.384	.353	4.678	6.090
	400	5.294	.353	4.588	6.000
	500	5.508	.353	4.802	6.214
Indosat	100	5.860	.353	5.154	6.566
	200	6.060	.353	5.354	6.766
	300	6.780	.353	6.074	7.486
	400	6.500	.353	5.794	7.206
	500	7.220	.353	6.514	7.926
XL	100	7.546	.353	6.840	8.252
	200	8.360	.353	7.654	9.066
	300	8.220	.353	7.514	8.926
	400	8.420	.353	7.714	9.126
	500	8.500	.353	7.794	9.206

The table above shows that:

1. In the GSM 1 (Telkomsel) signal type with a distance of 200 meters from the signal source, the fastest average response time is 4.956 seconds and the lowest response is 5.508 seconds.
2. In GSM 2 (Indosat) signal type with a distance of 100 meters from the signal source, the fastest average response time is 5.860 seconds and the lowest response is 7.220 seconds.

- In the GSM 3 (XL) signal type with a distance of 100 meters from the signal source, the fastest average response time is 7.546 seconds and the lowest response is 8.5 seconds.

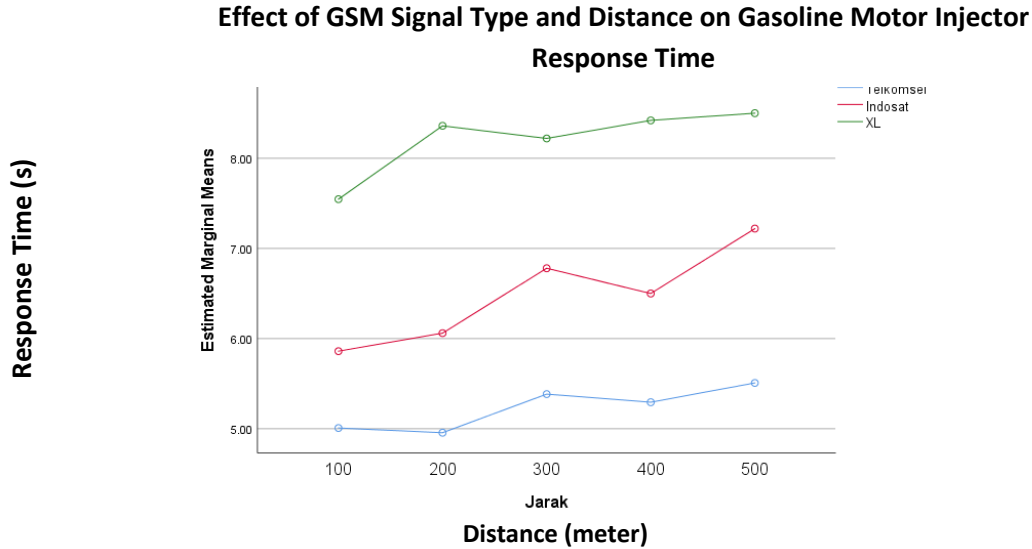


Figure 6. Graph of the Effect of GSM Signal Type and Distance on the Response Time of the Petrol Moto Injector

From the graph above, it can be concluded that the fastest of the three types of GSM signals (Telkomsel, Indosat, XL) is Telkomsel, with overall GSM 1 (Telkomsel) signal type with a distance of 200 meters from the signal source producing the fastest average response time. which is 4.956 seconds and the slowest is XL with a distance of 500 meters producing an average response time of 8.5 seconds.

## CONCLUSION

Based on the research that has been done, it can be concluded that: From the data above, it can be concluded that the GPS U-Blox NEO 6M can detect position accurately, has a point shift to the actual position with an average value of 0.0083113 kilometers or 8.3113 meters, meaning that the GPS NEO 6M is still within the absolute accuracy standard of 8- 10 meters (SNI 19-6724-2002). The interaction of distance and type of signal has no effect on the response time of the gasoline motor injector with a significance value of 0.854 which means  $>0.05$ . The fastest type of GSM signal out of the three types of GSM signals (Telkomsel, Indosat, XL) is Telkomsel with a distance of 200 meters from the signal source producing an average response time of 4.956 seconds and the slowest is XL with a distance of 500 meters producing an average response time of 8.5 seconds.

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## AUTHOR CONTRIBUTION STATEMENTS

The authors had participated in the research. The authors processing the finding, evaluation of research, and finishing review process.

## REFERENCES

- Abidin, Hasanuddin Z. 2000. Penentuan Posisi dengan GPS dan Aplikasinya. Jakarta: PT Pradnya Paramita.
- Badan Pusat Statistik. 2014. Statistik Kriminal 2014. Available: [www.bps.go.id](http://www.bps.go.id). Jakarta: Badan Pusat Statistik.
- Badan Standarisasi Nasional. 2002. Jaring Kontrol Horizontal SNI 19-6724-2002. Available: [www.big.go.id/assets/download/sni/SNI/SNI%2019-6724-2002.pdf](http://www.big.go.id/assets/download/sni/SNI/SNI%2019-6724-2002.pdf)
- Budicahyanto, Dwi. 2004. Membangun Aplikasi Handphone dengan MobileFBUS dan Visual Basic. Yogyakarta: Andi Yogyakarta X-Oerang Technology.
- Compoents101. 2017. 5V - 5 Pin Relay [On-line]. Available: <https://components101.com/5v-relay-pinout-working-datasheet>. Cited 2017, May 12.
- Dana, Peter H. 2000. Global Positioning System Overview[On-line]. Available: <https://www.colorado.edu/geography/gcraft/notes/gps/gps.html>. Cited 2000, May 2.
- Danniel, Larry. 2017. Cell Phone Location Evidence for Legal Professionals: Understanding Cell Phone Location Evidence from the Warrant to the Courtroom. Academic Press.
- Duffy, James E. 1989. Auto Electricity, Electronics, Computers. Illinois, South Holland: The Goodheart-Willcox Company, INC.
- Hidayat, Wahyu. 2012. Motor Bensin Modern. Jakarta: PT Rineka Cipta.
- Kadir, Abdul. 2017. Pemrograman Arduino dan Android Menggunakan App Inventor. Jakarta: PT Elex Media Komputindo.
- Oklilas, Ahmad Fali, dkk. 2014. Akurasi Pembacaan GPS pada Android untuk Location Based Service (Studi Kasus: Informasi Lokasi SMA di Palembang). Jurnal Ilmu Komputer Agri-Informatika.
- Priyastama, Romie. 2017. Buku Sakti Kuasai SPSS Pengolahan Data & Analisis Data. Yogyakarta: Start up pt anak hebat indonesia.
- Sugiharto, Toto. 2009. Analisis Varians. Jakarta: Universitas Gunadarma Fakultas Ekonomi.

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