"Pasahero" A Mobile Transit Application That Racks the Departure and Arrival Status of Buses

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Abstract

The Pasahero application will be developed as part of this research with the intention of enhancing commuters' productivity, efficiency, and level of customer service. Our study's main objectives are to shorten wait times at bus stops where people use the Pasahero app to time their walk to a stop or station, reduce travel times where users can adjust their travel schedules in accordance with the time provided by the Pasahero app, and boost transit use where users are content with the shorter wait and travel times. The "Design Thinking" methodology is used by researchers and designers to pinpoint issues and generate solutions, while it explores what might be and generates desired results that are beneficial to the end user using logic, creativity, intuition, and experience. The Input-Process-Output (IPO) model offers a framework for a life-cycle analysis approach that identifies performance indicators and standards for evaluating the use of nanomaterials to increase a system's sustainability. The data was collected with a survey. Using a four-point grading scale, testing the functionality, reliability, usability, efficiency, maintainability, and portability. And the results show that users strongly agree that it meets all of these factors of the Pasahero application.

Keywords
Transit, Real-Time Tracking, Transportation, Commuters

1. Introduction
Public transportation is a vital part of the community. There are a bunch of benefits for having great public transportation. For every ten million dollars of transit investment made, business sales increase by thirty million dollars. During the 2006 to 2011 period, residential property was an average of 42% more valuable if located near high-frequency transit service, which means cities reap greater tax revenues (Breggren 2017). Good public transportation gives an economic boost to the cities.

In this modern era in the Philippines, vehicles are very common. People tend to buy their own vehicles due to the fact that the Philippines have a bad public transportation system. Commuters cannot trust the reliability of the public transportation system. Also, having too many vehicles on the road will create congestion and traffic. According to CNN Philippines, The Philippines is now losing ₱3.5 billion a day due to traffic congestion in Metro Manila, the Japan International Cooperation Agency (JICA) said Thursday. In its 2014 report partnering with the National Economic Development Authority (NEDA), the country suffered ₱2.4 billion losses daily due to Metro Manila traffic. The report then projected ₱3.5

billion in daily losses by 2017 (CNN Philippines 2018). The report shows that the Philippines is losing a great amount of money every day due to the bad public transportation system.

In order to ease the problems of having a bad transportation system, creating a real-time public transit data QR payment mobile application can improve the system. The primary benefits include reduced wait times (people use an app to time their walk to a stop or station), reduced travel time (people adjust their trip choices), and increased transit use (people like reduced wait and travel times). In time, the higher-order impact stands to be even greater: a future where integrated real-time data from all transportation options enables a true mobility system that rivals private car use on convenience (Jaffe 2018). The real-time public transit data will make commuters time more efficient and productive.

Therefore, this research aims to develop a mobile application that consists of GPS and real-time tracking with QR payment in a specific area which is Clark, Pampanga. This mobile app will help the commuters to calculate their time. The main purpose of this project is to develop real-time public transit data to enhance the current bus service system and reduce the workload of the bus management team. It also provides the tracking of the bus within their stop by and other locations where they drop their other commuters before the bus can reach the commuters exact location. Lastly, the application provides a QR payment system that can remove manual payment or cash payment.

1.1 Objectives

This research aims to create Pasahero application a real-time public transportation transit data that will make the commuters time more productive, more efficient, and give commuters the best customer service. The main objectives of our research are reduced wait times in the bus station where people use Pasahero Application to time their walk to a stop or station, reduced travel time where people can adjust their trip choices accordingly to time presented through Pasahero Application and increasing transit use where people are satisfied with reduced wait and travel times

2. Literature Review

During these past years of technology becoming advanced, used often for daily use, and also the application of smart devices, everyday activities now include data gathering for users to have knowledge of raw data.

Use of Geolocation

Geolocation used with navigation is very effective and useful in this regard. Producing near real-time results, it helps create useful and helpful information especially on the road. One example being the navigation app “Waze”. According to Madleňák (2020) in his study and discussion of geolocation practices, “The visible position of subjects on the map helps to estimate the traffic flow and to adjust the generated results accordingly. The intelligent traffic management system can automatically evaluate usefulness of information with regard to the current situation an recommend the optimal variant.” With the information that tracker apps have today, can make an impact.

Bus Commuters

Commuters that take the bus are one of the many everyday commuters that need to get to a certain place, most commonly school or work. Many commuters are often late for work and students are late for class because they choose to get the bus ahead of time rather than simply using other alternative modes of transport. Increased waiting times and uncertainties once buses arrive build the transport system unattractive for commuters. To lessen this confusion and inconvenience, a message might be proven at the internet with the intention to offer the real-time facts about the bus displaying its arrival time that could lessen the tension of commuters awaiting the bus. With the arrival of GPS and the omnipresent cell network, real-time car monitoring for higher delivery control has become possible. These kinds of technology may be carried out to move structures, especially buses, which aren't capable of adhering to predefined timetables because of motives like traffic jams, breakdowns, and the like. With this kind of system that will be applied, this can help satisfy commuters. This will construct the very last conveyance device aggressive and Commuter-friendly. Various reasons that people take the bus instead of driving their own vehicle such as traffic jams, heavy parking fees and lack of parking slots at the destination. However, bus transportation services have very poor transportation information systems nowadays. Bus users do not know the exact arrival time for a bus, but only know the scheduled arrival time. With this kind of system, the use of private motors is decreased while extra people use transit motors, which in turn reduces visitors and pollution (Patel et al. 2017).

Real-Time Tracking and Global Positioning System
To obtain an automated Vehicle Location machine which can transmit the area statistics in actual time, lively structures are developed. In the prevailing system, the consumer does now no longer understand the precise area of the bus and each time he wishes to understand approximately the area, he has to name and ask someone. Sometimes, the bus can also get not on time through a few occasions which include site visitor's congestion. The capacity to track the automobile over the net is executed with the aid of using Global Positioning Satellites. The records transmitted from the monitoring tool are disseminated and saved in your personal account or dispatched over the wi-fi network. The facts are passed on a road stage map for viewing. The positioning records furnished pass connection with the nearest geographic address and displayed in residential/business address format.

The main disadvantage of the present system is that the system gives solely a broad layout of the geographical address, providing and doesn't provide street wise address. Speed of the vehicle and engine isn't any manner controlled by the existing systems, so exposing the vulnerability of a system that has only tracking (Kumar et al. 2016). The real-time bus monitoring machine makes use of GPS (Global Positioning System) technology to fetch information and shows the information using a package allowing a person to look at a particular bus on a specific route. As soon as this data is bestowed to the commuter with the aid of using wi-fi media or online internet media, they'll control their time expeditiously and attain the forestall clearly earlier than the bus arrives, or take an exchange showing that of delivery if the bus is delayed (Patel et al. 2017).

Lack of knowing information for bus commuters towards bus transit.
Public commuter transport stands for the availability of a social provider of transporting commuters from the factor of starting place to the factor of destination. This guarantees mobility of commuters on an everyday basis the use of specific manner of delivery running on a clock-face schedule. Efficient transport results in a decrease in private vehicle use, which considerably contributes to the reduction of traffic congestion and pollution, thereby raising the standard of living. The high-satisfaction of the delivery provider and users' willingness to purchase it are decided by way of means of their willingness to apply that technique of delivery. Public transport (PT) performs a key position there because it ends in a discount of traffic congestion generated by the use of non-public vehicles. In order to enhance the excellent shipping provider and entice and keep customers of PT, steps are taken to layout and put into effect an incorporated public commuter shipping system. An integration of transport modes is proposed with the purpose of making sure higher coordination and synchronization in the public commuter transport. The network line plan on the targeted space is organized during a clock-face schedule with railway lines that function as the backbone of the traffic load. The factors of integration of transport modes ensure a secure and clean passage of commuters from one mode into another. Adequate mobility and accessibility are the simple situations of today's society as a whole (Šipuš & Abramovič 2018).

Public Transit Performance
Public transit performance highly focuses on its service reliability. Maintaining such philosophy brings the trust and cooperation of many users. Three widely used indicators to assess the reliability being: 1) punctuality, assessing the deviation of departure or arrival times of vehicles from a given journey time; 2) interval regularity, defined as the regularity of intervals between vehicles; and 3) uptime compliance, as measured by the mean difference between the vehicle's actual and scheduled uptime (Eboli and Mazzulla 2012).

Secure Payment
With the increasing availability of digital technologies that support various payment systems, companies around the world have begun to adopt innovative micropayment products. This brings with it new users who have to deal with complex issues, as well as the potential to influence behavior, privacy, and the economy. However, some payment systems currently in use do not sufficiently take into account the requirements and activities of cardholders. Recently, QR codes have become widely used in various fields such as marketing, product tracking, document verification, and social media. The amount of information that can be encoded in the QR code depends on the size of the matrix, the type of data, and the level of error correction (Alhothaily et al. 2017).

3. Methodology
Design Thinking is a methodology used by researchers and designers to solve problems that are encountered and find solutions. Design Thinking involves logic, imagination, intuition, and experiences,

to explore possibilities of what could be and to create desired outcomes that benefit the end user. This involves five (5) phases – empathize, define, ideate, prototype, and test.

Figure 1. Design Thinking

This section discusses the detailed framework of design thinking methodology.

1. **Empathize** - this is the first stage of DTM which is to understand, make or show connection to a specific problem you want to resolve. The problem of the commuters is that they just tend to predict on what time the bus will arrive. In this stage, we researchers want to resolve their problems by giving them specific time and specific location of the bus arrival.
2. **Define** - the second stage of the DTM is the Define phase, in which you collect a data base on what you observed (which is the stage 1 "Empathize"). We collected different data such as: The time interval of the bus arriving at the same location, next is how many buses will be available on a specific sector, last is the location and its specific routing area.
3. **Ideate** - the third stage of DTM is the Ideate phase, this is where/what techniques should we use on resolving the problems we tackle on the first two stages:

a. Service notification that will notify all the commuters that are using the application.
b. Bus interruptions for the driver side, the driver will now be giving an update regarding operational status via Fire based cloud messaging.
c. Route blockage such as events, under construction, road traffic collision, etc.
d. QR Code will only be implemented if the company supports and executes necessary payment methods.
e. The commuters can see and track the available bus numbers that are roaming within the specific area.

4. **Prototype** – the fourth stage will mainly prioritize the presentation of the suggested features and will not reference the final product; prototypes will be kept and be further improved.
5. **Test** – the last stage will put the prototype in the hands of the commuters, the researchers and the respondents can now finalize the application.

The Input–Process–Output (IPO) model serves as a framework for a life-cycle analysis technique that identifies performance measures and criteria for evaluating the use of nanomaterials to improve a system's sustainability.

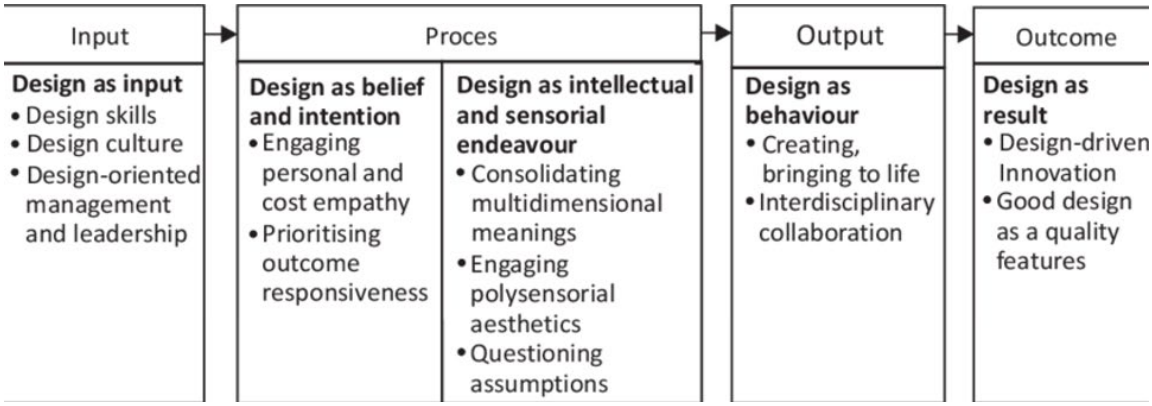

Figure 2. IPO Process

The proposed application targets commuters that use the bus as their mode of transportation. This provides real-time observation by the commuters of where the bus is, when it will arrive, and how long the trip will be. The usage of the app will be limited within the boundaries of Clark, Pampanga. Random sampling is used by researchers to gather information from the entire population. Each member of the subset has an equal chance of being chosen as part of the sampling process in random sampling.

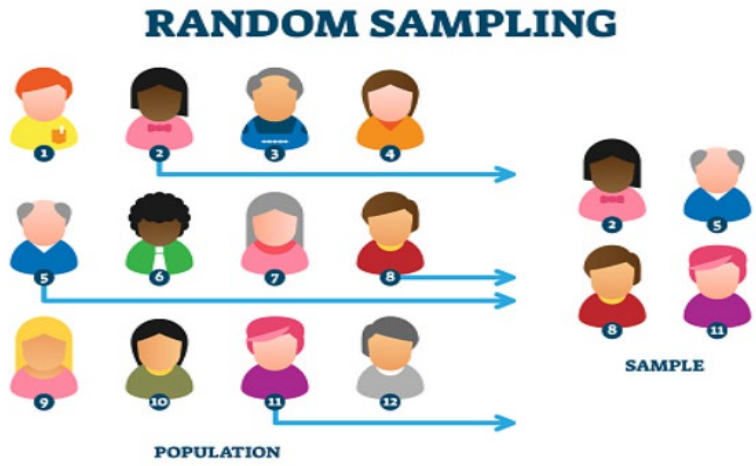

Figure 3. IPO Process

Data Collection

The Quantitative data gathered and collected through the survey questionnaires were analyzed using descriptive statistics through the support of the Social Sciences Statistical Program (SSSP). The information from each item on the survey questionnaires was extracted by the computation of its mean and standard deviation via the four-point grading scale, which is the standard for research. The interpretation of the scale is shown as follows:

Table 1. SSSP grading criteria

SCORE	CORRESPONDING RANK	RATE
4.00 – 3.26	Strongly Agree	4
3.25 – 2.51	Agree	3
2.50 – 1.76	Disagree	2
1.75 – 1.00	Strongly Disagree	1

The information from each of the items on the survey questionnaires will be extracted by the computation of its mean and standard deviation via the four-point grading scale, which is the standard for research. The interpretation of the scale is shown as follows:

5. Results and Discussion

5.1 Numerical Results

Table 2. Gender of participants

Gender	Frequency	Percent
Female	27	56.3
Male	21	43.8
Total	48	100.0

Table 3. The functionality of the software

Statements	Mean	Std. Deviation	Interpretation
The software can perform the tasks required.	3.33	.519	Strongly Agree
The result of the software is as expected	3.29	.504	Strongly Agree
The software can interact with another system	3.31	.589	Strongly Agree
The software can prevent unauthorized access	3.13	.733	Agree
Total	3.26		Strongly Agree

Table 4.Reliability of the Software

Statements	Mean	Std. Deviation	Interpretation
There are no faults or bugs in the software	3.10	.692	Agree
The software is capable of handling errors	3.23	.515	Agree
The software is capable of resuming work and restores lost data after a failure	3.23	.555	Agree
Total	3.19		Agree

Table 5. Usability of the Software

Statements	Mean	Std. Deviation	Interpretation
The user knows how to use the system	3.35	.601	Strongly Agree
The user learns to use the system easily	3.35	.601	Strongly Agree
The user uses the system without much effort	3.33	.519	Strongly Agree
The system interface looks good	3.40	.494	Strongly Agree

Total	3.36	Strongly Agree

Table 6. The efficiency of the software

Statements	Mean	Std. Deviation	Interpretation
The system quickly responds	3.34	.562	Strongly Agree
The system utilizes resources efficiently	3.29	.544	Strongly Agree
Total	3.31		Strongly Agree

Table 7. Maintainability of the Software

Statements	Mean	Std. Deviation	Interpretation
The faults in the system can be easily diagnosed	3.19	.607	Agree
The system can be easily modified	3.27	.536	Strongly Agree
The software can continue to function if changes are made	3.25	.601	Strongly Agree
The software can be easily tested	3.35	.526	Strongly Agree
Total	3.27		Strongly Agree

Table 8. Portability of the Software

Statements	Mean	Std. Deviation	Interpretation
The software can be easily tested	3.35	.526	Strongly Agree
The software can be moved to another environment	3.33	.595	Strongly Agree
The software complies with the portability standards	3.27	.536	Strongly Agree
The software can easily replace other software	3.15	.583	Agree
Total	3.28		Strongly Agree

Table 9. Summary per factor

Factors	Mean Rating	Interpretation
Functionality	3.26	Strongly Agree
Reliability	3.19	Agree
Usability	3.36	Strongly Agree
Efficiency	3.31	Strongly Agree
Maintainability	3.27	Strongly Agree
Portability	3.28	Strongly Agree

5.2 Graphical Results

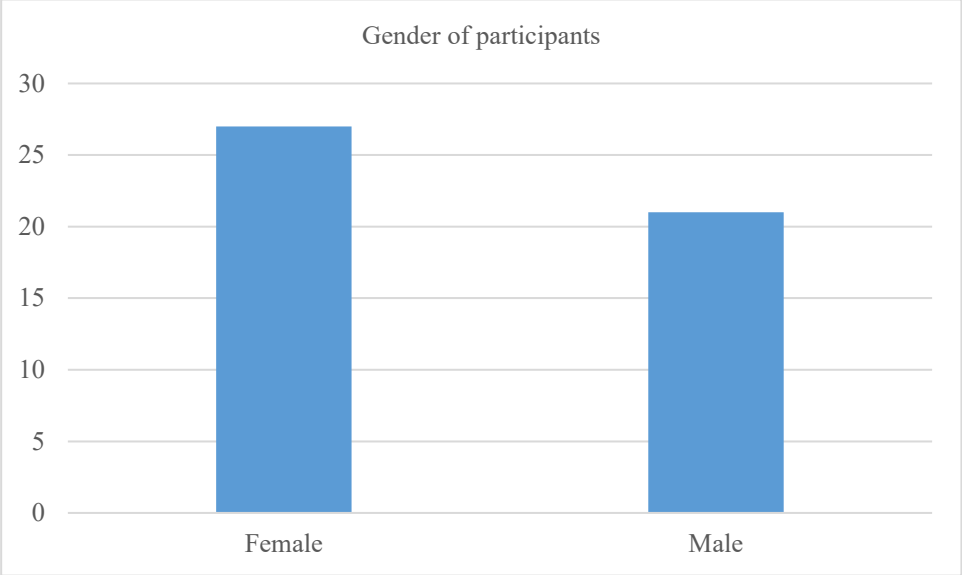

Figure 4. Gender of participants

There are forty-eight (n=48) participants in the initial survey study. There are twenty-seven (n=27, 56.3%) female participants and twenty-one (n=21, 43.8%) male participants.

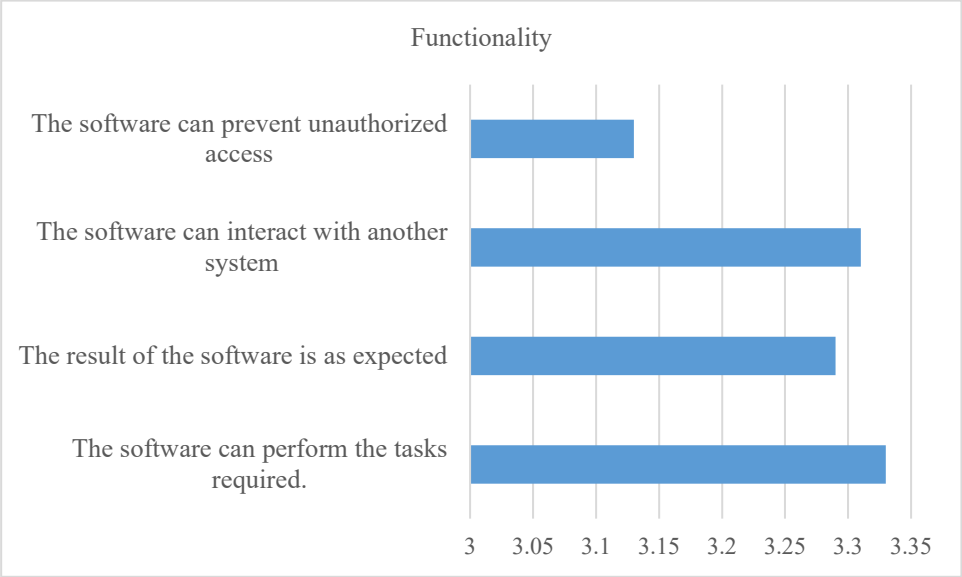

Figure 5. functionality of the software

The statement “The software can perform the tasks required” got the highest mean rating of 3.33 with a descriptive rating of “Strongly Agree,” and the statement “The software can prevent unauthorized access” got the lowest mean rating of 3.13; with the descriptive rating of “Agree.”

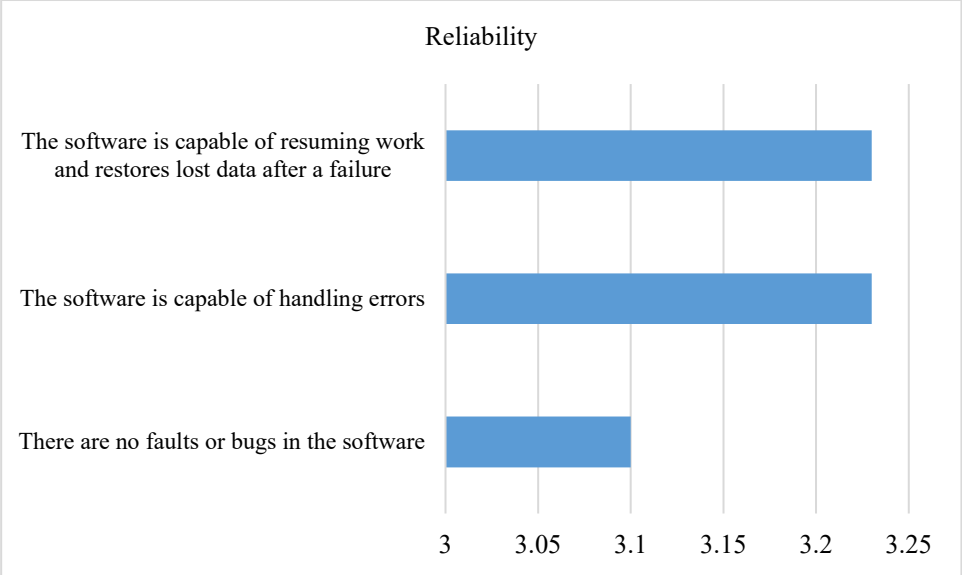

Figure 6. Reliability of the software

All three (3) statements got a descriptive rating of "Agree," with two statements having the highest mean score of 3.23.

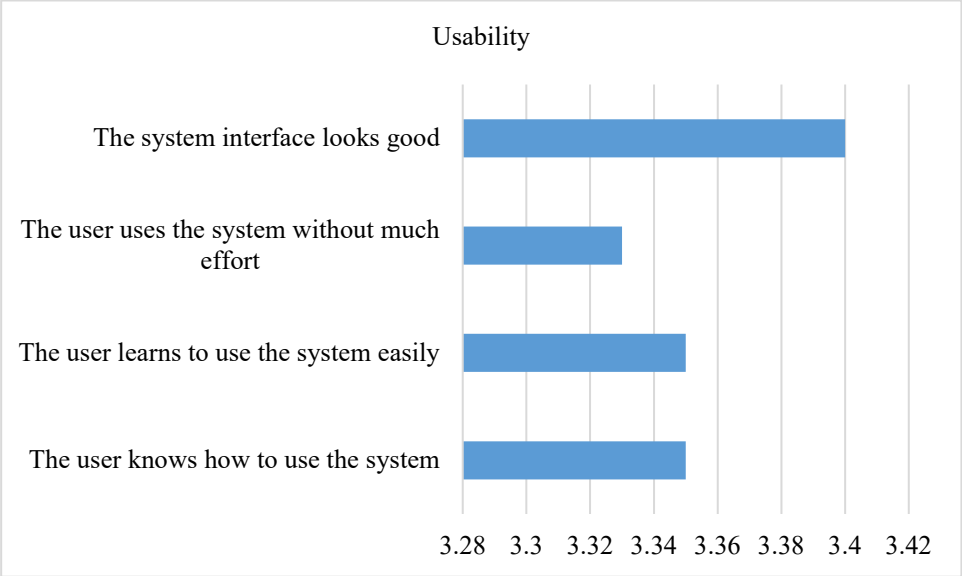

Figure 7. Usability of the software

All statements got the descriptive rating of "Strongly Agree," with one statement ("The system interface looks good") having the highest mean rating of 3.40, and one statement ("The user uses the system without much effort") having the lowest rating of 3.33.

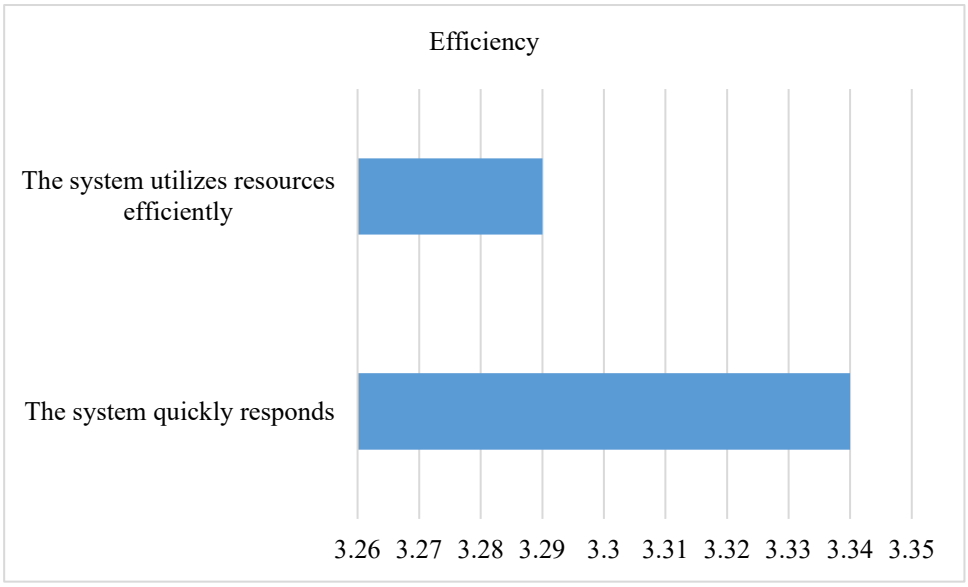

Figure 8. Efficiency of the software

All the factors' statements got a descriptive rating of "Strongly Agree."

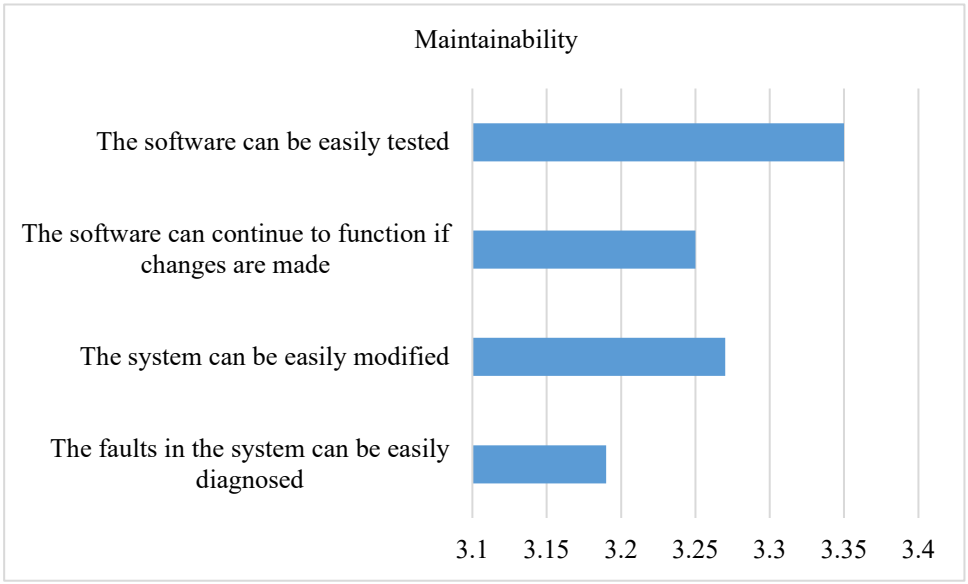

Figure 9. Maintainability of the software

Three statements got a descriptive rating of "Strongly Agree," while one statement got a descriptive rating of "Agree."

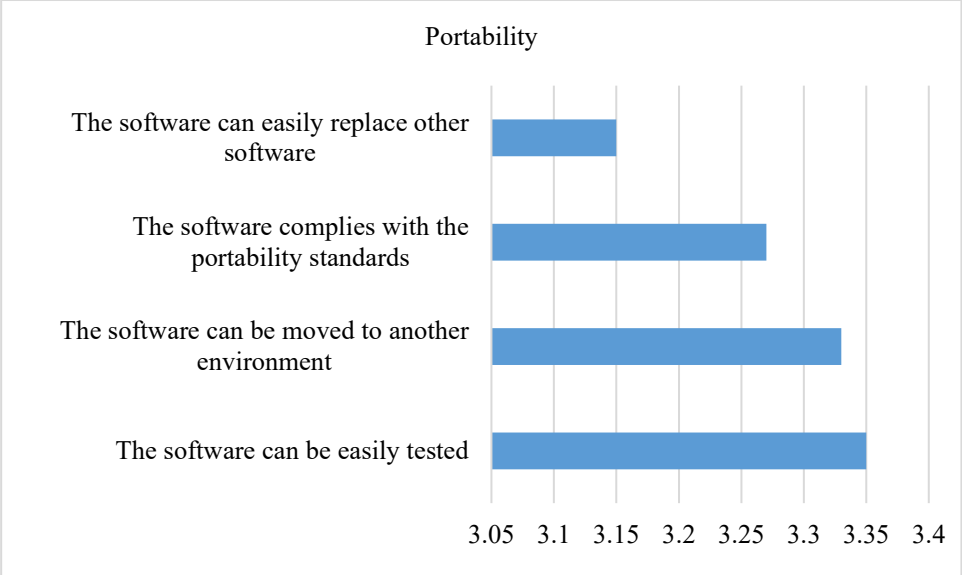

Figure 10. Portability of the software

A summative mean rating of 3.28 . Of all four statements, three got a descriptive rating of "strongly agree," and one statement got a descriptive rating of "agree."

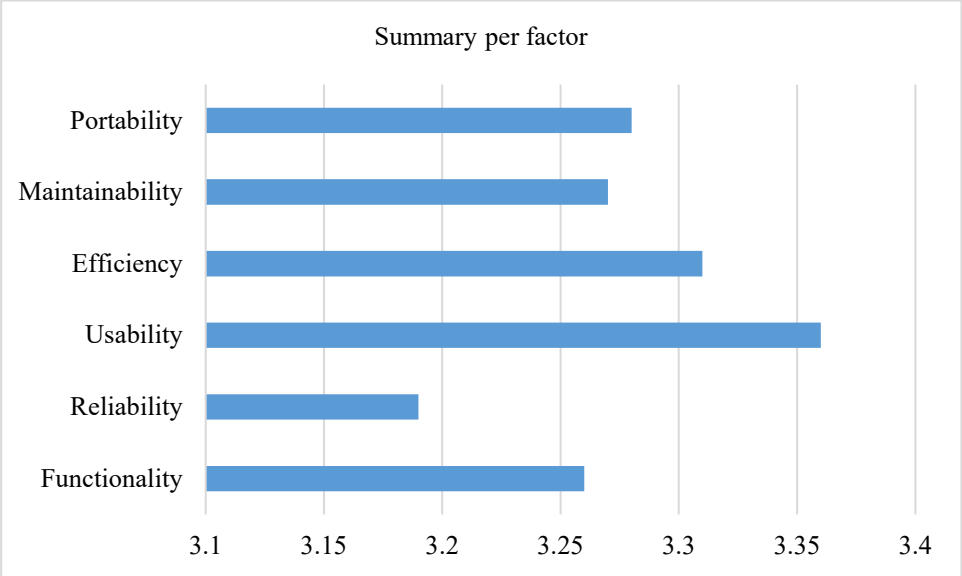

Figure 11. Summary per factor

Usability got the highest mean rating of 3.26 with a descriptive rating of "Strongly Agree," followed by the efficiency with a mean rating of 3.31 with a descriptive rating of "Strongly Agree." However, reliability got the lowest mean rating of 3.19 with an "Agree" descriptive rating.

5.3 Proposed Improvements

That the program should also be evaluated by students in terms of its accuracy, efficiency, reliability, and its overall effectiveness. Future researchers should evaluate, "Is the software consistent in terms of connectivity?" The operations of buses should be evaluated; "Do commuters find the application useful during their commute?"

5.4 Validation

This study can be used as a tool for future researchers to either improve or to create a similar kind of study. As this study has its own set of flaws and limitations. The limitations of this study in terms of

location have been used for the Clark area specifically, and with the improvement of future studies that will be conducted off of this study can expound the limits of the chosen area. The limits in terms of software can also be improved. With the applications' functions expressed in this study, future researchers can make use of evolving the processes to achieve more efficiency and stability when using the application.

6. Conclusion

Transportation has really become a vital part of the community and so has the progression of today's technology. Using technology with transportation in the Philippines has only been familiar with the common modes of transportation such as taxis, compact vehicles, and airplanes. Having programs and apps for buses are very uncommon. As the common transportation such as jeepneys, and tricycles, do not have the need to apply such technology. But technology will continue to be a part of people's everyday lives and there will be a time that the need for technology will be adapted in different aspects of transportation in this case. This research has proven that this application can help commuters that ride the bus as their daily mode of transportation. It helps finding specific routes for different commuters and also providing certain information needed in order for the commute to succeed.

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