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Original Article

Pattern Lock and GPS-Based Motorcycle Security System

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Abstract *- Motorcycles are currently widely used by the community, but it is undeniable that there are many cases of motorcycle theft as a result of users' negligence in parking their vehicles carelessly. This paper builds a motorcycle security monitoring system with the Internet of Things (IoT) capabilities using Pattern Lock, GPS Neo 6, and Raspberry Pi 3 sensors. The findings of this study show that the system works by utilizing a cross pattern, a voltage sensor took directly from the ignition of a motorcycle as a notification of the vehicle's life or death, and internet of things capabilities. Furthermore, this system has the advantage of being equipped with a GPS Neo 6 sensor, which functions to monitor the position of the motorcycle with longitude and latitude readings in the event of motorcycle movement.*

Keywords – *Motorcycle, Pattern Lock, GPS Neo 6, Raspberry Pi 3, IoT.*

I. INTRODUCTION

Motorcycles are one of the community's modes of transportation, and they play an important role in daily life in carrying out activities [1]–[13]. According to studies, motorbikes currently account for more than 80% of all motorized vehicles in Indonesia [14]–[17]. The increasing number of cases of motor vehicle theft [3], particularly of motorcycles, necessitates the development of a solution to secure them [4],[5]. Motorcycle users' negligence in parking their vehicles in an unsafe location leads to theft, making it difficult for motorcycle owners to track down the vehicle brought by the thief [18]–[27]. Efforts must be taken to anticipate motorcycle safety, and one way is to employ or install smart car technology [6]. In the event of a motorbike movement, the design of a motorcycle security monitoring tool employs GPS Neo 6 to calculate the distance of the vehicle when it is parked by determining the position of the location as a vehicle monitor [4],[3],[7],[8]. Using Internet of Things (IoT) technology, a Raspberry Pi 3 and Pattern Lock or a cross pattern on an Android smartphone may be used as a controller to turn on or off a motorcycle vehicle, allowing motorcycles to be monitored and controlled remotely [6],[9][10],[11]. The goal of the study is to design and build an Internet of Things-based motorbike security system that prevents the motorcycle from being started by the engine, either with the front starter or the side crank.

II. METHODOLOGY

To collect knowledge, an analytical approach is used; this technique employs an interpretive perspective [28]–[31]. Several case studies are drawn from academic papers, and the majority of these studies provide a comparative overview of the applied technology. The research method entails gathering contextual knowledge via systematic literature analysis, Software Analysis, Hardware Analysis, Block Diagram Design Concepts, and Circuit Systematic [32]–[36]. As a result, the authors decided to conduct a systematic review of the literature to develop an outline of the issues at hand.

A. Analysis Software

A software design that communicates with the hardware that has been created is referred to as a software design. A clear and systematic design flowchart is required to make IoT design easier. As a result, we'll require a flowchart. The flowchart of the designed tool is shown in Figure 1 [37]–[50].

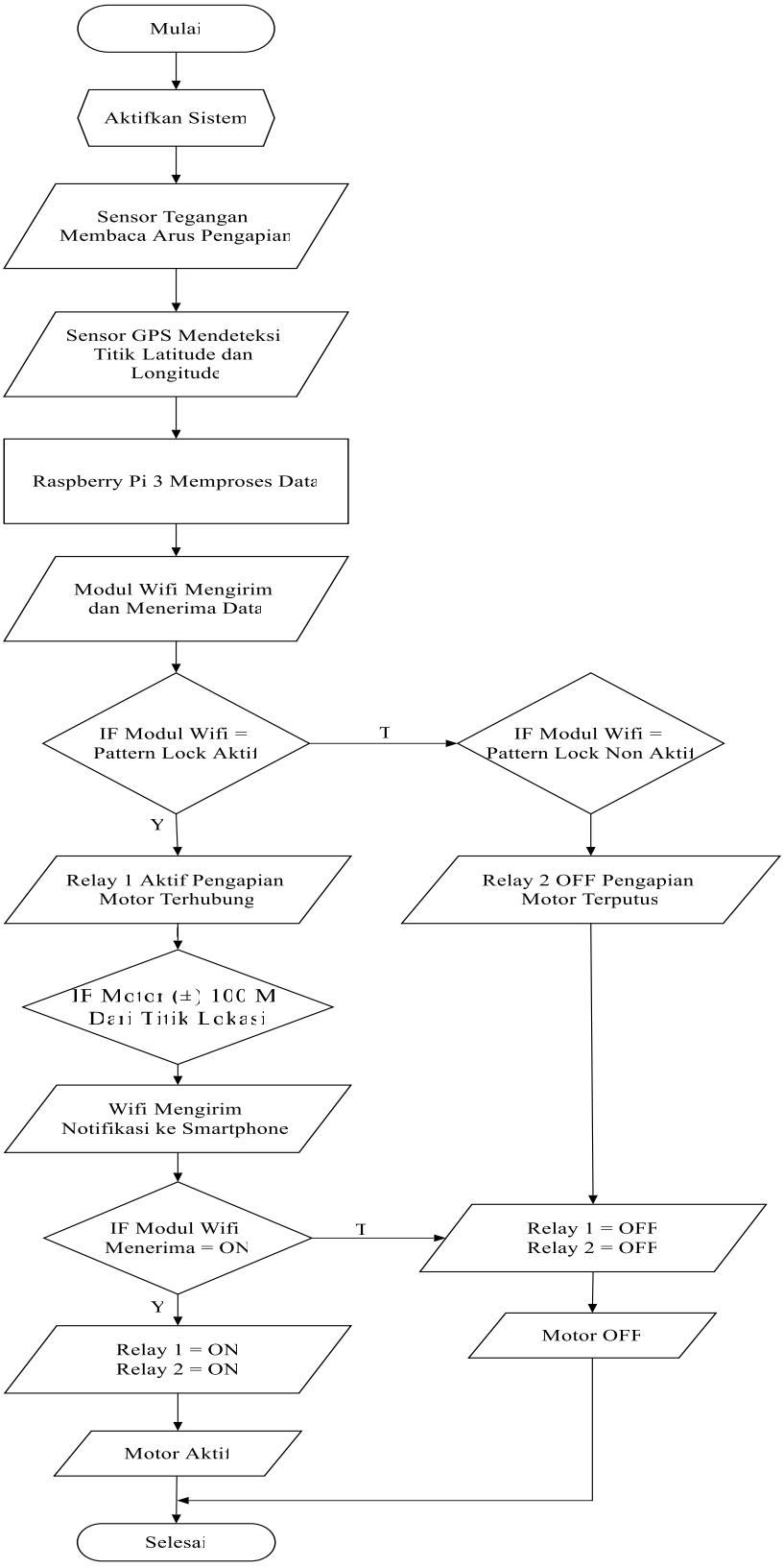


Fig. 1 Flowchart design

According to the flowchart in Figure 1, the tool's starting step involves the voltage sensor detecting the ignition current and the Neo 6 GPS sensor detecting the latitude and longitude coordinates [51]–[63]. The analog data is then transferred to the Raspberry Pi 3, where it is converted to digital data. Data is received and sent using a Wifi module or an esp8266 module. If the pattern lock is turned on, relay 1 is turned on, and the motorcycle ignition is linked; relay 2 is turned off, and the motorcycle ignition is detached [64]–[73]. The motorbike sends a notification if it moves more than 100 meters away from the location point. If the wifi module receives On, relay 1 and relay 2 will be On, and the motorcycle will be active; if the wifi module receives Off, relay 1 and relay 2 will be Off, and the motorcycle will be Off.

B. Analysis Hardware

Several hardware components are required to design a Motorcycle Security Monitoring system using Pattern Lock and the Internet of Things (IoT) Neo 6 GPS Sensor.

Table 1. Hardware

No.	Component	Function
1	Raspberry pi 3 model b	The system's primary control.
2	Atmega328p-pu	Convert to digital data
3	*Gps neo 6*	Data from a GPS receiver is read (latitude and longitude)
4	Relay	Connectors and circuit breakers
5	Ic 7805	Maintain voltage stability.
6	Resistor 203, Resistor 1k	Divider of voltage
8	Modul ESP 8266	Using the internet to send data to the cloud server
9	Transistor 1815	Raise the voltage.
10	Motorcycle USB charger	Raspberry Pi's current power supply.

C. Block Diagram Design Concepts

This step creates a design for a motorcycle that will be used to test the tool and make the subsequent phases easier to complete. The proposed control system's cycle diagram is shown below [74]–[83]. Figure 2 depicts the fundamental concepts of study design.

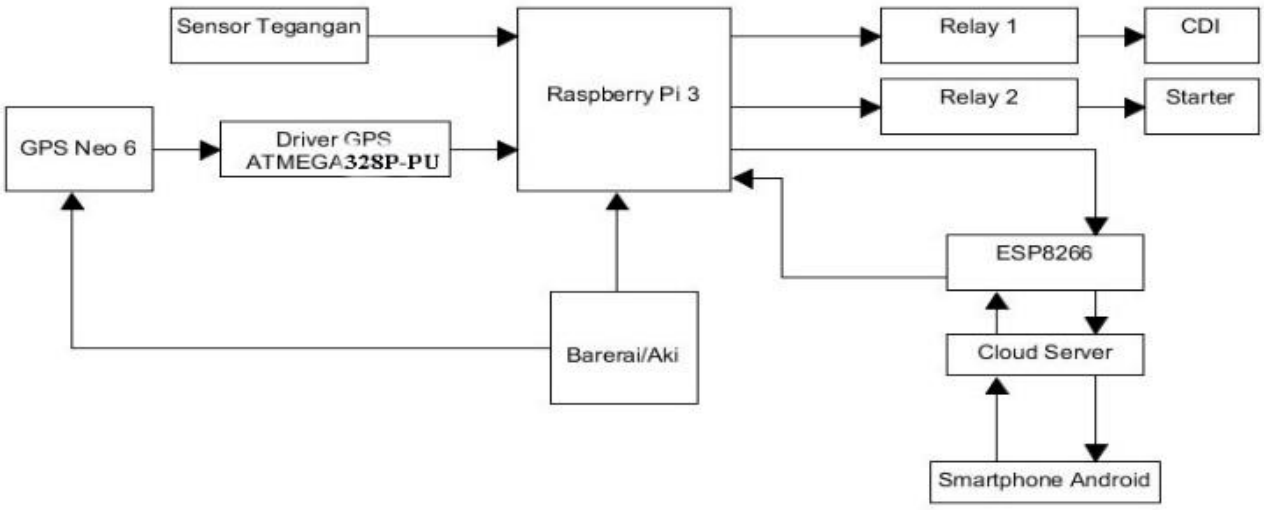


Fig. 2 Research Design Concept

The system cycle diagram in Figure 2 shows how to design a motorcycle security monitoring system using a Raspberry Pi 3 microcontroller [84], [85]. Input and output devices are connected to each pin on the microcontroller's port. The voltage sensor used to detect the ignition current on the motorcycle and the GPS Neo 6 used to identify the position with the coordinates are the input devices in this scenario. Meanwhile, the ATMEGA328P-PU collects data from the GPS Neo 6, translates it to digital data in the form of Latitude and Longitude, and sends it via serial connection to the Raspberry Pi 3 [86], [87], [96]–[100], [88]–[95].

The processed data instructs Relay 1 to disconnect and reconnect the current to the CDI, after which Relay 2 controls the current on the Starter[101],[102]. The Raspberry Pi 3's processed input can be sent to the cloud server via an internet connection (ESP8266), which can be accessed via an Android smartphone[103],[104]. The circuit breaker is controlled by an android smartphone using an internet connection to a cloud server, which then sends input commands to the microcontroller for processing[105],[106].

D. Circuit Systematic

The Raspberry Pi 3 microcontroller is used to create a series of tools for constructing a motorcycle security monitoring system. Figure 3 illustrates the circuit.

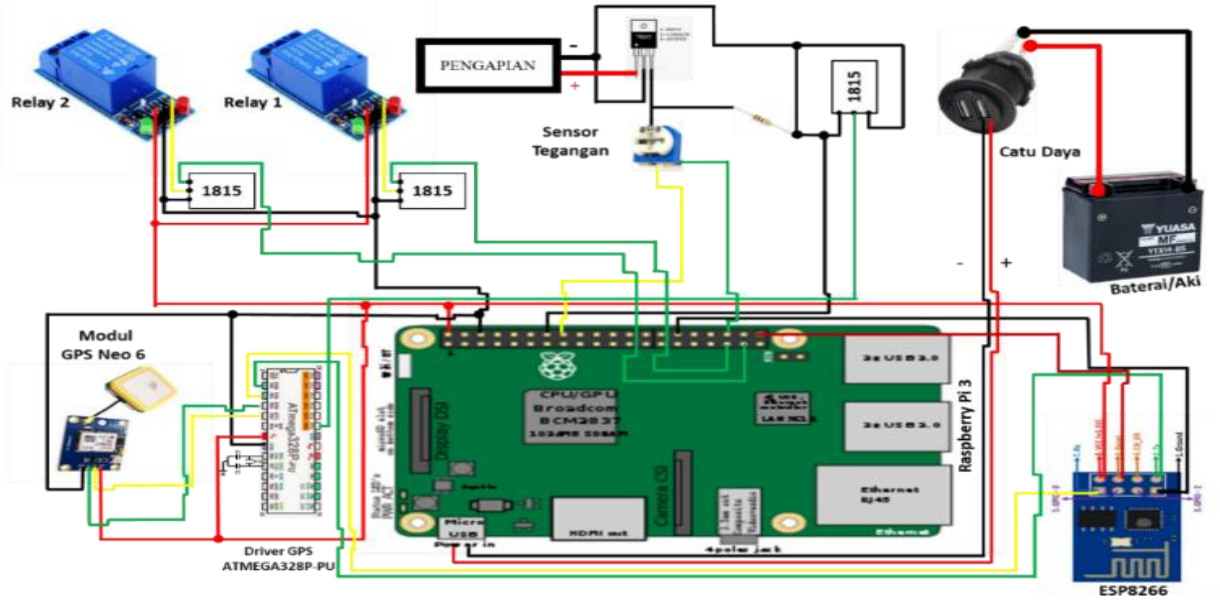


Fig. 3 Illustrates circuit

III. RESULTS AND DISCUSSION

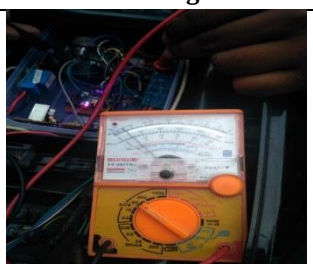
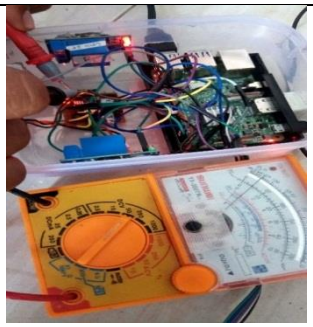
During this research, black-box testing was used. Functional requirements are the primary focus of black-box testing[107],[108]. It is possible to obtain input conditions that fully utilize all functional requirements for all programs by using black-box testing[109]. There is no way to know if a system is true or false unless it produces a certain output. The program's ability to meet user needs as well as errors can be measured from the output produced. In this system, the black box test is used to determine whether or not the input data output has been working as expected.

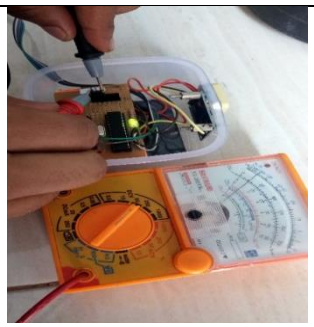
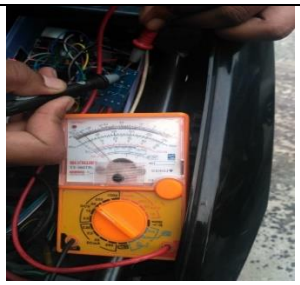
Some of the tests performed include circuit voltage testing, pattern lock testing, voltage sensor testing, testing for movement notification, relay module testing, GPS Neo sensor testing, esp 8266 module testing against the cloud server, and evaluating the test results.

A. Circuit Voltage Testing

This circuit voltage test aims to determine the incoming voltage to the circuit by the hardware or circuit specifications. An analog multitester is used in this test to detect the voltage in the circuit. Table 2 displays the results of the tests that were performed.

Table 2. Circuit voltage testing

No.	Circuit	Voltage	Testing
1.	Voltage test on Raspberry Pi 3	5 Volt	 The voltage produced by testing the voltage on the Raspberry Pi 3 with a multitester is 5 volts.
2.	Voltage test module ESP8266.	5 Volt	 The voltage on the ESP8266 module provides a voltage of 5 Volts when tested using a multitester.

3.	Voltage test module *GPS Neo 6*	5 Volt	 The Neo 6 GPS module provides a voltage of 5 Volts when tested with a multitester.
4.	Voltage test modul relay	5 Volt	 The voltage on the relay module provides a voltage of 5 Volts when tested with a multitester.

B. Pattern Lock Testing

If the pattern lock is in the form of a pattern (Z), the control menu will display; if it does not match the pattern that was set, the control form will not show. The results of the tests are shown in Figure 4 below.

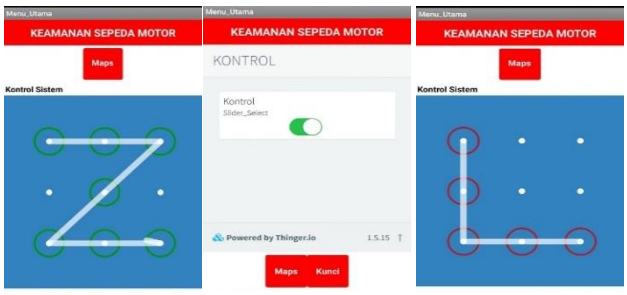


Fig. 4 Pattern Lock Testing Using the Set Pattern and Not Using the Set Pattern

C. Voltage Sensor Testing

If the voltage sensor is activated and detects voltage, it indicates that the motorcycle is operational, and the system will send a notification similar to the one shown in Figure 5 below.

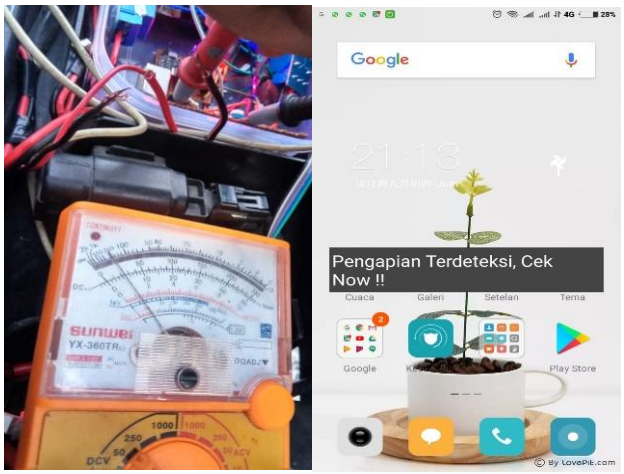
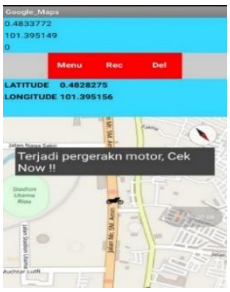
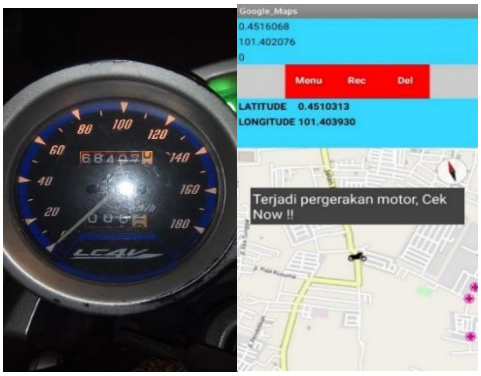


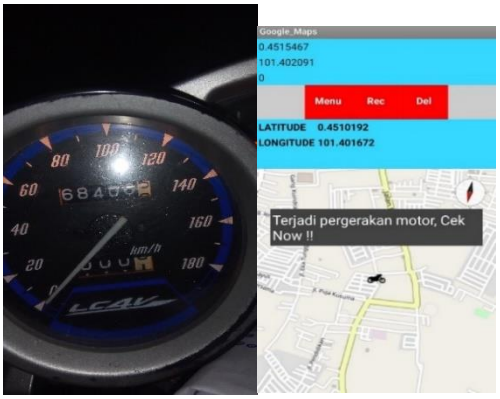
Fig. 5 Test Results for Voltage Sensors

D. Testing for Movement Notification

In this test, the system is tested with the application, and the system will notify the existence of movement based on the movement distance that has been set. To determine whether the system is functioning properly, several tests are performed to measure movement about the specified distance. Table 3 shows the test results.

Table 3. Testing for Movement Notification

Testing To	Distance measurement
1	  A pedometer on a motorcycle is used to measure 100 meters.
2	 A pedometer on a motorcycle is used to measure 250 meters.

3	 A pedometer on a motorcycle is used to measure 90 meters.

E. Relay Module Testing

Connecting the CDI ignition and the Dynamo Starter current of the motorcycle is a condition where the position of the NC (Normally Closed) contact on the relay is shown in Figure 6 below if Relays 1 and 2 are ON or active.

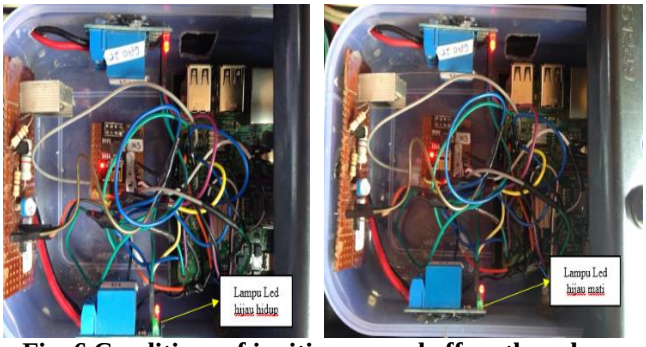
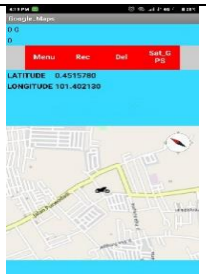
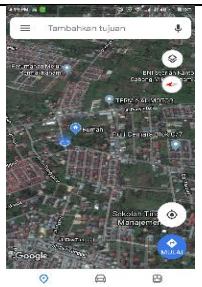
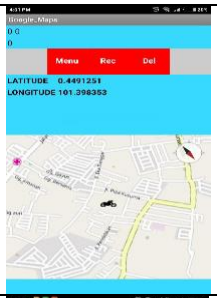
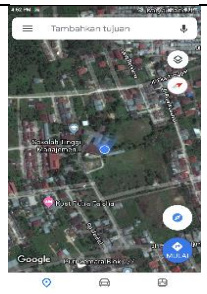
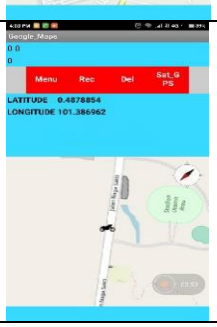
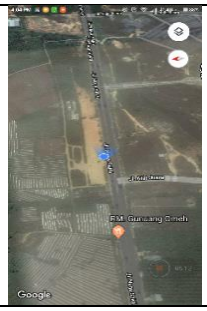


Fig. 6 Conditions of ignition on and off on the relay

F. Gps Neo Sensor Testing

The GPS accuracy test is carried out by comparing it to Google Maps, which results in the motorcycle's placement point being aligned with the Google Maps program. Table 4 below summarizes the findings of the tests that were conducted.

Table 4. Gps Neo Sensor Testing

Testing To	Location	Application Maps	Google Maps	Proof
1	West Sidomulyo, Jl. Trinity No. 9 Pekanbaru City, Riau 28289.			
2	West Sidomulyo, Pekanbaru City, Riau Islands 28294 Jl. Purwodadi Indah KM.10			
3	New Handsome Pekanbaru City Riau 28292 Jl. Naga Sakti Simpang			

G. Esp 8266 Module Testing Against The Cloud Server

Figure 7 shows a connection test between the ESP8266 module and the Cloud Server. If the connection is established, the Online status and graph will turn blue, indicating that the connection is established; if the graph does not appear, the ESP8266 Module connection to the Cloud Server is not established.

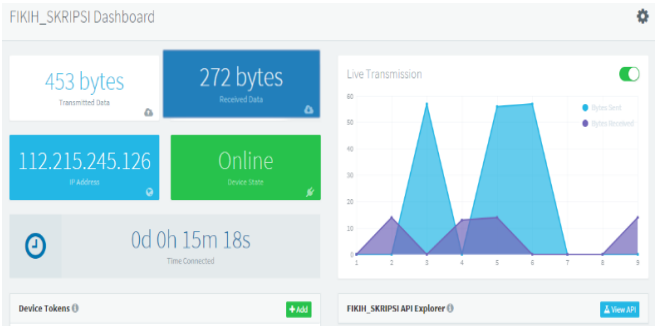


Fig. 7 ESP8266 Module Connection Test to Cloud Server

H. Evaluating Test Results

After all of the testing has been completed, an evaluation is required. The findings of the overall test evaluation are presented in Table 5.

Table 5. Gps Neo Sensor Testing

No.	Testing Expectations	Status of Testing	
		Succeed	Failed
1.	A voltage of 5 volts is applied to the circuit.	✓	-
2.	A voltage of 5 volts is applied to the circuit.	✓	-
3.	A voltage of 5 volts is applied to the circuit.	✓	-
4.	A voltage of 5 volts is applied to the circuit.	✓	-
5.	Pattern Lock is a feature that allows you to access the control form using a predetermined pattern.	✓	
6.	If the motorcycle is running, the voltage sensor can detect the voltage on the ignition.	✓	-
7.	Notifications can be sent if the motorcycle shifts.	✓	-
9.	Based on the longitude and latitude of the motorcycle's position, the Neo 6 GPS sensor can detect the location.	✓	-

V. CONCLUSION

In this paper, we present a motorcycle safety monitoring system based on the Internet of Things that can control ignition and monitor motorcycles from a distance. The voltage sensor connected to the microcontroller circuit can detect motorcycle voltage, and the installed Neo 6 GPS module will send Longitude and Latitude in real-time on the android smartphone application that produces maps of location points so that it will send notifications if there is movement on the motorcycle. For future work, the author suggests adding an application interface to the settings menu to change the pattern lock pattern. On the other hand, a camera must be included in the hardware design to identify motorcycle users (motorcycle thieves), with the goal of the system being able to connect to emergency numbers such as the police call center number so that when a motorcycle is stolen, the system can send location point information and pictures of the thief. We believe that with more hardware supporting system design, this research will provide a more accurate security monitoring system. As a result, it will have numerous advantages in people's lives.

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