

# Development and evaluation of motorcycle immobilizer using radio frequency

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## ARTICLE INFORMATION

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## ABSTRACT

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*This study aimed to develop and evaluate a Motorcycle immobilizer using radio frequency for any kind of motorcycle. Mainly, this device demobilizes the motorcycle in a certain distance after being grabbed and stolen from the parking area. The device, a 27 MHz transmitter-receiver radio frequency that serves as a wireless control to the motorcycle, specifically protects the owner from the heinous criminals and motor jackers throughout the Philippines. Once the transmitter is turned on, the receiver circuit energizes the relays which allow the current from the Circuit Direct Ignition (CDI) to the distributor of the motorcycle. The range of the device reception is up to ten (10) meters, and when the transmitter is out of range, the receiver circuit cuts-off the power of the first relay, but the second relay cuts-off after running for another 21 seconds. The second relay belongs to the off delay circuit in the entire circuitry of the device. The transmitter*

*device has a port for charging the rechargeable battery.*

*Utilizing the experimental method of research to achieve its main objective, the study had data gathered in this research from 251 COT, BIT, BTTE first and second year automotive students officially enrolled in Marikina Polytechnic College (MPC) during the academic year of 2013-2014 and 5 automotive Instructors.*

*These statistical tools treated the data: frequency and ranking, weighted mean, and one factor ANOVA. The study revealed that there is no significant difference between the perceptions of the four groups of respondents as to the design and functionality, usefulness, durability, safety and maintenance of the device.*

*The group of respondents accepted the developed Motorcycle Immobilizer using radio frequency as an anti-thief device for its **design and durability, functionality, usefulness and promoting safety and maintenance and security** of both the vehicle and the owner as evidenced by its **over-all weighted mean of 4.59**, verbally interpreted as **strongly agree**.*

### Keywords

Motorcycle Immobilizer, Radio Frequency, Anti-theft Device

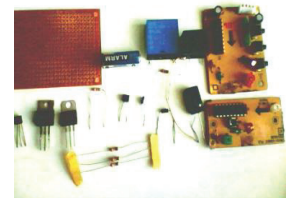
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Immobilizer device



mmobilizer device and motorcycle



Immobilizer device parts

## Introduction

One can likely list down a hundred causes of theft or cite reasons for common theft around the world for ages. Admittedly, theft is dishonestly taking one's belonging whether on large or small scale. Also greed makes woman steal. She cannot find contentment to do every means to satisfy the craving to the extent even detriment to denying other the right to own.

The Philippine law stated in section 1, Article 301 of *Batas Pambansa Bilang 71* that "Qualified theft- the crime of theft shall be punished by the penalties next higher by two degrees than those respectively specified in the next preceding article, if committed by the domestic servant, or with grave abuse of confidence, or if the property stolen is motor vehicle, mail matter or large cattle or consists of coconuts taken from the premises of a plantation, fish taken from the fishpond or fishery or if property is taken on the occasion of fire, earthquake, volcanic eruption, or any other calamity, vehicular accident or civil disturbance."

The article mentioned that people are liable to a qualified theft, if they steal motor vehicle. According to the top Gearblog site owned by Summit Media, 80% of car thefts in the Philippines occur in Metro-Manila. Eight out of ten car thefts in the country from January to July 2014 occurred in Metro-Manila, *Inquirer.net* reported based on figures released by the Philippine Nation Police or PNP said.

The PNP Highway Patrol Group (PNP-HPG) reported that Quezon City remains as the Philippines' "car theft capital," as it accounted for 26 percent of the reported cases, followed by Manila with 21 percent and Makati with 7 percent. After Metro-Manila, the PNP-HPG claiming the next hot areas for car theft covers the Calabarzon (Cavite, Laguna, Batangas, Rizal, Quezon) and Central Luzon, accounted for 10 percent and five percent of the total cases, respectively.

In this regard, development and enhancement of this gadget will prevent the possible harm to the owner or driver, because

of the reluctance to give away their vehicle to the grabber.

By contrast, innovation is a feasible solution necessary to give people a good security of their belongings.

## Statement of the problem

The study sought to answer the following questions:

1. What are the students' and professors' assessment of COT, BIT, BTTE as automotive respondents on the **Motorcycle Immobilizer using Radio frequency** with respect to:
  - 1.1 Usefulness
  - 1.2 Safety and Maintenance
  - 1.3 Durability and Design
  - 1.4 Functionality?
2. Is there a significant difference in the evaluation of the four groups of respondents on the **Motorcycle Immobilizer using Radio Frequency** in terms of the usefulness, safety and maintenance, durability and Design and functionality?
3. Is the Developed Motorcycle Immobilizer using Radio Frequency a good example of security device for Motorcycle?
4. What are the comments and suggestions of the four groups of respondents to further improve the Motorcycle Immobilizer using Radio Frequency?

## Related Literature

There are many inventions on the security system. The most common vehicle equipped with this kind of system is the car. On the other hand, there is still less invention in the market for motorcycle. This project is focused on motorcycle security system. It will use alarm, some sensors and doing some modification at the starting system of the motorcycle to immobilize the unit.

Galassi (2012) reports a passive anti-theft system workby immobilizing the motorcycle engine. The passive anti-theft system prevents the engine from starting unless e coded key programmed specifically to the used motorcycle. Factory installed anti-theft devices are great. But some of thefts are smart enough to break all of security application in one’s motorcycle. So the need to choose a passive alarm that wouldn’t make one suffer from a stolen motorcycles.

Bilke (2009) avers that sometimes, a simulated anti-theft device can deter a would-be thief just as well as an actual alarm system. To that end, the circuit automatically flashes two super-bright LEDS, mounted in the rear-light cluster of a motorcycle, to simulate the warning commonly used to indicate an active alarm. A mercury switch activates the circuit when the motorcycle is leaned to rest on its kickstand. It’s not the motorcycle to be immobilized but the will of the theft to steal it.

Joe (2010) holds that the only thing an average rider can do is to get a solid chain lock, a disc lock and an alarm system. He or She should ALWAYS have ‘fire/theft’ included on his/her insurance policy, and must not the bike outside if possible. In parking outside, the rider must make sure it is a safe location. (i.e. in a well-lit area, near people that can be witnesses, if the bike is stolen. Always he/she has the alarm and put on the chain/disk lock), enough to deter the average thief, but will never deter the professional. Spending more money will simply boomerang, just as tagging parts of the vehicles and alarms with rider notification entail expenss, but won’t deter the culprit.

### Conceptual Framework

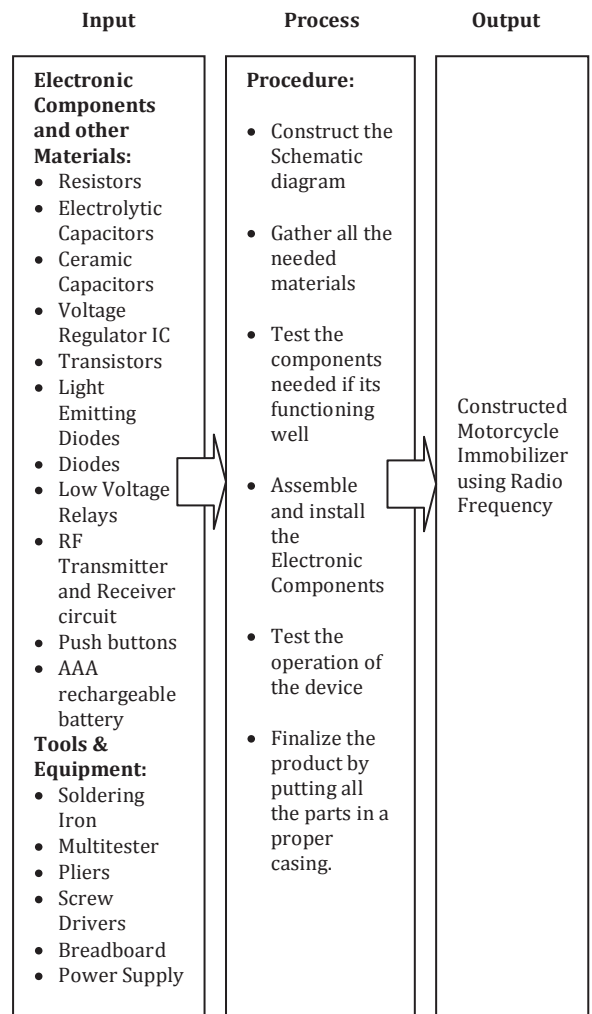


Figure 1. Conceptual model for the construction of motorcycle immobilizer using radio frequency

The input consists of electronic components and other materials such as resistors, electrolytic capacitors, ceramic capacitors, voltage regulator IC, transistors light emitting diodes, diodes, low voltage relays, RF transmitter circuit, RF receiver circuit, push buttons, the tools & equipment like soldering Iron, multi-tester, pliers, screw drivers, breadboard and DC converter. The process includes constructing the schematic diagram, gathering materials needed, testing the components needed for the device to function weel, assembling and installing the electronic components, testing the device’s operation and finalizing the product by putting all the parts in a proper casing. After processing the input, the output includes the

constructed Motorcycle Immobilizer using radio frequency.

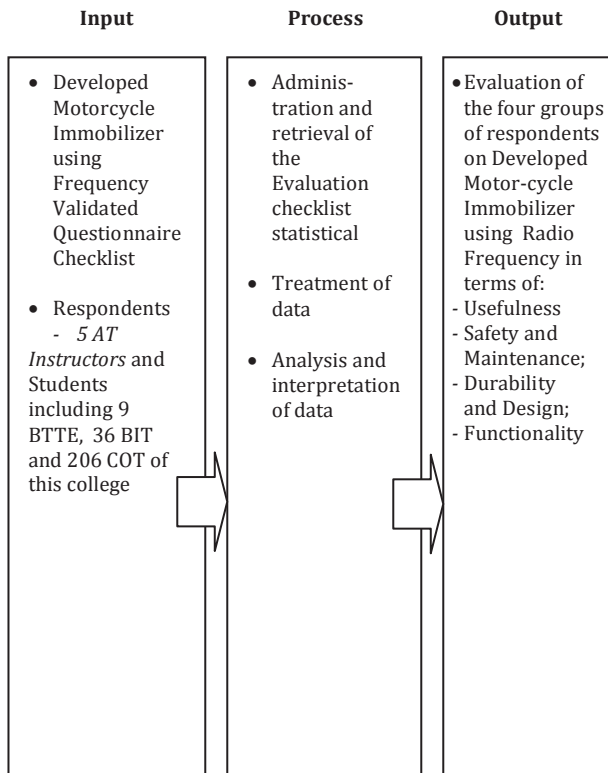


Figure 2. Conceptual model for the evaluation of motorcycle immobilizer using radio frequency

The input consists of developed motorcycle immobilizer using Radio Frequency", validated questionnaire checklist. Respondents are Instructors, COT, BIT and BTTE students of the college. The process includes administration and retrieval of the evaluation checklist, statistical treatment of data, analysis and interpretation data. The output produces the Level of Evaluation of the four groups of respondents.

## Method

To achieve its objective, the study utilized the experimental type of research, as defined by several authors in their own ways.

Keegan (2010) held that the method of research is a controlled procedure that manipulates an independent variable to observe and measure any effect on the

dependent variables. The essential features of the experimental method are then the control, observation and measurement of variables. Illustrating the hallmarks of a science, the use of the experimental method in the psychological research makes us more confident about the validity of any cause-effect relationship established between an independent variable. The experimental method makes us more confident about the generalization of its results to a wider population. It also emphasizes the strict procedures that help other replicate the experiment to confirm, or otherwise, the other research findings. This is how scientific knowledge grows, the experimental method sets out to test a null hypothesis, when rejected, allows the researcher to accept the experimental, or research hypothesis. Hypotheses will, more often than not, be tested at a level of significance in form of a wager, probability, or p value; a researcher places on them that their result happened by chance.

## Source of Data

The data gathered in this research were from 549 students from the COT class, 96 students from the BIT class and 24 students from the BTTE class from first year to third year officially enrolled at Marikina Polytechnic College (MPC) in the second semester, school year 2013-2014. By contrast, 5 automotive teachers represented the other group of evaluators. Presented in Table 1 is the group of sample-student respondents officially enrolled in Automotive Technology during the academic year 2013-2014 who evaluated the Motorcycle Immobilizer using Frequency.

Table 1  
Distribution of Student-Respondents as Evaluators of the Development and Evaluation of Motorcycle Immobilizer using Radio Frequency

Course	Total Enrolled	Number of Respondents
COT	549	206
BIT	96	36
BTTE	24	9
Total	669	251



As gleaned in table 3, five out of 5 items have weighted means of 4.79, 4.65, 4.77, 4.96, 4.63 interpreted as strongly agree respectively by the COT, 4.52, 4.44, 4.86, 4.92, 4.67 and interpreted as strongly agree by the BIT, 4.22, 4.44, 4.67, 4.33, 4.22 and interpreted as agree by BTTE and 4.60, 4.40, 4.40, 4.40, 4.40 and interpreted as agree by teacher-respondents.

It implies that the Motorcycle Immobilizer using Radio Frequency is accepted with regard to usefulness, as evidently seen in its over-all weighted means of 4.76, 4.68, 4.38 and 4.44 by the COT, BIT, BTTE students and Automotive-teachers respectively. The results were interpreted as strongly agree by the four groups of respondents.

**Safety and Maintenance.** Table 4 presents the weighted mean and verbal interpretation of the evaluation of the four groups of respondents the developed Motorcycle Immobilizer using Radio Frequency as to Safety and Maintenance.

Table 4  
Assessment of the Four Groups of Respondents on the Motorcycle Immobilizer Using Radio Frequency as Regards Safety and Maintenance

Criteria	COT		BIT		BTTE		TEACHER	
	WM	VI	WM	VI	WM	VI	WM	VI
The device is safe to use.	4.87	SA	4.39	SA	4.22	A	4.60	SA
The capacity of motorcycle battery is tolerable by the device's circuit.	4.46	SA	4.81	SA	4.89	SA	4.40	A
The power source of the transmitter device is rechargeable	4.74	SA	4.86	SA	4.56	SA	4.20	A
The circuit connection is easy to locate in case of malfunction.	4.53	SA	4.47	A	4.33	SA	4.40	A
The device is properly insulated and protected by fuse.	4.98	SA	4.94	SA	5.00	SA	4.60	SA
General Weighted Mean	4.72	SA	4.69	SA	4.60	SA	4.44	A

Table 4 yields that 5 out of 5 items have weighted means of 4.87, 4.46, 4.74, 4.53, 4.98 and interpreted as strongly agree by the COT, 4.39, 4.81, 4.86, 4.47, 4.94 interpreted as strongly agree by the BIT; 4.22, 4.89, 4.56, 4.33, 5.00 and interpreted as strongly agree by BTTE; and 4.60, 4.40, 4.20, 4.40, 4.60 interpreted as agree by teacher-respondents.

It implies that the Motorcycle Immobilizer using Radio Frequency is accepted as to safety and maintenance, as evidenced by its over-all weighted means of 4.72, 4.69, 4.60 and 4.44 by the COT, BIT, BTTE students and Automotive-teachers respectively. The results were interpreted as strongly agree by the four groups of respondents.

**Durability and Design.** Table 5 presents the weighted mean and verbal interpretation of the four groups of respondents on the developed Motorcycle Immobilizer using Radio Frequency with regard to durability and design.

Table 5  
Assessment of the Four Groups of Respondents on the Motorcycle Immobilizer Using Radio Frequency as Regard to Durability and Design

Criteria	COT		BIT		BTTE		TEACHER	
	WM	VI	WM	VI	WM	VI	WM	VI
The design of the immobilizer device is good for convenient use.	4.99	SA	4.64	SA	4.67	SA	4.60	SA
It has indicator light to indicate charging and running mode.	4.90	SA	4.89	SA	4.89	SA	4.60	SA
The system of the device is made of good quality components.	4.48	A	4.17	A	4.00	A	4.20	A
The overall device's body is durable.	4.42	A	3.92	A	4.11	A	4.20	A
It has a sleek design for easy installment in compartment.	4.54	SA	4.47	A	4.00	A	4.40	A
General Weighted Mean	4.67	SA	4.42	A	4.33	A	4.40	A

As revealed in table 5, five out of 5 items have weighted means of 4.99, 4.90, 4.48, 4.42, 4.54 interpreted as strongly agree by the COT; 4.64, 4.89, 4.17, 3.92, 4.47 interpreted as

agree by the BIT; 4.67, 4.89, 4.00, 4.11, 4.00 interpreted as agree by BTTE; and 4.60, 4.60, 4.20, 4.20, 4.40 interpreted as agree by teacher-respondents.

It implies that the Motorcycle Immobilizer using Radio Frequency is accepted in its to durability and design as evidently shown in its over-all weighted means of 4.67, 4.42, 4.33, 4.40 by the COT, BIT, BTTE students and Automotive-teachers respectively. The results were interpreted as agree by the four groups of respondents.

**Functionality.** Table 6 presents the weighted mean and verbal interpretation of the evaluation of the four groups of respondents on the developed Motorcycle Immobilizer using Radio Frequency as to Functionality.

Table 6  
Assessment of the Four Groups of Respondents on the Motorcycle Immobilizer Using Radio Frequency as Regards Functionality

Criteria	COT		BIT		BTTE		TEACHER	
	WM	VI	WM	VI	WM	VI	WM	VI
It operates immediately when the transmitter is on.	4.93	SA	4.06	A	5.00	SA	4.60	SA
The device immobilizes the motorcycle when it reaches the cut off range plus the off delay time.	4.86	SA	4.42	A	4.33	A	4.60	SA
The flashlight of the transmitter illuminates well.	4.98	SA	4.67	SA	4.78	SA	4.20	A
The device is easily operated by a simple on/off switch.	4.90	SA	4.70	SA	4.56	SA	4.80	SA
It has non-interfering reception.	4.79	SA	4.44	A	4.00	A	4.60	SA
General Weighted Mean	4.89	SA	4.46	A	4.53	SA	4.56	SA

Table 6 shows that all 5 items have weighted means of 4.93, 4.86, 4.98, 4.90, 4.79 interpreted as strongly agree by the COT;

4.06, 4.42, 4.67, 4.70, 4.44 interpreted as agree by the BIT; 5.00, 4.33, 4.78, 4.56, and 4.00 interpreted as strongly agree by BTTE; and 4.60, 4.60, 4.20, 4.80 and 4.60 interpreted as strongly agree by teacher-respondents.

It implies that the Motorcycle Immobilizer using Radio Frequency is accepted with regard to functionality evident in its over-all weighted means of 4.89, 4.46, 4.53 and 4.56 by the COT, BIT, BTTE students and Automotive-teachers respectively. The results were interpreted as strongly agree by the four groups of respondents.

**Summary of the Evaluation of the Four Groups of Respondents on the Evaluation of Motorcycle Immobilizer using Radio Frequency**

Table 7 presents the weighted mean and verbal interpretation of the summary Evaluation of four groups of respondents on the developed Motorcycle Immobilizer using Radio Frequency.

Table 7  
Summary of the Evaluation of the Four Groups of Respondents on the Evaluation of Motorcycle Immobilizer using Radio Frequency

Criteria	COT		BIT		BTTE		Teacher	
	WM	VI	WM	VI	WM	VI	WM	VI
Usefulness	4.75	SA	4.68	SA	4.38	A	4.44	A
Safety and Maintenance	4.72	SA	4.69	SA	4.60	SA	4.44	A
Durability and Design	4.67	SA	4.42	A	4.33	A	4.40	A
Functionality	4.89	SA	4.46	A	4.53	SA	4.56	SA
General Weighted Mean	4.76	SA	4.56	SA	4.46	A	4.46	A

Table 7 shows that all 5 items or 100 percent of the item were rated strongly agree with weighted means of 4.75, 4.72, 4.67, and 4.89 for the COT students. 4.68, 4.69, 4.42, and 4.46 for the BIT students. 4.38, 4.60, 4.33, 4.53, for BTTE students. Similarly, the same 100 percent of the items were assessed strongly agree with weighted means of 4.44, 4.44, 4.40,

4.56, 4.46 and 4.46 respectively by the teacher-respondents.

It can be inferred that the developed Motorcycle Immobilizer using Frequency is accepted which is evident by its over-all weighted means of 4.76, 4.56, 4.46, 4.46. In general, the results were interpreted as strongly agree by all four groups of respondents.

Comparison of the Evaluation of the Four Groups of Respondents as regards to the Evaluation of Motorcycle Immobilizer using Radio Frequency as regards to usefulness, safety and maintenance, durability and design and functionality.

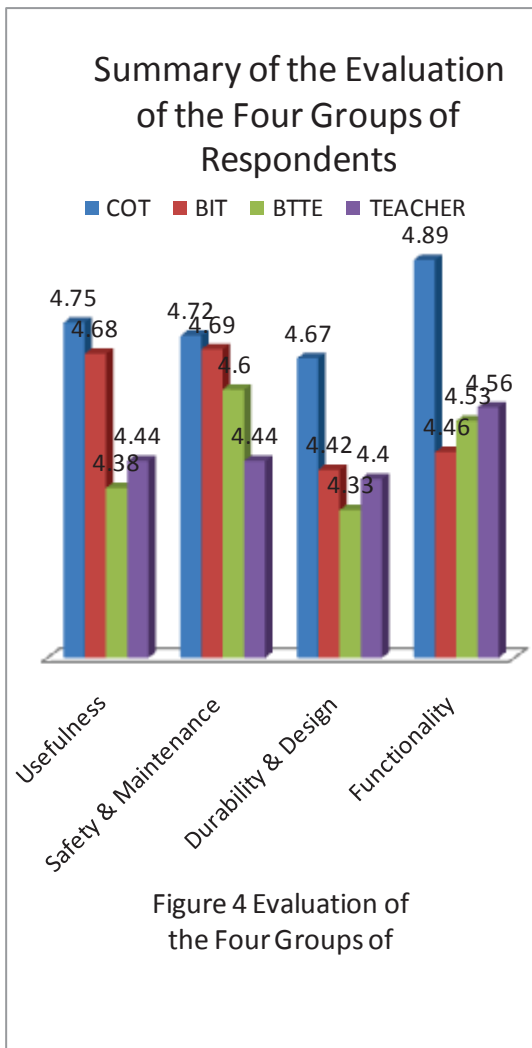


Table 8 presents the computed  $F$  value and tabular  $F$  value on the assessment of the four groups of evaluators on the developed motorcycle Immobilizer using radio frequency with regard to usefulness.

Table 8  
Significant difference on the Assessment of the Four Groups of Respondents of the Motorcycle Immobilizer using Radio Frequency as regards Usefulness

Source of Criteria	Sum of square	Degree of Freedom	Mean square	Computer F. Value	Value 0.01 Decision	Interpretation
Between Column	1.65	3	.10	2.2	5.29	Accept Ho
Within Column	0.66	16	.22			Not Significant

Note: Computed  $F$  value > Tabular  $F$  value (Reject Ho);  
Computed  $F$  value < Tabular  $F$  value (Accept Ho)

The table shows that the computed  $F$  value of 2.2 is less than the tabular  $F$  value of 5.29 at 3 degree of freedom between the column and 16 degree of freedom within the column. It leads to the acceptance of null hypothesis at 0.01 level of significance. This implied that there is no significant difference in the assessment of the four groups of evaluators regarding the effectiveness of the developed Motorcycle Immobilizer using Radio Frequency. It means that the four groups of respondents agreed that the device is suitable and feasible as an anti-theft device for motorcycles.

Table 9. Presents the computed  $F$  value and tabular  $F$  value on the assessment of the four groups of evaluators on the developed Motorcycle Immobilizer using Radio Frequency as regards to safety and maintenance.



Table 9  
*Significant Difference on the Assessment of the Four Groups of Respondents in the Evaluation of Motorcycle Immobilizer using Radio Frequency as regards to Safety and Maintenance*

Source of Criteria	Sum of square	Degree of Freedom	Mean square	Computed <i>F</i> Value	Tabular <i>F</i> Value 0.01	Decision	Interpretation
Between Column	-9.8	3	-61	1.07	5.29	Accept Ho	Not Significant
Within Column	-1.96	16	-0.65				

**Note:** Computed *F* value > Tabular *F* value (Reject Ho);  
 Computed *F* value < Tabular *F* value (Accept Ho)

The table shows that the computed *F* value of 1.07 is less than the tabular *F* value of 5.29 at 3 degree of freedom between the column and 16 degree of freedom within the column. It leads to the acceptance of null hypothesis at 0.01 level of significance. This implied that there is no significant difference in the assessment of the four groups of evaluators regarding the effectiveness of the developed Motorcycle Immobilizer using Radio Frequency. It means that the four groups of respondents agreed that the device is safe to install in motorcycles and easy to maintain.

Table 10 presents the computed *F* value and tabular *F* value on the assessment of the four groups of evaluators on the developed Motorcycle Immobilizer using Radio Frequency with regard to Durability and Design.

Table 10  
*Significant Difference on the Assessment of the Four Groups of Respondents of Motorcycle Immobilizer using Radio Frequency as to Durability and Design*

Source of Criteria	Sum of square	Degree of Freedom	Mean square	Computed <i>F</i> Value	Tabular <i>F</i> Value 0.01	Decision	Interpretation
Between Column	1.3	3	0.11	1.38	5.29	Accept Ho	Not Significant
Within Column	0.32	16	0.08				

**Note:** Computed *F* value > Tabular *F* value (Reject Ho);  
 Computed *F* value < Tabular *F* value (Accept Ho)

The table shows that the computed *F* value of 1.38 is less than the tabular *F* value of 5.29 at 3 degree of freedom between the column and 16 degree of freedom within the column. It leads to the acceptance of null hypothesis at 0.01 level of significance. This implies that there is no significant difference in the assessment of the four groups of evaluators regarding the effectiveness of the developed Motorcycle Immobilizer Using Radio Frequency. It means further that the four groups of respondents agreed that the device is durable for any type of motorcycle and has a sleek design that fits the motorcycles compartment.

Table 11 presents the computed *F* value and tabular *F* value on the assessment of the four groups of evaluators on the developed Motorcycle Immobilizer Using Radio Frequency as regards to functionality.

Table 11  
*Significant Difference on the Assessment of the Four Groups of Respondents of the Motorcycle Immobilizer using Frequency as to Functionality*

Source of Criteria	Sum of square	Degree of Freedom	Mean square	Computed <i>F</i> Value	Tabular <i>F</i> Value 0.01	Decision	Interpretation
Between Column	1.06	3	0.07	2.71	5.29		
Within Column	1.06	0.56	0.19	2.71	5.29	Accept Ho	Not Significant

**Note:** Computed *F* value > Tabular *F* value (Reject Ho);  
 Computed *F* value < Tabular *F* value (Accept Ho)

The table shows that the computed *F* value of 2.71 is less than the tabular *F* value of 5.29 at 3 degree of freedom between the column and 16 degree of freedom within the column. It leads to the acceptance of null hypothesis at 0.01 level of significance. This implies that there is no significant difference in the assessment of the four groups of evaluators regarding the effectiveness of the Development and Evaluation of Motorcycle Immobilizer Using Radio Frequency. It means that the four groups of respondents agreed that the device is easy to operate and that it needs minimal effort to make it function.

### Discussion

1. The COT, BIT, and BTTE students assessed the device with general weighted means of 4.76, 4.56 and 4.46, respectively, while the AT teacher respondents agreed to all the above cited criteria a general weighted mean of 4.46. The four groups of respondents strongly agreed to the usefulness, safety, and maintenance, durability and design and

functionality of the developed motorcycle immobilizer.

2. There were no significant differences in the evaluation of the four groups of respondents as to the usefulness, safety and maintenance, durability and design and functionality of the product.
3. The device is a good means to secure the life of the motorcycle owner.
4. The comments and suggestions of the respondents follow:
  - a. The product is a good safety device
  - b. The immobilizer device should be made portable.

### Conclusion

Based on the findings of the study, these conclusions were drawn:

1. The developed motorcycle immobilizer using radio frequency is accepted by the automotive students and professors as a security device.
2. The device is a good means to secure the life of the motorcycle users and owners.
3. The developed device serves to motivate teachers and students to enhance their thinking ability to produce feasible products that can contribute more benefits to the community.

### Recommendations

In light of the findings and conclusions drawn, these recommendations are hereby forwarded:

1. The developed motorcycle immobilizer using radio frequency be developed for commercial purposes to utilize its effectiveness, especially for motorist safety features.

2. Future researchers be encouraged to develop safety devices that would promote security and safety to their properties.

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