13th SCBTII
Sustainable Collaboration in Business, Technology, Information and Innovation

Telkom University

Recover Together, Recover Stronger: Challenges and Opportunities Toward Sustainable Digital Economy

PROCEEDING BOOK 2022

e-ISSN: 2621-3192

Organized By

Fakultas Ekonomi & Bisnis
School of Economic & Business
Telkom University

University Partner

Proceedings of International Conference on Sustainable Collaboration in Business, Technology, Inforation and Innovation (SCBTII)

Third Edition, December 2022

Vol 3. Year 2022

e-ISSN: 2621-3192

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Prototype Motorcycle Security System Using Arduino Based on Internet of Things Integrated With WhatsApp Application

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Abstract
The theft of motorcycle vehicles in the last three years 2019-2021 is still relatively high, there are around 100 thousand cases of theft. Therefore, motorcycle owners secure their vehicles by using a padlock and can also close the ignition for today's motorcycles. Even though this has been done, the vehicle can still be stolen by giving liquid to open the padlock and breaking into the ignition using the "T" key. And vehicle owners do not get information early on the theft of their vehicles. So he made a motorcycle security tool that has a system to provide information in the form of notifications to motorcycle owners if there are indications of theft and can also find out the whereabouts of motorcycles in real time. The use of Arduino Uno R3 using IoT (Internet of Things) technology which is supported by the GSM/GPRS SIM808 module. This is useful for making it easier to send vehicle information using the MQTT protocol as a communication link between motorcycle security tools and broker servers. The information is sent to the motorcycle owner via the WhatsApp application message media.

Keywords— Motorcycle security; MQTT Arduino; IoT

I. INTRODUCTION

Theft is a criminal act, which greatly disturbs the comfort of the community. One of them is the theft of motorcycles, both two-wheeled and four-wheeled. The number of cases of motorcycle theft in the last three years 2019-2021 is still relatively high, there are around 100 thousand cases of motor vehicle theft (Bandung, 2018), although statistically there is a decrease, but it does not reduce the sense of security to the owner much vehicle. Sourced on the official website of the Indonesian Statistics Center, throughout 2019-2021 there have been thousands of cases of motor vehicle theft, 23,476 cases occurred in 2019, 18,557 occurred in 2020, 19,798 occurred in 2020.

Some motor vehicle owners simply lock the handlebars feel quite safe, even though key breaking techniques are currently increasingly diverse. Usually the theft technique is carried out using a T letter key or a liquid inserted in the motorcycle keyhole. The security system of the motorcycle's default keyhole cover can apparently be opened with a box-shaped key that has four small holes. In addition to locking the handlebars, another security that is still relatively used today is to use a padlock that is mounted on the disc so that the wheels cannot run, but even with a padlock, thieves can still break into it. As for other safeguards, namely by adding switches and relays for connecting and breaking electric current to the motor coil, although in such a way motor vehicle thieves can casually carry out their actions without inviting suspicion. (Bagenda, 2014) Therefore, motorcycle owners need to increase their vigilance and further enhance the safety of their motorcycles.

Based on the information above, then how to design an appropriate motorcycle security system model, where this security system can provide information on indications of theft as early as possible and provide information on the position of the motorcycle vehicle through a mobile device that is sent to the motorcycle owner directly, so as to avoid motorcycle theft. An innovative tool to secure motorcycles from theft is to combine Arduino Uno R3 microcontroller, two 5 volt Relay modules by combining IoT (Internet of Things) technology which is supported by the GPS Shield module and the GSM/GPRS SIM808 module. In connection with the development of smart cellular technology, on the user side, the tool will be integrated with the WhatsApp application. It aims to make it easier for users to track the location of the vehicle or control the device and monitor vehicle activity. So with the above technology, it is hoped that the prototype security system can anticipate the occurrence of vehicle theft and can minimize the number of motorcycle thefts.

II. LITERATURE REVIEW

(Bagenda and Prasetya, 2014) in their article entitled prototype of motorcycle security and control system based on the atmega8535 microcontroller, discusses the motorcycle security system using the Atmega8535 Microcontroller which is integrated with mobile phones via the Sort Text Message (SMS) feature. The purpose of

their research is to provide an alternative to motorcycle security from the criminal act of theft, so it is hoped that vehicle owners can find out vehicle information when an indication of theft occurs. The results of their research showed that after the implementation of this motorcycle security system, vehicle owners who previously had difficulty in obtaining vehicle position information became easier to find the position of their vehicle. Another study on motorcycle safety with a microcontroller by (Juwariah, et al., 2019) in his article entitled -Based Motorcycle Safety System, discusses a motorcycle security system using a microcontroller using fingerprints. The purpose of this research is to create a motorcycle security system with fingerprints, so that only people who have registered their fingerprints can start the motorcycle engine.

The research (Begenda and Prasetya, 2014) and (Juwariyah, et al., 2019) has a relationship with the author's research because it discusses where the motorbike is using an IoT-based Microcontroller module that is connected to an application on a smartphone, but of course there are some modifications to the type of Microcontroller and smartphone application that is adapted to the object of research.

III. RESEARCH METHODOLOGY

There are two stages in this research, the system design scheme in the first stage is the design of a motorcycle security system using Arduino as shown in Fig 1.

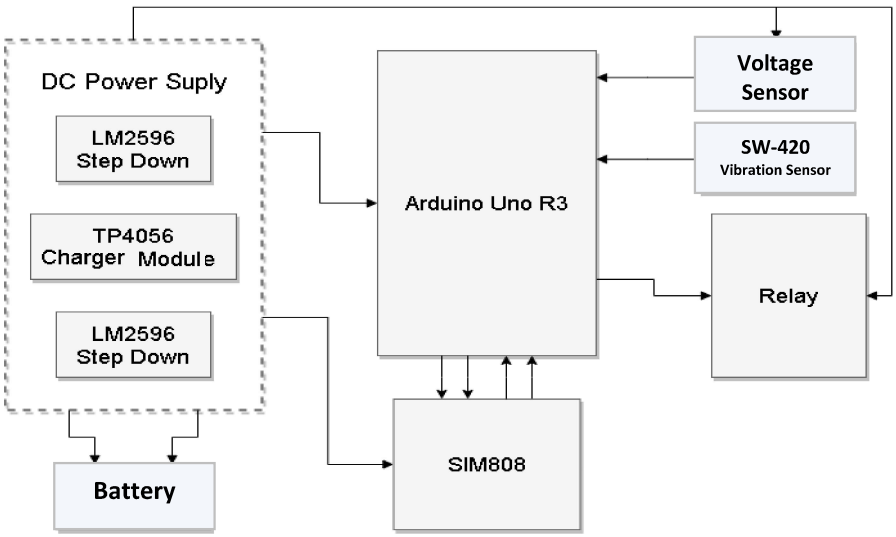

Fig 4. Block Diagram of a Motorcycle Security Prototype

The second stage of designing a motorcycle security system is IoT design using the MQTT protocol such as in Fig 2.

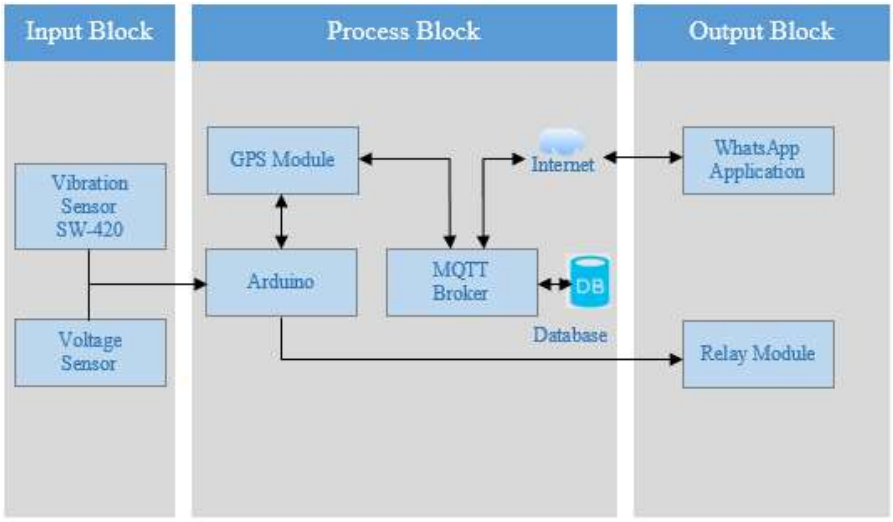

Fig 2. MQTT Communication Block Diagram

IV. RESULT / FINDING

In the first stage the results of the design of the motorcycle security system cable using Arduino which are integrated with the WhatsApp application, are shown in Fig 3.

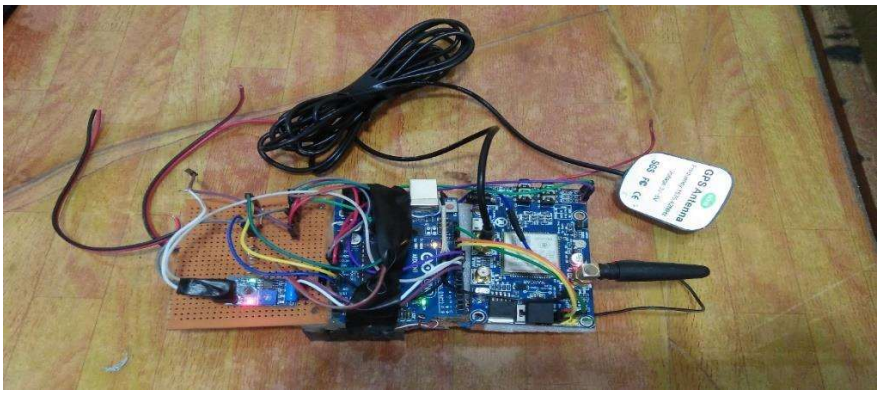

Fig 3. Motorcycle Security Prototype Interface

The results of this prototype design were tested on a motorcycle and showed the motorcycle security system was running smoothly good. All trials carried out show that a motorcycle that is turned on in an inappropriate procedure will provide information in the form of a WhatsApp message and information on the latest motorcycle position, and users can turn off the motorcycle engine through the WhatsApp application.

Table 1 is the result of testing of relay devices, there are four test scenarios carried out on relay devices. The first test scenario to turn off the ignition system on a motorcycle vehicle by sending the code /engine,1 was successfully carried out. The second test scenario to activate the ignition system by sending the code /engine,0 was successfully carried out. The third test scenario is to test whether the system rejects other instructions by sending code that has not been set, and the results show that the system does not respond to unrecognized instructions. The fourth scenario is to test the connectivity of the device by assigning the number 1 to the NC pin, and it was successfully done.

Table 6. Relay Test Result

Testing	Test scenario	Expected result	Test results
1	/engine,1	Turning off the ignition system	[√] successful [ ] unsuccessful
2	/engine,0	Turning on the ignition system	[√] successful [ ] unsuccessful

3	Other commands	Not responding	[√] successful [ ] unsuccessful
4	Gives a value of 1 on the NC pin	Can connect	[√] successful [ ] unsuccessful

Table 2 is the result of testing the SIM888, this test is carried out to determine whether the system can connect using the GPRS cellular network and test the system of sending and receiving SMS. From the test results show that all the expected results in the testing process run as expected, so that the system can communicate via the GPRS cellular network, and the system can communicate by sending and receiving short messages (SMS) between cellular networks.

Table 7. SIM808 Test Result

Testing	Test scenario	Test expected	Test results
1	Activate GPRS	Can connect to the internet	[√] successful [ ] unsuccessful
2	Activate GPS feature	Successfully retrieve GPS coordinate data	[√] successful [ ] unsuccessful
3	Turn on SMS feature	Can receive and send SMS	[√] successful [ ] unsuccessful
4	Combining MQTT feature	Publish and subscribe was successful	[√] successful [ ] unsuccessful
5	Input voltage 4 volt	GPRS and GPS standby	[√] successful [ ] unsuccessful

Table 3 is the result of testing the MQTT protocol. The test results show that the Arduino Microcontroller and the server can be connected so that they can exchange information, and the connection between the two is stable.

Table 8. MQTT Protocol Testing Result

Testing	Test scenario	Test expected	Test results
1	Publish	Sending data from Arduino to server	[√] successful [ ] unsuccessful
2	Subscribe	Received data from Server to Arduino	[√] successful [ ] unsuccessful
3	Connection	Connection stable	[√] successful [ ] unsuccessful

Table 4 is the result of testing the WhatsApp application, this test was carried out to test the interaction between the system and the WhatsApp application. The test results show that the system can send messages to the user's WhatsApp number to send the latest information from the system, besides that the system can also be controlled via the WhatsApp application by using pre-set commands.

Table 9. WhatsApp Testing Results

Testing	Test scenario	Test expected	Test Results
1	Message"/device list"	Data can be saved in database	[√] successful [ ] unsuccessful
2	Message "/engine"	Controls motorcycle ignition system	[√] successful [ ] unsuccessful
3	Message "/location"	Getting data location from tools	[√] successful [ ] unsuccessful

Table 5 is the result of testing the GPS device, from the test results obtained the speed of data transmission during the day and night. The results of testing data transmission using a GPS device during the day from 5 experiments carried out resulted in an average data transmission of 196.6 seconds. While the average data transmission via GPS at night shows 72 seconds. So the difference in data transmission time between night and day is 124.6 seconds.

Table 10. Testing Results of GPS Device

Data - (n)	Day (s)	Night (s)	Difference (x)	(Xi – X)	(Xi –X)2
1	208	64	144	19.40	376.36
2	188	56	132	7.40	54.76
3	193	75	118	-6.60	43.56
4	198	79	119	-5.60	31.36
5	196	86	110	-14.60	213.16
SUM	983	360	623	0.00	719.20
Average	196.6	72	124.6		

Standard Deviation $= \sqrt{\frac{\sum(x_i - x)}{n-1}} = \sqrt{\frac{719.0}{4}} = \sqrt{179.80} = 13.04$

Absolute Error $= \frac{Standard\ Deviation}{\sqrt{n}} = \frac{13.04}{\sqrt{n}} = 5.83$

Relative Error $= \frac{Absolute\ Error}{X} x\ 100\% = \frac{5.83}{124.6} x\ 100\% = 4.67\%$

Tools Accuracy Value = 100% - Relative Error = 100% - 4.67% = 95.33%

Based on the calculation data in Table 5, there is a difference in the value of the time spread, which is 144 seconds while the smallest difference is 110 seconds and the average difference is GPS signal locking for 124 seconds. By knowing the average difference, it can be seen that the standard deviation is 13.04 with an error value of 5.83 for each sample.

V. DISCUSSION

The results of this study indicate that the use of the MTQQ on a smartphone is well integrated as shown by the success of the system in controlling for monitoring and controlling with a smartphone. These results are in accordance with research conducted by (Rochman, et al., 2007) which showed that the use of the MQTT protocol succeeded in controlling for controlling and monitoring on smartphones, the application of the MQTT protocol was used to send and receive messages with the publish/subscribe mechanism. Where publishers will send messages and subscribers will receive messages. The same thing was also stated by (Suryatini, et al., 2021) who stated that the use of the protocol had succeeded in connecting Android devices via smartphones with servers, with test results reaching 100% accuracy and data sent by publishers and data received by subscribers achieving conformity. 100%.

Another factor that supports the successful implementation of this motorcycle security system is the suitability of the latest location data sent via GPS. The results show that GPS has succeeded in sending motorcycle vehicle location data with an accuracy value of 95.33% with an error value of 5.83, these results indicate that data transmission via GPS is very good and accurate. This is in line with research conducted by (Rahman, et al., 2019) showing that GPS managed to send location data with a margin of error of 4.58, this result shows that the use of GPS is accurate and reliable to get the latest vehicle location information. Research conducted by (Nugroho & Dzulkiflih, 2021) which states that the use of GPS is considered more efficient in obtaining vehicle location points because it is real time.

VI. CONCLUSION AND RECOMMENDATION

Based on the results of the analysis, design and implementation that have been carried out, the conclusions obtained are that the prototype motorcycle security system is able to provide vehicle information to motorcycle owners in the form of message notifications or calls in the event of an indication of theft. And the owner can find out the whereabouts of the motorbike if there has been a theft by sending a location request message via the WhatsApp application.

This study only uses a vibration sensor, relay, and SIM module in building a prototype motorcycle security system.research can use RFID modules such as research conducted by (Musyafa, et al., 2021) or adopt research conducted by (Normawan & Supriyono, 2019) which uses usernames and passwords in making motorcycle security systems.

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