Fuel Consumption of a Traditional Motorized-Tricycle in Tagbilaran City

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ABSTRACT
This study analyzes the impact of load condition and distance traveled on fuel consumption in a motorized-tricycle. It investigates whether the belief among tricycle drivers that more passengers result in additional income holds true, without considering the associated fuel costs. Real-time data was gathered using advanced sensors, a microcontroller, and storage media.

The analysis utilizes the Multiple Correlation Formula to determine the strength of the relationship between fuel consumption, load condition, and distance traveled. The resulting Multiple Correlation Coefficient value (R) of 0.8154 shows a strong positive correlation between load condition, distance traveled, and fuel consumption. The Adjusted R Square value of 64.00% indicates that 64% of the variation in fuel consumption can be explained by these two dependent variables.

Through Multiple Regression Analysis, a mathematical model is developed to predict fuel consumption based on the independent variables of load condition and distance traveled. The regression equation is represented as Y' = 0.6169 + 0.0066X1 + 0.0008X2, where Y' represents the predicted fuel consumption, X1 represents the load condition, and X2 represents the distance traveled.

In summary, this study offers a comprehensive examination of the relationship between fuel consumption, load condition, and distance traveled in a motorized-tricycle. It sheds light on the economic implications of passenger and load weights on fuel costs.

Keywords – motorized-tricycle, data acquisition system, Arduino uno, floater, reed switch, multiple correlation, linear regression.

INTRODUCTION

The motorized-tricycle, which consists of a motorcycle with a sidecar for passengers, was legalized in 1985 by the late President Ferdinand Marcos, recognizing its crucial role in the hierarchical public transportation system of municipalities and its status as a primary means of transportation. According to the National Statistics Coordination Board's 2012 data, there are approximately 658,675 units of motorcycle/tricycle-for-hire providing transportation services nationwide, accounting for nearly 68% of the total number of public vehicles in the country.

In Tagbilaran City, preliminary information from the License and Permit Division in the City Hall reveals the operation of nearly 3,000 motorized-tricycles within the city. Fuel consumption for a motorized-tricycle during a 100 km travel distance typically ranges from 5 to 7 liters. Consequently, the total fuel consumption cost for motorized-tricycles in the entire city could amount to at least ₱ 555,000 per day.

These figures demonstrate the substantial fuel consumption associated with motorized-tricycles. A study by Chidiebere et al. (2014) highlighted the potential of reducing fuel consumption by improving the tricycle body design to minimize wind resistance, resulting in a decrease of 2% in drag coefficients and up to 17.34% in fuel consumption reduction.

Different types of motorized-tricycles are found across the country, varying in their passenger capacity depending on the tricycle body type. Gumasing (2014) proposed a type of body design for motorized-tricycles that adheres to existing standards and enhances passenger ergonomics and comfort. This design allows a maximum of three passengers: two in the cabin and one on the back seat. In Tagbilaran City, regulations set by authorities restrict the maximum number of passengers to two. However, other types of motorized-tricycles found elsewhere can accommodate up to 10 regular passengers on ordinary trips, as described in a comparative analysis of motorized-tricycles in Davao.

Increasing the number of passengers or load results in a substantial weight increase, necessitating additional power for the motorized-tricycle to maintain movement and subsequently leading to higher fuel consumption costs. This observation is supported by studies where reducing vehicle weight resulted in fuel consumption savings. Many tricycle drivers believe that having more passengers translates to additional income without considering the fuel consumption associated with overload capacity. Traditionally, tricycle drivers manually measure their daily fuel consumption by starting their day with a fully fueled tank and adding up the amount of fuel consumed throughout the day.

OBJECTIVES

An efficient and scientific analysis of the cost of fuel consumption, load condition, and distance traveled in a motorized-tricycle necessitates an engineering approach and the development of a measurable mathematical model using a real-time data acquisition system. The primary objective of this study is to design a robust data acquisition system utilizing sensors, a microcontroller, and storage media to accurately capture information on fuel consumption and distance traveled by a motorized-tricycle. Furthermore, the study aims to establish a mathematical model that quantifies the relationship between the cost of fuel consumption, load condition, and distance traveled, with the ultimate goal of implementing a method to determine the optimal number of passengers that will yield the desired earnings for the driver.

METHODOLOGY

This study used the experimental method to investigate the relationship between fuel consumption, load condition, and distance traveled in a motorized-tricycle. Controlled variables included air resistance, friction, road slope, motorcycle type, and driver profile. The study focused on the cost of fuel consumed as the dependent variable, with load condition and distance traveled as the independent variables. The objective was to test the hypothesis of a correlation between fuel consumption, load condition, and distance traveled. See Figure 2 for an overview of the research stages.

The study performed the following processes:

1. Compliance to the initial requirement composed of the following: type of motorized-tricycle, type of sensors to be deployed, and other initial information;
2. Deployment of sensors and other type of measuring device to obtain information on fuel-level of motorcycle tank and the number of contacts on switch or revolutions of the front wheel to measure distance traveled;
3. Designing the data acquisition system using a microcontroller together with a storage media;

4. Data Gathering for the fuel consumed and distance traveled;
5. Data analysis of the dependent variable and independent variables;
6. Obtaining a mathematical model using multiple regression analysis that will predict the outcome of the cost of fuel consumed given its load condition and distance traveled;
7. Results validation between the actual value and the predicted value of the cost of fuel consumed; and
8. Analyzing the break-even point of the income of the tricycle driver and the formulation of conclusion and recommendation.

The environment and participants of this study involved the motorized-tricycle in Tagbilaran City. The common type of tricycle found in the city is shown in Figure 1. This is considered as the City's major mode of transportation. The maximum number of passengers allowed is only two (2) based on the regulations set by City Lawmakers.

Figure 1. Motorized-tricycle in Tagbilaran City

Majority of the types of motorcycle used 4-stroke engines. a variety of make of motorcycle commonly used in motorized-tricycles. This type of motorcycle doesn't have a fuel gauge system to accurately monitor the fuel level. Table 1 shows the technical specifications from the Four (4) Stroke motorcycle.

TABLE 1. TECHNICAL SPECIFICATIONS OF A MOTORIZED-TRICYCLE

Spec	Make
Motor engine type	4-Stroke
Engine displacement	123.7 cm^3
Bore and Stroke	54.0 mm and 54.0 mm
Motorcycle Dry Weight	108 kg
Fuel Tank Capacity	9 liters
Fuel System	Carburetor
Fuel Type	Regular Unleaded Petrol (91 Research Octane Number (RON))

Spec	Make
Fuel Level Indicator	Not Available

An improvised fuel tank was created to facilitate the measurement of drained fuel. The tank, depicted in Figure 2, possesses dimensions of 21.0 cm x 8.5 cm x 12.5 cm and is constructed using a 1 mm thick steel plate. Its total capacity is 2231.25 cm3, featuring an opening with a fuel cap and an outlet equipped with a fuel cock. A floater is incorporated within the fuel tank.

To collect data from the floater and display it, a microcontroller was employed. The analog output generated by the floater underwent conversion into a digital format by mapping input voltages ranging between 0 and 5 V to integer values spanning from 0 to 1023. Consequently, the resolution between readings amounted to 0.0049 V per unit. Voltage readings were mapped into integer values, with the minimum and maximum voltages recorded as 0.294 V and 4.704 V, corresponding to integer values of 60 and 960, respectively. By employing this mapping function, a reading of 60 represented a fuel level of 0%, while a reading of 960 represented a fuel level of 99%.

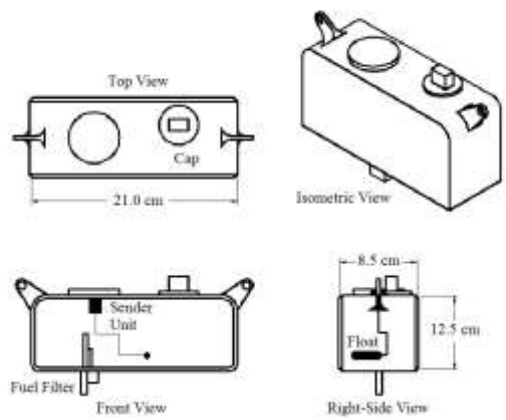

Figure 2. Orthographic and isometric views of the improvised fuel tank.

Table 2 displays the results on the readings in the microcontroller during the testing and calibration of the floater.

TABLE 2. MICROCONTROLLER READINGS OF THE DRAINED FUEL

Drained # (i)	**Microcontroller Reading %**		**Average Fuel Drained (cm^3)**
	Initial Reading	**Next Reading**	
1	84	74	73.67
2	74	70	59.50
3	70	61	67.50
4	61	55	70.50
5	55	48	53.11

Drained # (i)	Microcontroller Reading %		Average Fuel Drained (cm^3)
	Initial Reading	Next Reading	
6	48	41	69.11
7	41	35	50.86
8	35	26	65.00
9	26	22	55.11
10	22	12	56.11
11	12	10	53.33
12	10	0	54.00

Table 2 reveals limitations of the floater, as varying intervals between initial and subsequent readings were observed, leading to inconsistent results. Additionally, the data demonstrates that the volume of drained fuel differs with each occurrence. However, during calibration, it was noted that the tests yielded nearly the same volume of drained fuel for corresponding readings.

To determine the fuel consumption of a motorized-tricycle, a microcontroller was utilized to read the initial and subsequent fuel levels indicated by the floater inside the fuel tank. The fuel consumption (F_consumed) is calculated using equation 1, which involves summing the average drained fuel values from the initial and subsequent readings obtained by the microcontroller. For example, if the initial reading is 55 and the final reading is 35, the total fuel consumed would be 173.08 cm3 (as shown in Table 2: 53.11 + 69.11 + 50.86).

$$F_{consumed} = \sum_{i}^{n} R_i + \ldots R_n \qquad \textbf{(1)}$$

Where:

$F_{Consumed}$ = Fuel consumed (cm^3)
R_i = Initial reading of the level of fuel based on average drained fuel (%)
R_n = Next reading of the level of fuel based on average drained fuel (%)

The improvised fuel tank, measuring 21.0 cm x 8.5 cm x 12.5 cm and made from a 1 mm steel plate, features an opening with a fuel cap and an outlet with a fuel cock. It is attached to the side of the cab, with a fuel hose connecting it to the motorcycle carburetor. Inside the tank, a floater is positioned to monitor fuel levels.

For the load condition, passengers were manually weighed using a scale. The test involved five passengers with different weights, while the driver's weight remained controlled.

To measure the distance traveled, an electrical switch known as a reed switch was employed. Placed near the front wheel of the motorcycle, the switch consists of two pairs of contacts: the main part and the magnet. When a magnetic field is present near the main part, the circuit is closed. The pair of magnetizable metal reeds was located along the front wheel, with one part connected to the fork and the other to the rotating rod in the wheel. The data of interest was the number of contacts made, with a contact occurring if the distance did not exceed 5 mm.

During data gathering, the improvised fuel tank was attached to the cab, the reed switch was affixed to the front wheel, and the data logging system, comprising an Arduino Microcontroller and storage media, was placed in front of the passenger side of the cab.

To determine fuel consumption and distance traveled, multiple tests were conducted along a road segment on CPG East Avenue between Tagbilaran City and the neighboring municipality of Baclayon. This location was chosen due to lower traffic volume and relatively flat terrain with a slope of approximately 4 km. The road conditions resembled those found within the city. Elevation data from NAMRIA indicated that the road was approximately 20 meters above sea level. The tests were conducted in fair and sunny weather, with an average temperature of 34 °C.

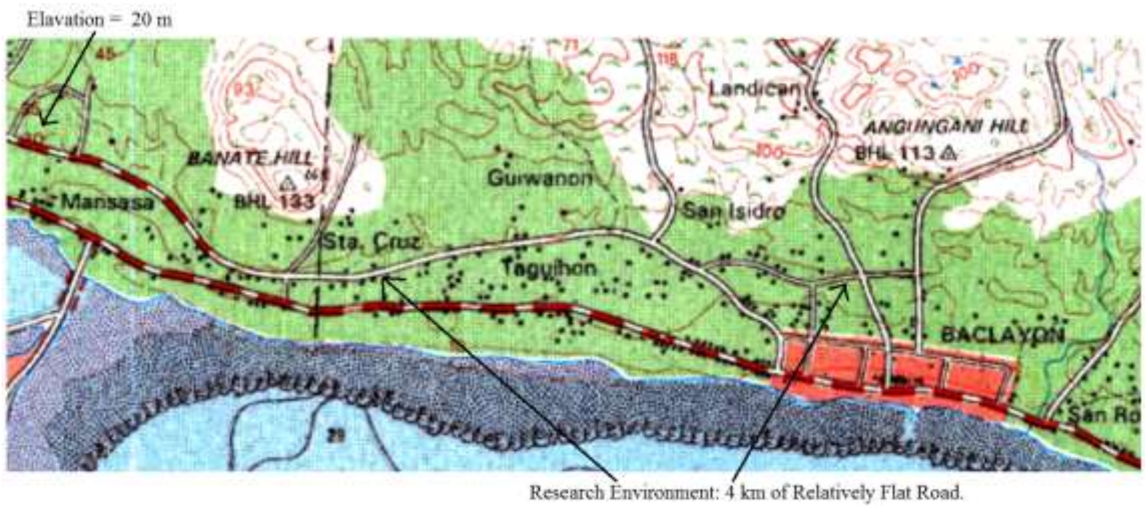

Figure 2. Topological map and elevation of the research environment

In the data analysis, multiple correlation analysis was employed to examine the relationship between the independent variables (X_1) and (X_2) and the dependent variable (Y). Specifically, the study investigated whether a correlation exists between the cost of fuel consumed and the load condition and distance traveled in a motorized-tricycle. The cost of fuel consumed served as the dependent variable, while the load condition and distance traveled were considered independent variables. The experiment collected data on the number of passengers, load condition, distance traveled, and fuel consumption. Multiple Correlation Coefficients were calculated to determine the presence of correlations between the dependent and independent variables.

The Multiple Correlation Coefficient denoted as R is shown in equation 2,

$$R = \sqrt{\frac{\left[\left(r_{y,x1}\right)^2 + \left(r_{y,x2}\right)^2\right] - \left(2r_{y,x1}r_{y,x2}r_{x1,x2}\right)}{1-\left(r_{x1,x2}\right)^2}} \qquad \textbf{(2)}$$

Where:

R = Multiple Correlation Coeffiecient

$r_{y,x1}$ = Correlation between the dependent variable (cost of fuel consumed and the first independent variable (load condition)

$r_{y,x2}$ = Correlation between the dependent variable (cost of fuel consumed) and the second independent variable (distance traveled)

$r_{x1,x2}$= the coefficients of determinants between twoindependent variable (load condition and distance traveled)

The value of R measured depicts how close the points are lying to a straight line. The value could be -1 to 0 to +1 or (-1<= R <=1). If the value of R is +1 or -1, this means there is a perfect correlation. A plus 1, means positive gradient and a minus1, means negative gradient. If R=0, this means that there is no connection at all between the two variables, therefore no regression analysis may be applied. If there is a correlation between the dependent and two independent variables, then Multiple Regression Analysis may be applied. The analysis was used in predicting the value of dependent variable given the value of one or more independent variables. The formula for Multiple Regression Analysis is shown in equation 6.

$$b_1 = \left(\frac{r_{y,x1} - r_{y,x2} r_{x1,x2}}{1-\left(r_{x1,x2}\right)^2}\right)\left(\frac{SD_y}{SD_{x1}}\right) \qquad \textbf{(3)}$$

$$b_2 = \left(\frac{r_{y,x2} - r_{y,x1} r_{x1,x2}}{1-\left(r_{x1,x2}\right)^2}\right)\left(\frac{SD_y}{SD_{x2}}\right) \qquad \textbf{(4)}$$

Where:

b_1 = the change of Y for each increment in X_1 or the first independent variable (load condition)

b_2 = the change of Y for each increment in X_2 or the second independent variable (distance traveled)

$r_{y,x1}$ = Correlation between the dependent variable (cost of fuel consumed) and the first independent variable (load condition)

$r_{y,x2}$ = Correlation between the dependent variable (cost of fuel consumed) and the second independent variable (distance traveled)

SD_y = Standard Deviation for the dependent variable (cost of fuel consumed (Y))

SD_{x1} = Standard Deviation for the independent variable (load condition (X_1))

SD_{x2} = Standard Deviation for the independent variable (distance traveled (X_2))

$$a = \underline{Y} - b_1\underline{X_1} - b_2\underline{X_2} \qquad \textbf{(5)}$$

Where:

a = the value of Y when X is zero

$\underline{Y}$ = the mean of the dependent variable (cost of fuel consumed (Y))

$b_1\underline{X_1}$ = the value of b_1 multiplied by the Mean of the load condition (X_1)

$b_1\underline{X_2}$ = the value of b_2 multiplied by the Mean of the distance traveled (X_2)

$$Y' = a + b_1X_1 + b_2X_2 \qquad \textbf{(6)}$$

Where:

Y' = the predicted value of Y or the dependent variable (cost of fuel consumed)

X_1 = the first independent variable (load condition)

X_2 = the second independent variable (distance traveled)

a = the value of Y when X is zero

b_1 = the change of Y for each increment in X_1 or the first independent variable (load condition)

b_2 = the change of Y for each increment in X_2 or the second independent variable (distance traveled)

To validate the suitability of Multiple Regression Analysis as the data model, a residual plot was utilized. Residual plots are commonly employed in simple linear regression to assess the adequacy of the linear model by checking for constant variance. In an ideal scenario, the residual plot should exhibit a random scatter of points without any discernible patterns.

In terms of the driver's income, tricycle drivers play a vital role in providing transportation services to passengers, facilitating their travel to desired destinations. In return, passengers compensate the driver with a monetary value determined by the implemented fare matrix set by the relevant authority, as presented in Table 4. In Tagbilaran City, the standard fare for motorized-tricycles is ₱7 for the first kilometer or fraction thereof, with each additional kilometer or fraction incurring an extra ₱1 to the base fare.

TABLE 3. MOTORIZED-TRICYCLE FARE IN PESOS POINT OF ORIGIN (SOURCE: TAGBILARAN CITY HALL 2015)

Motorized-Tricycle	**Regular Base Fare for General Commuters**	**Regular Base Fare for Students, Senior Citizens and Differently Abled Persons**
1. For the first one (1) km. or fraction thereof	P 7.00	P 5.60
2. For every succeeding kilometer or fraction thereof	P 1.00	P 1.00
3. For the first 1 km. or fraction thereof from any point in the City to the wharf and vice versa from 4:00 am to 10:00 pm	Add P 2.00 on the regular base fare	Add P 2.00 on the regular base fare
4. For the first 1 km. or fraction thereof from any point in the City to the wharf and vice versa from 10:00 pm to 4:00 am	Add P 5.00 on the regular base fare	Add P 5.00 on the regular base fare.

For the driver's perspective, the costs to consider are the fuel consumption and the boundary per day which range from ₱200 – ₱250. The normal number of trips per day is thirty (30). The expenses for the maintenance are handled by the tricycle operator or the owner.

Majority of the tricycle drivers believe that having more passengers (n) would mean an additional income for them without knowing the cost of fuel consumed for overload capacity. In order for the tricycle driver to gain profit, the profit function equation is used. Profit function $P(n)$ is equal to the Revenue function $R(n)$ minus the Cost function $C(n)$ as shown in equation 7. The Revenue function $R(n)$ is the fare of every passenger per trip while the cost function $C(n)$ is the fixed cost and the variable cost. The fixed cost is the boundary or rent equivalent in a trip and the variable cost is the fuel consumed per trip.

$$P(n) = R(n) - C(n) \quad \textbf{(7)}$$

Where:

$P(n)$ = is the Profit function (₱)
$R(n)$ = is the Revenue function (₱)
$C(n)$ = is the Cost function (₱)

The relation between the profit, revenue and cost function was determined by assuming that the weight of every passenger is 50 kg and the distance traveled by the motorized-tricycle per trip is 1000 m. Hence, for one (1) passenger the load condition is 50 kg with revenue of ₱ 7.00, for two (2) passengers, the load condition is 100 kg with revenue of ₱ 14.00 for three (3) passengers the load condition is 150 kg with revenue of ₱ 21.00.

In Figure 3, it shows the slope function of revenue and costs intersect at point (N). This point represents the break-even where the revenue and cost are the same and the profit is zero. The side on the left which is n<N represents the driver is not earning or losing while on the side to the right which is n>N represents the driver is earning.

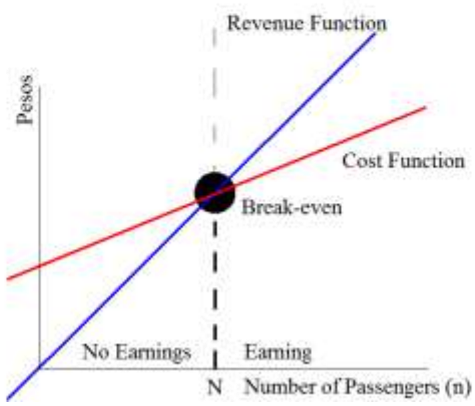

Figure 3. Break-even point for the driver’s income per trip.

RESULTS AND DISCUSSION

The correlation between the cost of fuel consumption to the load condition and distance traveled was determined by conducting several tests through traveling the motorized tricycle with different load conditions and varied distances. Table 5 shows the summary on the analysis of the data.

TABLE 4. CORRELATION BETWEEN THE LOAD CONDITION, DISTANCE TRAVELED AND COST OF FUEL CONSUMPTION

Relation	Correlation Value	
Load Condition (X_1) - Fuel Consumption Cost (Y)	$r_1 =$	0.1014
Distance Traveled (X_2) - Fuel Consumption Cost (Y)	$r_2 =$	0.7940
Load Condition (X_1)- Distance Traveled (X_2)	$r_1r_2 =$	-0.1048
	$R =$	0.8154
	$R^2 =$	0.6649

Relation	Correlation Value	
	Adjusted R^2 =	0.6400

The relationship between the cost of fuel consumed to the load condition and the distance traveled was performed using multiple correlation coefficients. It was found out that the correlation coefficient is 0.8154. There is a strong positive relation between the independent variables and the dependent variable. This means that as the load condition increases and as the distance traveled increases, the fuel cost consumption also increases. According to adjusted R^2 value, 64% of the cost of fuel consumption can be explained by the dependent variables.

TABLE 5. MULTIPLE REGRESSION ANALYSIS RESULTS

	Coefficients	Standard Error	t Stat	P-value
Intercept	0.6169	0.891395662	0.692112438	0.494776304
Load Condition	0.0066	0.003978914	1.666576446	0.107159517
Distance Traveled	0.0008	0.000115232	7.26168893	8.24139E-08

Table 6 displays the result of the multiple regression analysis. The cost of fuel consumed is determined by the load condition and distance traveled.

$$Y' = 0.6169 + 0.0066\, X_1 + 0.0008\, X_2 \qquad \textbf{(8)}$$

This equation means that for every increase for each unit of change in load condition, there is a change of 0.0066 units in the cost of fuel consumption with the distance traveled being held constant. In addition, for each unit of change in distance traveled, there is a change of 0.0008 units in the cost of fuel consumption with the load condition held constant.

To validate the results, the relative percent error was used to determine the error or variations between the actual and predicted value of the cost of fuel consumed. These variations or error may be represented as margin of error or tolerance. The relative percent error *t* was being computed. Figure 4 illustrates the diagram of the percent error between the actual and predicted value of the cost of fuel consumed. The average relative error is 17.41%.

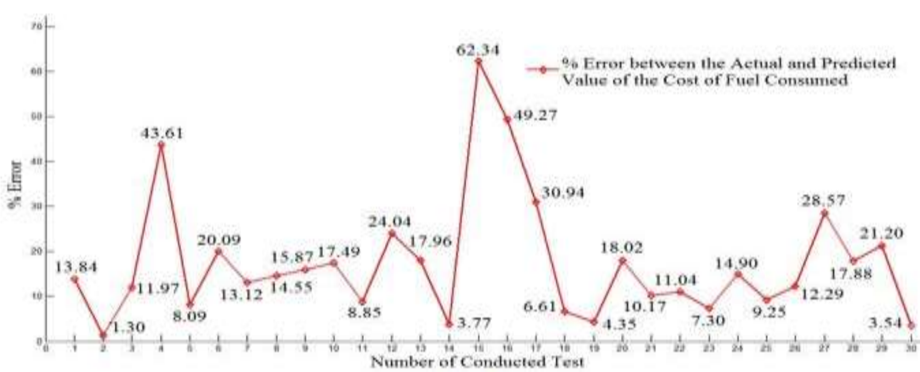

Figure 4. Percent Error between the actual and the predicted value of the cost of fuel consumed.

To formulate an acceptable margin of error or tolerance, the value of adjusted R^2 which is 64% was considered. Hence, it shows that 36% of the cost of fuel consumed may be explained by other factors beyond the scope of this study. These factors may include the air resistance, friction of wheel or road surface. Therefore, the average relative percent error which is 17.41% is acceptable or tolerable, because it falls within the allowable margin of error of 36%.

To further validate the accuracy of the equation 8, the residual was being computed. Residual is the difference between the actual value and the predicted value. The residual plot is illustrated in Figure 5. It shows that the points are randomly dispersed around the horizontal axis. This random pattern (or without pattern) suggests that linear model is suitable for the data and the predicted equation for the cost of fuel consumed is valid.

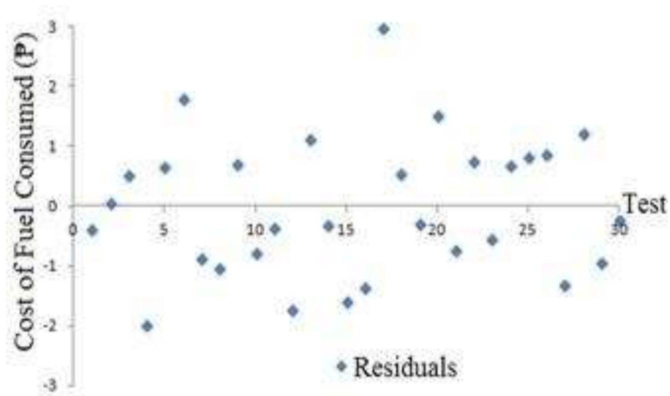

Figure 5. Residual plot.

TABLE 6. EXPERIMENTAL COMPARISON OF TRAVELING STRAIGHT NON STOP AND TRAVELING WITH AT LEAST 5 STOPS (WITH FIXED LOAD CONDITION OF 120 KG AND DISTANCE OF AT LEAST 5000 METERS).

Traveling Straight without Stops		**Traveling with at Least 5 Stops**	
Distance Traveled (m)	**Cost of Fuel Consumed (₱)**	**Distance Traveled (m)**	**Cost of Fuel Consumed (₱)**
5388.52	4.44	5405.09	4.57
5392.20	4.12	5410.61	4.70
5462.15	4.44	5408.77	5.11
5598.48	4.93	5651.87	6.03
Average	**4.48**	**Average**	**5.11**

Table 6 shows the experimental data with comparison on nonstop travels straight nonstop travels and traveling with at least 5 stops in between. Cost of fuel consumption in relation to the distance traveled for both with and without stops have average values of ₱4.48 and ₱5.11 respectively. This showed that there is an additional amount of ₱ 0.63 for traveling 5000 m with stops compared to those without stops. Figure 6 presents the pattern of the experimental data in relation to the cost. It shows the cost is higher in traveling with stops than without stops. This difference is due to the additional amount of fuel consumption when the motorized tricycle is idle or when the engine is running but not moving.

Furthermore, the motorcycle engine normally runs in the lower gears after stopping. Using low gear consumes more fuel compared to the higher gears as supported by Calasanz et.al. [14]. The cost of fuel per liter was based on the fuel price for the month of May 2016 which is ₱ 37.00 or an equivalent of ₱ 0.037 per cm^3.

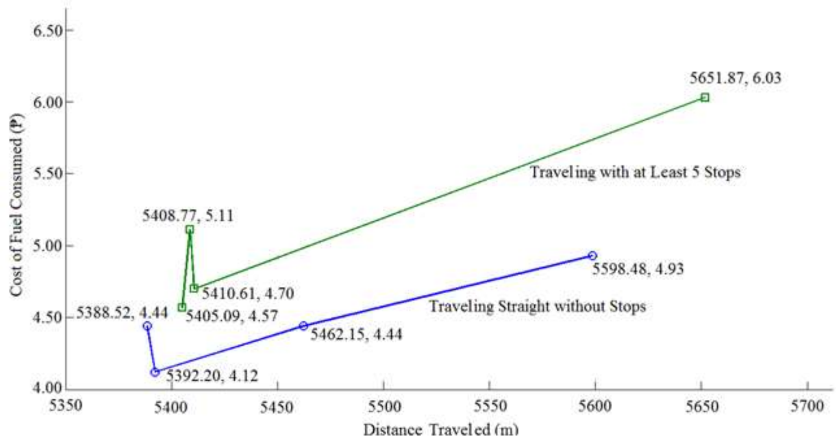

Figure 6. Graphical presentation between traveling without stops and with at least 5 stops.

Based on equation 10, applying values for a load condition of 50 kg and a distance traveled of 1000 m the predicted value for the cost of fuel consumption is ₱ 1.45. The total cost is ₱ 7.50 (rent) + ₱ 1.45 (fuel) equal to ₱ 8.95. For a 100 kg load and 1000-m traveled, the predicted cost of fuel is ₱ 1.79 with a total cost of ₱ 9.29. Complete data including the profit, revenue and cost are shown in Table 7.

TABLE 7. RELATION BETWEEN PROFIT, REVENUE AND COST FUNCTION

Passengers (n)	Load Condition (kg)	Distance Traveled (m)	Cost of Fuel Consumed (₱)	Fare (₱)	Revenue (₱)	Cost (₱) (FC+ VC)	Profit (₱) (Revenue-Cost)
0	0	1000	1.45	7	0	8.95	-8.95
1	50	1000	1.79	7	7	9.29	-2.29
2	100	1000	2.12	7	14	9.62	4.38
3	150	1000	2.45	7	21	9.95	11.05
4	200	1000	2.78	7	28	10.28	17.72
5	250	1000	3.11	7	35	10.61	24.39
6	300	1000	3.44	7	42	10.94	31.06
7	350	1000	3.77	7	49	11.27	37.73
8	400	1000	4.11	7	56	11.61	44.38

It is clearly shown that if a motorized-tricycle is traveling with only one (1) passenger with a load condition of 50 kg, the driver has no income with a loss of ₱2.29, instead. When traveling with at least two (2) passengers with an equivalent maximum load condition of 100 kg, the driver starts to have an income of ₱ 4.38.

Figure 7 illustrates the relationship between the revenue and cost function to the number of passengers (***n***). A driver has a losing profit in a zero to one (0-1) passenger per trip. The minimum number of passengers is two (2) with an equivalent maximum load condition of 100 kg in order for the driver to have an income.

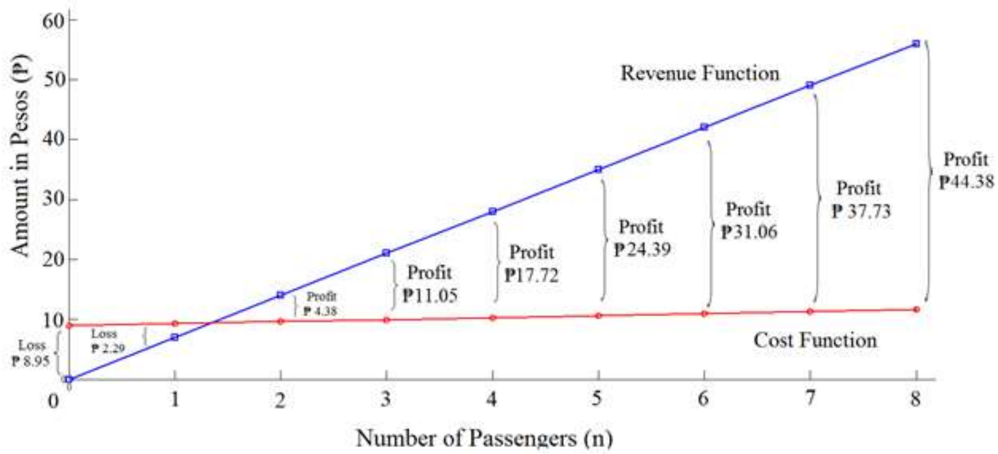

Figure 7. Relation between the revenue and cost function to the number of passengers.

Table 7 and Figure 7 suggest that to attain a profit of a motorized-tricycle, the minimum number of passengers per trip needed to travel should be at least two with an equivalent maximum load condition of 100 kg.

CONCLUSION

In conclusion, the findings of this study demonstrate a clear relationship between the load condition of passengers, distance traveled, and the cost of fuel consumption in a motorized-tricycle. As the load condition and distance traveled increase, there is a corresponding increase in fuel consumption costs. These results highlight the importance of optimizing passenger load and distance traveled to ensure economic viability for motorized-tricycle drivers. This information can be utilized to inform decision-making processes and promote efficient operations within the motorized-tricycle transportation system.

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