Suitcase security system using Android and GPS

Hendri* **and Rosyinta**

Department of Electrical Engineering, Faculty of Engineering, Universitas Negeri Padang, **INDONESIA**

*Corresponding author: hendri@ft.unp.ac.id

Abstract—Technological progress is something that cannot be avoided in line with the development of science. Technology provides many benefits because technology is present to facilitate human work. One of the technological advances is the presence of airplanes. To go wherever humans are not restricted by distance and time. Generally, people will use a suitcase to store their luggage when they travel because it is easier to carry. But the theft of items in the suitcase is rampant. For this reason, a security system can be made that can inform the owner that the suitcase has been forcibly opened. The PIR sensor installed in the suitcase will detect if there is movement and temperature of the human body heat in the suitcase. Then GSM SIM900A will send a notification to the owner and the buzzer will sound. If the suitcase has been stolen and taken away then we can see the location of the suitcase in the application that has been made with coordinates obtained from the GPS module installed in the suitcase. In addition, we can activate or deactivate the sensor through an application that has been made with the aim that when the owner opens the suitcase there will be no notification that the suitcase has been forced open and the buzzer will not ring.

Keywords*: Suitcase, Arduino, GSM SIM900A Module, GPS Module, Sensor PIR*.

I. INTRODUCTION

The development of times is very rapid as the development of technology and science develops. Technology provides many benefits, because technology is present to facilitate human work. One of the technological advances can be seen in the development of transportation equipment, namely by the presence of airplanes. To go wherever humans are not restricted by distance and time. Before traveling, of course, a container is needed to store luggage. One of them is by using a suitcase. Suitcases are in great demand because they can store lots of luggage and are easy to carry around. But it is undeniable that there is still widespread luggage theft with the aim of taking valuables inside.

For this reason, a security system can be made that can notify the owner if the suitcase is opened without the knowledge of the owner and can find out where the suitcase has been taken away by the thief.

II. METHODS

In the literature study explain the relevant material used in this paper in accordance with all the descriptions mentioned earlier. A suitcase is a container that is used to store items needed when traveling. Suitcases are generally in great demand because they are easy to carry everywhere and can store a lot of luggage. The size of the suitcase used is 37 cm long, 22 cm wide and 55 cm high as in the following figure.
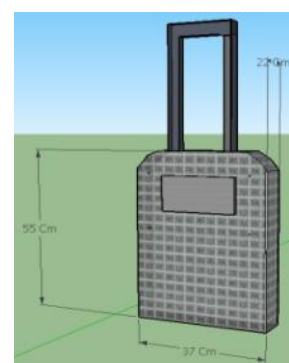

Figure 1. Suitcase

A. Arduino

Arduino is an open source microcontroller board and has its own programming language, which is in the form of C language. In addition, programming is easier because it uses simple functions and is suitable for beginners who want to learn easily.

Figure 2. Arduino Uno Module

B. PIR Sensor (Passive Infrared Receiver)

PIR sensor is a sensor that can detect passive infrared which is around it like the human body. The workings of the PIR sensor, which is infrared emission, enter through a Fresnel lens and concerning pyroelectricity. Then the pyroelectric will generate an electric current so that the sensor will be active.

Figure 3. PIR Sensor

C. GSM SIM900A module

The GSM module is a device that is designed for communication between machines and machines and humans with machines. GSM can exchange information by sending messages or receiving messages like cell phones. To be able to perform GSM functions by using the commands that are on AT-Command.

Figure 4. GSM SIM900A Module

D. GPS module

To display the location and position on earth in realtime can use GPS (Global Positioning System).

GPS satellites that orbit the earth are responsible for storing and receiving data transmitted by the controlling station. One module that can provide location coordinates is the GY-NEO6M GPS module.

Figure 5. GPS GY-NEO6M Module

E. Buzzer

Buzzer is one of the electronic components that can turn electrical vibrations into sound vibrations. The sound frequency that can be generated by the buzzer between 1-5 Khz. The usual buzzer is used to indicate a process has been completed or as an alarm notification if something happens.

Figure 6. *Buzzer*

F. Tool design

In this section, we will explain how to design tools that include designing hardware and software.

G. Block diagram

The block diagram explains how the tool works according to the cause and effect between input and output.
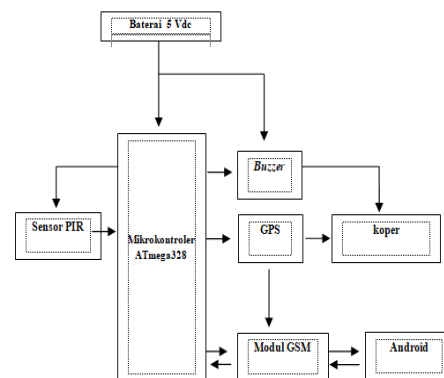

Figure 7. Diagram Block

H.　Hardware design

Hardware design aims to determine the electronic components used in the design of the device. The following components are used:

1.　*Powerbank*
2.　Arduino UNO
3.　GSM SIM900A Module
4.　GPS GY-NEO6M Module
5.　PIR Sensor
6.　*Buzzer*

The mechanical form of the tool design is a box with a length of 24 cm, width of 10 cm and height of 6 cm as shown Figure 8.
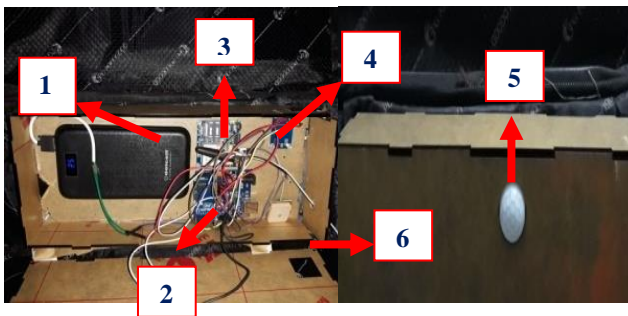

Figure 8. Tool Shape

I.　Software Design

Software design aims to explain what software is used in this paper. The software used is as follows.

1.　MIT App Inventor

MIT App Inventor is software that is used for the development of android applications. This device is easy to use because it consists of program blocks arranged like a puzzle. MIT App Inventor is used to create a suitcase security system application such as the following display.

Figure 9. Designer

Buttton is made in accordance with the desired command such as the search location button, open the suitcase, close the suitcase and close the application. To make an application program made in the block section as shown below.
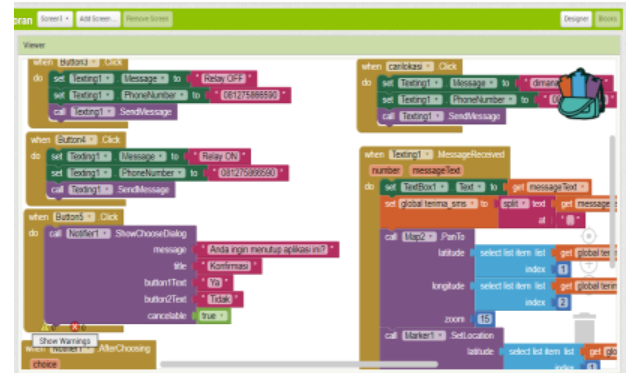
2.　Arduino Programming Language

To create a program code on the main control system (Arduino) using Arduino IDE (Integrated Development Environment) software. This programming language uses C language and has simple functions that are easy to use.

III. RESULTS

To prove whether the tool is running well it needs to be tested. The tests carried out are testing the power supply, testing the PIR sensor, reading the GPS coordinates, testing the GSM module and buzzer.

A.　Testing of power supply

In order to be able to supply voltage to the system using a power supply sourced from a 5 volt DC battery. To find out the output voltage produced by a battery, a voltmeter is used to test (Masdi H, 2004: 2). Tests carried out can be seen in the following Table 1.

Table 1. Testing

Condition	Voltage	Wave Form
OFF	0 Volt	
ON	5,13 Volt	

From the results of the above tests the value of the output voltage is 5.13 volts. The voltage can supply the voltage of each component used in the system.

B. Testing of PIR sensors

The PIR sensor is used to detect hand movements in the suitcase. The PIR sensor is installed in a box attached to the frame of the suitcase. To find out how far the sensitivity of the PIR sensor is, test each side of the suitcase and get the following results.

Table 2. The sensitivity

Suitcase Section	Distance (cm)	Sensor
Right side	26	Detected
Left side	26	Detected
Front side	30	Detected

From the above tests it can be seen that the sensor can detect each side of the suitcase. If theft is carried out on the right or left side, the sensor can still detect.

C. Testing the buzzer

The buzzer is used as an alarm when the suitcase is opened without the owner's knowledge. For this reason, testing is done so that it can be seen how far the buzzer sounds can still be heard.

Table 3. The buzzer

Distance (m)	Buzzer Sounds
1	sound heard
2	sound heard
3	sound heard
4	sound heard
5	sound heard
6	sound not heard

From the tests conducted it can be seen that up to a distance of 5 meters the buzzer sound can still be heard but at a distance of 6 m the buzzer sound starts to be hard to hear.

D. Testing the Application and GSM SIM900A

In the android application, a button is used to give commands by sending a message to the GSM SIM900A module. After the message is sent, this GSM module will execute the command according to the message. The buttons are "open the suitcase" and "close the suitcase". For this reason, it is necessary to test whether GSM SIM900A can execute commands after the desired button is pressed.

Table 4. Result of testing

Distance (km)	Open button	Close button	GSM	Sensor
3	Pressed down	Not pressed	Received	HIGH
	Not pressed	pressed down	Received	LOW
9	Pressed down	Not pressed	Received	HIGH
	Not pressed	pressed down	Received	LOW
12	Pressed down	Not pressed	Received	HIGH
	Not pressed	pressed down	Received	LOW

From the test results above GSM SIM900A can execute commands sent from the application as far as possible while there is still a GSM signal. The accepted command corresponds to the command button pressed on the application.

IV. DISCUSSION

The GPS module is used to find out where the suitcase is if it is carried by a thief. When the "Search Location" button in the application is pressed, it will send a message to GSM SIM900A to send the coordinates of the GPS module. After the coordinate point is sent, the location of the suitcase will appear in the folder in the application. The following tests are carried out.

Table 5. Checking

Distance (km)	Coordinate	Map
0	Lat -0.891964, Long 100.349000	

Distance (km)	Coordinate	Map
1	Lat -0.8971569, Long 100.3499204	
3	Lat -0.884146, Long 100.350680	
9	Lat -0.921260, Long 100.366150	
12	Lat -0.924032, Long 100.362940	
14	Lat -0.926254, Long 100.351430	

The test started from the starting point, namely the Faculty of Engineering, Padang State University, where the android was placed at the starting point, while the suitcase was taken away to find out whether GSM could send location coordinates to the android application. From the test results in the table above, it can be seen that GSM can send coordinates as far as possible while GSM and GPS signals are still available.

V. CONCLUSION

After testing and analyzing the design of the suitcase security system using Android and GPS, it can be concluded that the PIR sensor can detect movement on each side of the suitcase and can receive GSM commands properly. When the PIR sensor is active, the buzzer is also active, this means that the buzzer can work properly according to the instructions given. While getting a signal, GPS can display the location coordinate properly even though there is still a small percentage of errors. The buttons available on the application can work properly according to what commands are pressed on the button. Map and Marker can find location points quickly after GSM 900A sends GPS coordinates. GSM can work well as long as the available signal also good.

REFERENCES

Antonius Rachmat C. 2010. *Algoritma Dan Pemograman Dengan Bahasa C*. Yogyakarta : Andi Offset.

Masdi H. et al. 2004. *"Design of a Prototype D-STATCOM For Voltage Sag Mitigation".* In Power and Energy Conference. PECon 2004. Proceedings. National (pp. 61-66). IEEE.

Megapolitan.kompas.com. Diakses 1 september 2019

M.F Wicaksono & Hidayat. 2017. *Mudah Belajar Mikrokontroler Arduino Disertasi 23 Proyek, termasuk Proyek Ethernet dan Wireless Client Server*. Bandung : Informatika Bandung.

Nikodemus. 2013. *Pemograman Android dengan APP Inventor*.Yogyakarta: CV Andi Offset.

Nitin, Shyam. *2015*. "SMS Based Kids Tracking and Safety System by Using RFID and GSM*".* *IJISET - International Journal of Innovative Science, Engineering & Technology* (Volume 2 Tahun 2015). ISSN : 2348 – 7968. Diakses 15 September 2018.

Petruzella, Frank D. 2001. *Elektronik Industri* (Sumanto Terjemahan). Yogyakarta : Andi.

Rohimah. 2014. *Pengaman Tas Pendeteksi Sayatan Menggunakan Teknologi Global Positioning System (GPS) Dengan Sensor* LDR *Via Short Message Service (SMS).* Palembang : Politeknik Negeri Sriwijaya

Yohana Damayanti. 2014. *Sistem Buka Koper Dengan Pendeteksi Sayatan Menggunakan Rfid Berbasis Mikrokontroler Atmega8.* Palembang: Politeknik Negeri Sriwijaya.