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Motorcycle Security System using SMS Warning and GPS Tracking

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***Abstract*—Today, technology has been developing rapidly. Various types of technology have been developed and provide a great deal of convenience in human life activities, including security systems. Motorcycles, parked in a park or on the street, are at high risk of being stolen. A security system for Motorcycles with SMS warning and GPS tracking that can prevent theft of a motorcycle is needed. The research aimed to design a security system for motorcycle consisting of a SIM808 GSM Module to send warning messages, and a GPS tracker to provide information in latitude and longitude coordinates to track the stolen motorcycle using Google Maps. GPS Tracker worked by reading the coordinates where the object was located. The tests were carried out by moving and integrating the motorcycle system, and the results could be seen in the coordinate changes, monitored by Google map showing the movement of the motorcycle. The system made was significantly closer to what was planned.**

Keywords—GPS, GSM, SMS Warning, Tracking, Security System, Map.

I. INTRODUCTION

Technology is developing very rapidly at the moment. Various kinds of technological works have been created to make it easier for humans to carry out their activities, including the security system. however, there are still frequent cases of motorcycle theft, due to the lack of a security system on motorcycles that only uses ignition [1] – [3]. A dual safety system on the motorcycle has been designed to prevent motorcycle theft using SMS [2], [4], [5] and GPS Tracking system [2], [4], [6]–[11], integrated directly into the internet network on a smartphone, and monitor the location of the motorcycle via Google Maps [11], [12].

Several researchers have created an automatic motorcycle security system using GPS (global positioning system), GSM (global system for mobile communication), RFID (Radio Frequency Identification) [2], [5], [6], [8], [13] – [16] and short message service (SMS) [2]. Sriborrirux designed and realized a security system based on GPS, GSM, using the android application on mobile phones [2]. The security system equipped with an artificial intelligence algorithm could find the shortest path needed by a user.

When a motorbike is stolen [8], [14], [17], an alarm that sends an SMS warning to the Android smartphone is activated. That way, the owner will soon find out that the bike has been stolen. If the thief has managed to remove the bike, the motorbike's location can be identified by tracking the coordinates sent by SMS Module SIM 808. To track the location of the stolen motorcycle, the owner can access the SIM card number installed in the GSM Module [1] – [4], [6], [8], [10] – [12],[17] and the GPS Tracker [4], [6] – [12], [14], [18] using Google Maps. The Global Positioning System (GPS) Tracker module provides convenience as it accurately calculates the geographical location of the motorbike's location by receiving information from GPS satellites.

GPS Tracker works to obtain vehicle location coordinates (latitude and longitude) and the Google Maps to display the map of the location, while the GSM module as an intermediary device that connects communication to the Arduino UNO microcontroller [6].

II. METHOD

A. SMS Warning Message and GPS Tracking

SMS-based warning system has become popular as a communication device for people around the world [19] – [23]. All cellphones can now communicate using GSM.GSM (Global System for Mobile Communications) [21], [24] – [27] is a cellular network protocol used on cellphones or smartphones. GPS (Global Positioning System) technology is a navigation technology that provides accurate positioning and information [27] – [30], managed by the United States. It began in 1973 and was designed for military purposes, but later authorized for commercial use.

The specifications and characteristics for GSM/GPRS + GPS Module are as follows:

•General features

• Quad-band 850/900/1800/1900MHz

• GPRS mobile station class B

• Compliant to GSM phase 2/2+

– Class 4 (2 W @ 850/900MHz)

– Class 1 (1 W @ 1800/1900MHz)

• Control via AT commands (3GPP TS 27.007,

27.005 and SIMCOM enhanced AT Commands)

• Supply voltage range 3.4 ~ 4.4V

•Specification for GPS

Receiver type

- 22 tracking /66 acquisition-channel

- GPS L1 C/A code

Sensitivity

-Tracking: -165 dBm

Accuracy

-Horizontal position: <2.5m CEP

•Specifications for SMS via GSM/GPRS

• Point to point MO and MT

• SMS cell broadcast

• Text and PDU mode

B. System Block Diagram

The operating principle of the motorcycle security system as illustrated in figure 1 is that when the engine starts, the security system activates the engine ignition [5], [6], [12], [13], [15] and at the same time, it activates the alarm and transmits signals to be processed by Arduino microcontroller. The system will send an SMS message and the last coordinate points of the vehicle's movement every one minute to the owner using the SMS Gateway facility.

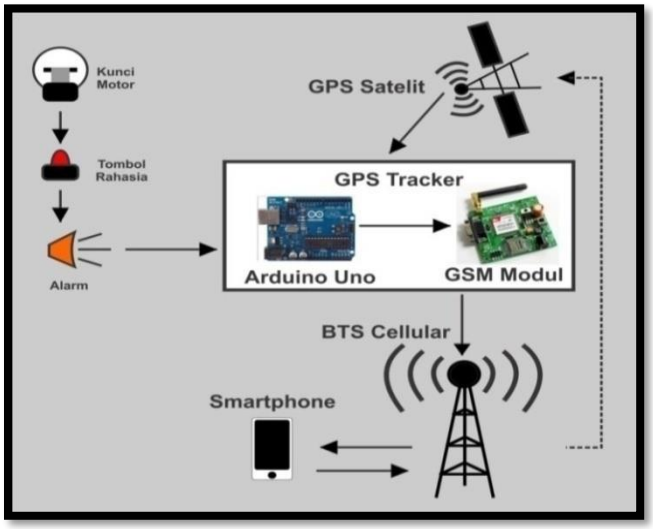

Fig. 1. System Block Diagram

Figure 1 shows that the GPS generates data from the GPS sensor on the GPRS Shield SIM808. When a motorcycle is stolen by unlocking the motor key, the engine lock output enters the Arduino UNO input for access and sends an SMS warning message. Access to these alerts is provided by the GPRS Module SIM808. The SIM808 GPRS module is a component that sends data communications from Arduino Uno to smartphones and from smartphones to Arduino Uno. Data communication cannot take place without the use of an intermediate GPS satellite. When the motorcycle moves, GPS Satellite continues to detect the movement of the motorcycle.

The GPS tracker device installed in the vehicle had been set up to send the data of the motorbike location obtained from GPS communication with GPS satellites. Figure 2 displays SMS warning messages informing the coordinate values. Users need the Google Maps application installed on the smartphone to find the motorbike location visually, and then copy and paste the SMS data of the coordinates to connect to the GPS. The smartphone will keep monitoring the motorcycle location.

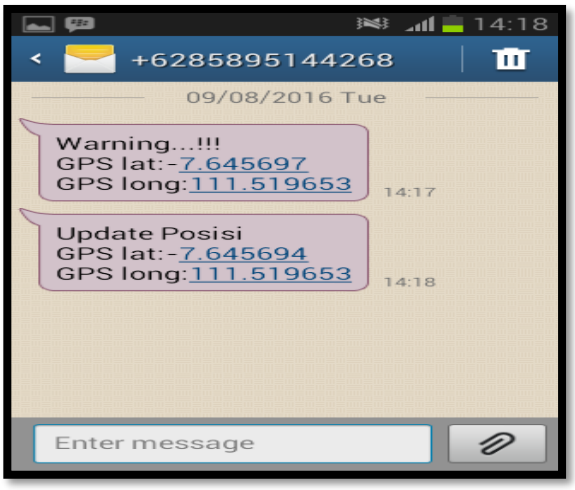

Fig. 2. SMS warning with coordinate values

C. System workflow program

Figure 3 shows the system workflow diagram, and Figure 4 shows the operation process starting when GPRS is active, and the GPS sensor located on the GPRS Shield SIM808 detects the location of the motorcycle. When requesting a position via SMS, the GPS sensor will read the coordinates of the location, and then sends them via SMS. The GPS sensor will read the data and send them repeatedly every one minute via SMS.

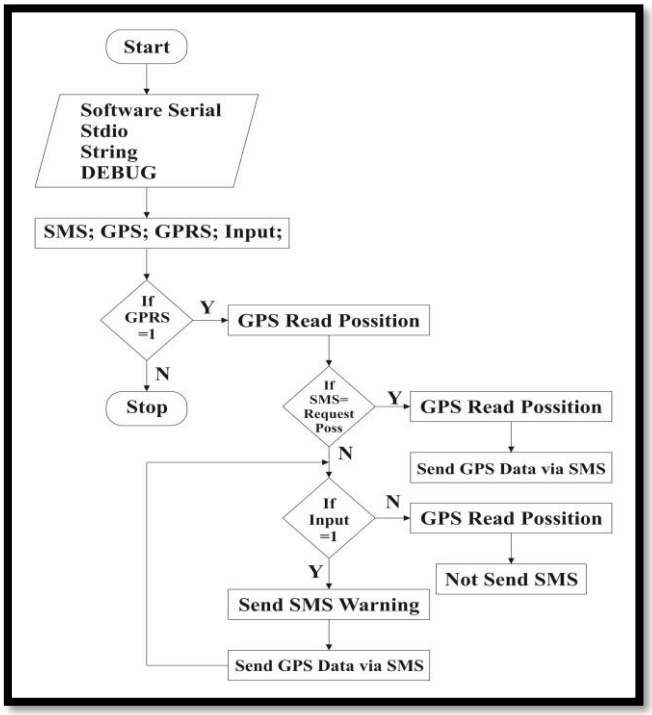

Fig. 3. Flow diagram of GPS Tracker

Generally, the work of the GPS (Global Navigation Satellite System) starts when the motorcycle security system is activated.

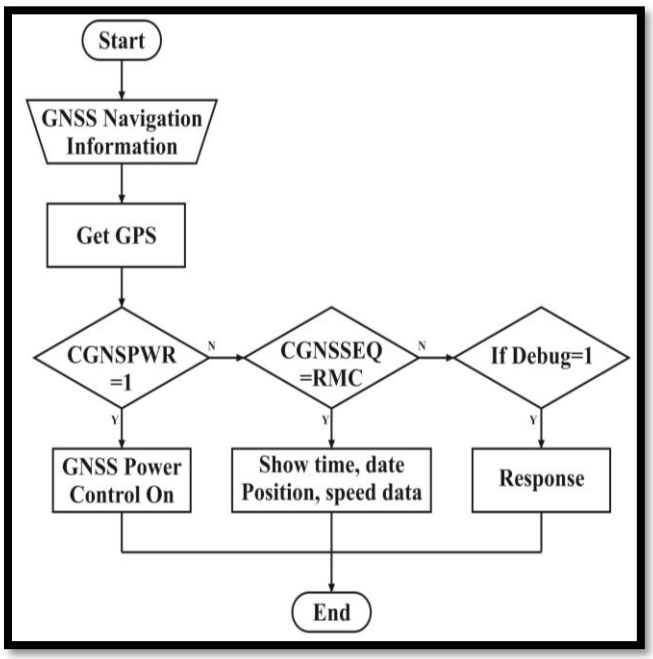

Fig. 4. GPS Tracking

GPS tracking displayed in figure 4 shows that when searching for locations, several AT commands are needed to order some GPS functions. If the AT Command instructs CGNSPWR to be active, it means that the GNSS Power Control is on and active, so the GPS will start processing the data. When AT Command orders CGNSSEQ = RMC, it is defined as reading the last description of the NMEA (National Marine Electronics Association) sentence. The RMC is the AT command contains time, date, position, path, and data speed commands. Debug the program functions to display the response in the form of data in latitude and longitude coordinates.

III. RESULT

Project implementation is shown in Figure 5 in the form of a security system prototype, complete with an SMS Warning message and GPS tracking to be installed on the motorcycle ignition.

Fig. 5. Hardware prototype

A. Testing with Google maps

The step to track the object was first defining the user location to determine the location and accuracy of Google Maps in the tracking process. This process was performed by entering the latitude and longitude coordinates where the user's starting point was. The second step was opening Google Maps and clicking the “current location” button. Finally, entering the latitude and longitude coordinates, for example, -7.645625, 111.5198.

Fig. 6. Tracking on Google Maps when users and objects are in one location

Figure 6 shows the tracking on Google Maps when users and objects are in one location. It shows that when testing Google Maps by searching for the coordinates for the analysis results, the system works and can detect the starting location latitude and longitude, which are the same as the location of the motorcycle (the initial position is indicated by the arrow).

B. Coordinates Testing

The coordinates testing was performed at Jl. Serayu, Gg. field (Fig. 7). The test aimed at determining changes in latitude and longitude coordinates. The tested coordinates were placed at the starting point, and the measurement was 10 meters north, south, west, and east from the starting point. Table 1 presents the result of the coordinate test.

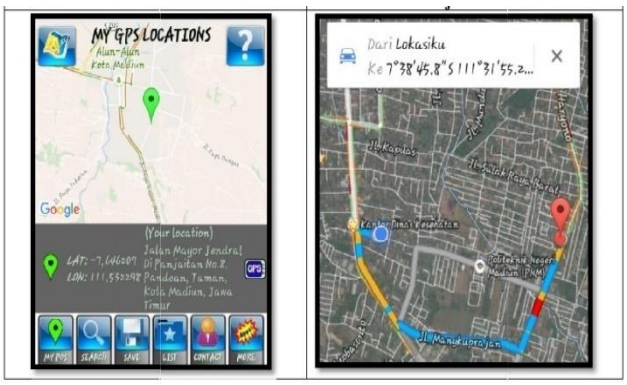

Fig. 7. Comparison data between the data from the Google Maps and from the SMS response

TABLE I. COORDINATE POINT TESTING RESULTS

Points of the compass	*Latitude*	*Longitude*
Starting Point	-7.648308	111.525
	-7.648302	111.5254
	-7.648233	111.525
North direction	-7.648308	111.525
	-7.648302	111.5254
	-7.648233	111.525
East direction	-7.648367	111.5255
	-7.648362	111.525
	-7.648362	111.525
South direction	-7.648412	111.5250
	-7.648411	111.525
	-7.648411	111.5253
West direction	-7.648288	111.5241
	-7.648293	111.524
	-7.648240	111.5240

The coordinate number for latitude is marked with a minus (-), while longitude with a plus (+). At one position, the numbers change with the tolerance of one digit for the last digit on latitude and longitude. The following conversion formula is used to convert decimal numbers to decimal degrees.

The decimal coordinate data value -7.648240, 111.5240 means that the number 7 is the degree value, and the number .648240 ... is the number of divisions of 60 from the decimal coordinate value. The degree value -7° means -7° and 60*0.648240 = 38.895. The degree value 111° means 111° and 60*0.5240 = 31.44. Thus, the result of the conversion of decimal degrees is -7° 38.895', 111° 31.44'

C. Testing the movement of Object

Object monitoring starts when the object is in RRI

Madiun City, Jl. Panjaitan and users are in Pandean Village, Jl. Serayu Timur Gg 2, as shown in Figure 8.

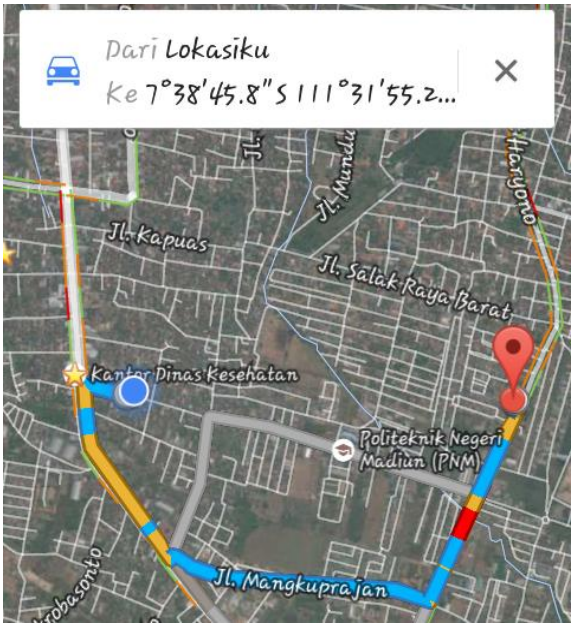

Fig. 8. Test object tracking

The object monitoring results can be seen when the object is in the Madiun State Polytechnic, and the user is on Jl. East Serayu Gg 2, as shown in Figure 9.

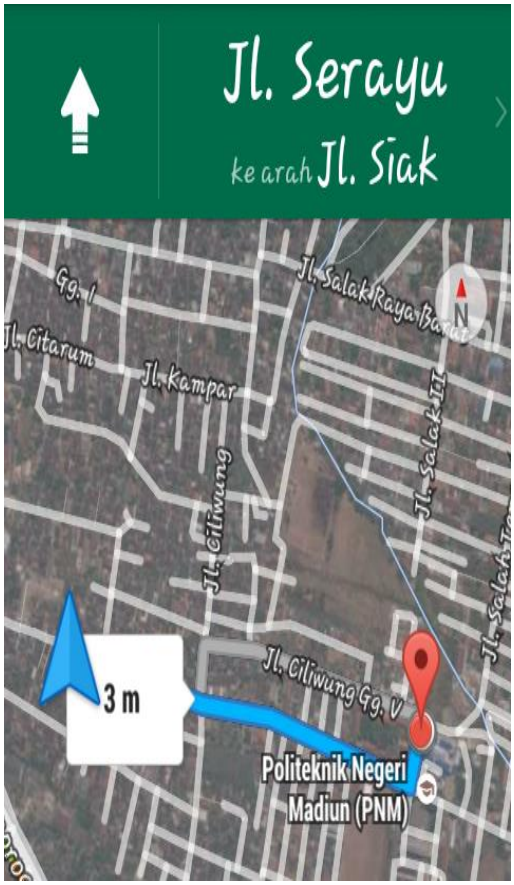

Fig. 9. Testing tracking objects with the user

When the tracking and data from the object showing the same coordinate number, it means that the object is not moving, as shown in Figure 10.

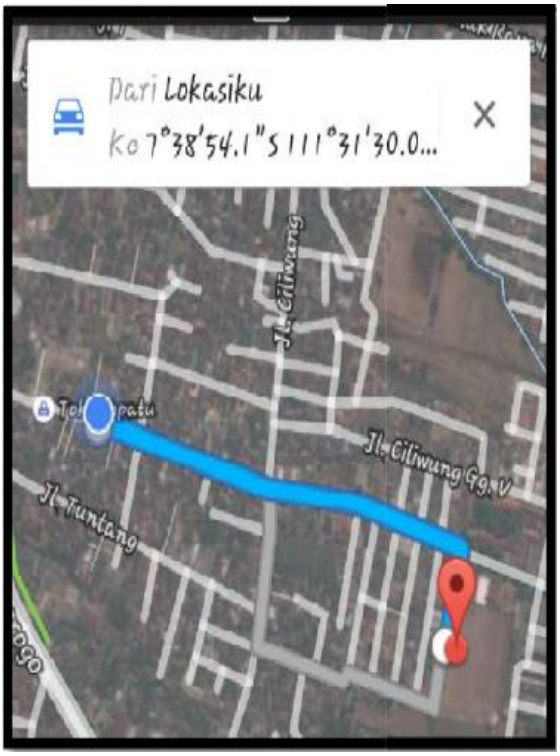

Fig. 10. Testing when the object is not moving

The SMS Gateway facility identifies the location of the object, and the SMS data value entered to Google Maps updates the position, as shown in Figure 11.

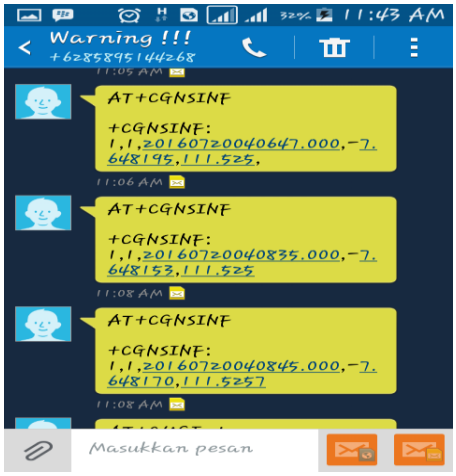

Fig. 11. SMS warning with decimal degree value

The user can follow the blue path seen on Google Maps to check the object location. Following is the conversion value from decimal coordinates to degrees at the locations of the user and the object.

- When the user is on Jl. Serayu Gg 2, Madiun city, the coordinates show: -7.631395.111.545588, the conversion values to decimal degrees are -7° (60*0, 631395)', 111° (60*0.545588)' - 7° 37.8837', 111° 32.73528' decimal degrees.
- When the user is on Jl. Serayu, Gg. Field, Madiun City, the coordinates show: -7.648302.111.5254, the conversion values to decimal degrees are -7° (60*0.648302)', 111° (60*0.5254)' -7° 38, 89812', 111° 31,524' decimal degrees.
- When the user is at the Madiun State Polytechnic campus, Jl. As, Madiun city, the coordinates show -7.646923.111.5264, the conversion values to decimal degrees are -7° (60*0.646923)', 111° (60*0.5264)' -7° 38.81538 ', 111° 31,584'
- When the user is at RRI on Jl. Panjaitan, Madiun city, the coordinate number shows -7.646043.111.5320, the conversion value becomes: -7° (60*0.646043)', 111° (60*0.5320) -7° 38.76258', 111° 31.92' degrees decimal.

IV. CONCLUSIONS

GPS sensor reading is based on where the object is located. Every movement and shift of 10 meters, the coordinate number changes. The object search on Google Maps is based on the longitude and latitude coordinates that are converted to decimal degrees. Monitoring objects uses Google Maps on the user's Smart Phone.

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