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THE DRIVERLESS PUBLIC BUS TRANSPORT RIDERSHIP IN MALAYSIA: AN EXPLORATIVE STUDY

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Abstract

In Malaysia, air pollution, accidents and congestion remain to be the significant problems faced by the government. A driverless public bus transport is considered to be an option in addressing these issues. This paper tends to overlay the factors that affect the driverless public bus transport ridership when the driverless vehicle is adopted in Malaysia in the future. Driverless public bus transport is perceived to enhance the accessibility, safety and increase commuter satisfaction. In this study, perceived ease of use, safety and environmental impact are explored on how these factors affect the driverless public bus transport ridership by using a quantitative approach. The results of this study will be beneficial towards urban authorities and town planners in Malaysia by providing the useful information regarding the factors affect the driverless public bus transport ridership in the future urban transportation and the readiness of Malaysian on accepting the driverless public bus transport.

Keywords: Urban, driverless technology, ridership, public transport, user readiness.

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1. Introduction

Transport is an essential component towards every human being in order to move from one place to another place, and it is undeniable that mobility is a part of a human's daily routine. At the end of the 20th century, the concept "Smart City" has coined and become more prevalent in today society. Smart City concept is used to enhance the living standard, reduced the used of scarcity resources and cost by implementing user-friendly information and communication technologies (Lim & Taeihagh, 2018). As cities overgrow, the pressures on social stability, economy and environment also increased, which included other growing problems that urban transportation contributes such as climate change, air pollution, unequal access to services and adverse effects on public health (Lim & Taeihagh, 2018). There are several characterisations, and certain aspects that need to have to become a Smart City, which is the transportation, parking and traffic management of the city need to be smart (Olaverri-Monreal, 2016). Thus, driverless technology should be implemented more in public transport instead of the private car only, as the main focus of Smart City is to increase the number of people transported per hour and not on driverless vehicles as a single solution (Zwaan & Lohmann, 2017).

2. Problem Statement

The first problem encountered in urban transportation is the increase of road collision and freak accidents. According to Annual Transport Statistic Malaysia 2017, the number of road accidents is increasing continuously from the year 2008 (373,071 accidents) to the year 2017 (533,875 accidents). Also, there are 20 people die every day from road traffic accidents, and eight people out of 10 die from a human error which means human error causes 80% of the accidents (Ahmad, 2018). Thus, it can be concluded that drivers have an enormous influence on the rate of accident. By launching self-driving busses in Malaysia, it not only helps to lower and removing the number of potential fatalities caused by human error but also leads Malaysia towards Smart City.

In addition to the increases of accident rate; urban transportation has an impact on the environment. The transport industry is one of the contributors to air pollution and noise pollution even though it provides benefit to people in term of travelling. Traffic condition of urban areas is contributed up to 40% of CO2 emission and 70% of other pollution's emission. According to Salahudin et al. (2013), 97.1% of Malaysia Carbon dioxide (CO2) was released by transportation activities, and 2.9% of Malaysia Carbon dioxide (CO2) was released by other activities such as power station, industrial and hence on.

The paper explores on the importance of driverless public bus transport that can be implemented in Malaysia and the factors that will influence the ridership for the driverless public bus transport in near future. In order to prevent urban transportation problems included the increase of private ownership vehicles, driverless public bus transport service has to be introduced in Malaysia and make it accessible and safe convenient way of urban commuting. However, very limited works that focus on perceived ease of use; safety and environmental inclined affecting the user willingness to ride (ridership).

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3. Research Questions

The paper discusses on driverless public bus transport if implemented in Malaysia, what are the factors concerns by publics, which would influence the ridership of driverless public bus transport. Therefore, the pertaining research questions are addressed in the paper as follows

i. What is the relationship between perceived ease of use and driverless public bus transport ridership?
ii. What is the relationship between safety and driverless public bus transport ridership?
iii. What is the relationship between environmental impact and driverless public bus transport ridership?

4. Purpose of the Study

4.1. Technology acceptance model (TAM)

There have been a few types of research that exists on the mechanisms which can increase the intention of consumers to use driverless public bus transport. In order to investigate the ridership of driverless public bus transport, a priori acceptability of technology will be addressed to evaluate the technology itself, which is known as the technology acceptance model (TAM). TAM is an information system theory that simulates the intention of users to accept and use the technology. According to Davis and Venkatesh (1996), TAM is widely used by researchers to understand and explain the acceptance of the user towards the technologies. In this study, TAM believes that the impact of external variables (safety, environment, availability and awareness) on user behaviour is determined by perceived usefulness and perceived ease of use. Also, many empirical studies have shown that TAM is a robust and straightforward technology acceptance behaviour model for a variety of information systems (Davis et al., 1989; Davis & Venkatesh, 1996). According to TAM, perceived ease of use is also affect perceived usefulness, due to the easier it is to use it, the more useful the system is (Venkatesh & Davis, 2000). Besides, according to Choi and Ji (2015), the belief and attitudes of an individual will influence their intention to use or accept that technology. It also agreed by few studies which stated that attitudes and prior acceptability are correlated as the intention of using the technology can be predicted to some extent by user's attitude and prior acceptability (Parasuraman et al., 1992; Payre et al., 2014).

4.2. Ridership

Several studies have been developed to determine the success factors that contribute to increasing increase in transit ridership. For example, Haire and Machemehl (2010) has pointed out the impacts of fuel prices on ridership. The introduction of new technology such as autonomous driving technology will play an essential role in increasing ridership for public transport system without decreasing the fare revenue. Besides, technology not only will allow transit companies to improve their operation at a reasonable cost and effort but also assists them in the daunting and challenging task such as reintroducing and repromotion public transportation to masses when they embrace the technology (Liwag & Drummond, 2011). Public transportation is more useful to transport the masses than small driverless vehicles such as a self-driving car, and thus public transportation will be transformed with the advent of autonomous driving technology.

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Also, public bus transportation is the most flexible compared to another transport mode such as rail, subway or tram as they do not travel strictly on a fixed route.

4.3. Safety

Safety can be defined as how a public transport service safe from traffic accidents and their safety that passengers feel when they are travelling (Redmana et al., 2013). According to Redmana et al. (2013), a study on public transport ridership showed a 5% increase over five years due to the improvements of comfortability such as safety and cleanliness. The study revealed that satisfaction increased which 5% of 2400 passengers satisfied with the improvement in service quality, especially safety. There were 80% of respondents stated that they would consider using driverless public bus transport because they believed that driverless vehicle is safer than a human-operated vehicle. However, there were also 57% of respondents choose not to use driverless public bus transport as they think the driverless vehicle is less safe than a human-driven vehicle. Therefore, safety is considered as one of the essential factors that will influence the driverless public bus transport ridership (Piao et al., 2016). Moreover, a study on the factors influences the selection of transport mode among older adolescents resulted in three main categories, which are including personal factor, social factor and physical environment factor. Safety as one of the concerned factor as it will not influence the choice of transport mode. The study focuses on older adolescents, shown that safety was not a very important factor for choosing transport mode for travelling short distances. This is because of the transport users reported that the riders more focuses on oneself carefulness instead of the safety of the vehicle.

4.4. Environmental Impact

According to Beirao and Cabral (2007), the study indicated that the environmental impact did not be the essential factor to be considered by the respondents when they are choosing the transport mode. Some supporting researches explained about although the rise of awareness and concerns on negative environmental impact among the car users, but the users' behaviour would not change significantly. However, part of the car users will view the car pollution as motivation, and this may eventually make them switch from private car to public transport. Some of the car users said that busses are also responsible for pollution. Although public bus transit is not as environmentally friendly as rail, it still can be used to reduce pollution emission (Liwag & Drummond, 2011). Therefore, this study also developed to investigate the relationship between the user's concern on environmental impact and the ridership of driverless public bus transport. It is vital to promote the public bus ridership in terms of emission reduction and efficiency compared to rail because the emission from private vehicles will be reduced and increase the occupancy rates of the bus. Thus, driverless public bus transport that studied in this research will be sustainable transportation that able to reduce the emission efficiently and should be promoted to reduce the dependency of private vehicles.

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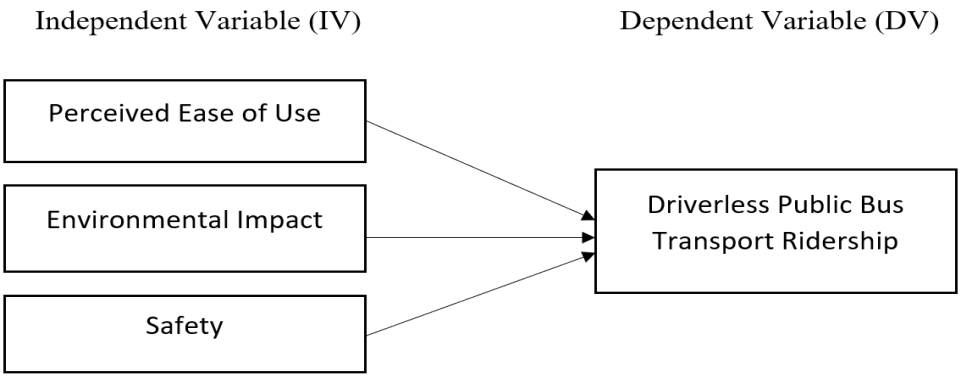

Figure 01. The research framework of Driverless public bus transport ridership

5. Research Methods

A systematic and theoretical analysis is known as a research methodology, is involving the processes that describe and predict conditions, and then solve the issue through the process on how to use the techniques of conducting research. This study will conduct a correlation study to determine the relationship between the predictor's variables (perceived ease of use, safety and environment) and the determinants (influence factor in promoting the driverless public bus transport ridership) (see Figure 01). By using the correlation research to analysis, data will help to measure the association between the independent variables and dependent variable (Phyllis, 2014). This research is using a quantitative approach where the questionnaire in this study is adapted from SPAD (2018), Lund (2001), Survey Monkey (2011), SurveyMonkey (n.d.) and Marathe (n.d.). The acceptability of respondents and driverless public bus transport ridership was investigated by using the Seven-point Likert-type scale. The response rate is range from 1, which extremely disagrees to 7, which is extremely agreed.

All Malaysian of all races, employment status, age level and educational status are the population for this study and the sample in this study are those citizens who live in Malaysia and has used public bus transport before no matter which states. Therefore, the result collected will be more accurate due to the experience provided by the respondents. Convenient sampling method was used in this study to collect the data. Respondents who are eligible to answer our questionnaire are the person who aware of the existence of driverless public bus transport. There were 400 sample sizes used for this study, and 13 respondents will not be used due to the unaware of the existence of driverless public bus transport. In this study, correlation analysis has also been used in this study to test the strength of the relationship between criterion variable (driverless public bus transport ridership) and predictor variables (perceived ease of use, safety and environmental impact). Last but not least, multiple regression analysis will be carried out to determine whether there is a significant relationship between predictor variables and the criterion variable.

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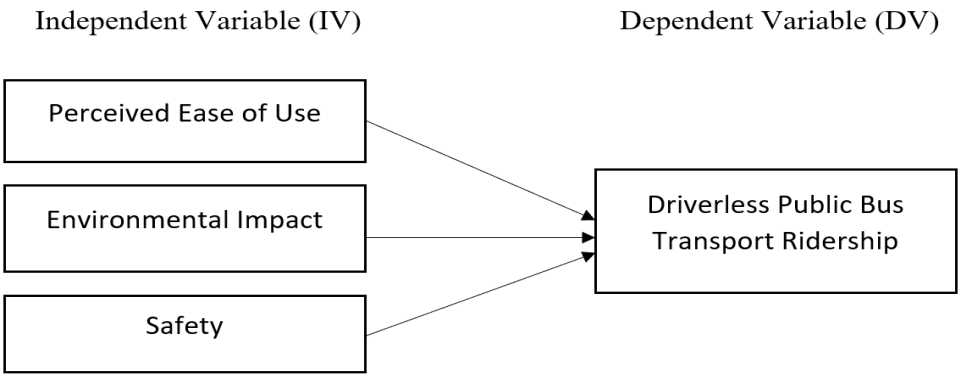

Figure 02. The research framework of Driverless public bus transport ridership

5.1. Analysis

Inferential analyses had been used to address the research questions and to determine the significant relation between perceived ease of use (PEOU); environmental impact (EI) and safety (SAFE) with driverless public bus transport ridership (DR) (see Figure 02). Besides, the reliability test has been used in this study to know the reliability of the variables. Cronbach's Alpha shown the value of 0.909, which is higher than 0.7, represented that all six variables are reliable and valid for further data analysis in this study.

6. Findings

6.1. Correlation Analysis

Correlation analysis is used to investigate the strength of the relationship between independence variables and dependence variables as tabulated in Table 01.

Table 01. Correlations between constructs and scale reliability values

Variable	Mean	PEOU	SAFE	EI	DR
PEOU	5.8240	1			
SAFE	5.5379	0.588**	1		
EI	5.4920	-0.023	-0.061	1	-
DR	5.0175	-0.016	0.030	0.357**	1
a. Predictors: (Constant): Perceived Ease of Use (PEOU), Environmental Impact (EI), Safety (SAFE)					
b. Dependent Variable: Driverless Public Bus Transport Ridership (DR)					

Note: **. Correlation is significant at the 0.01 level (2-tailed).

In this study, the research set out to determine the relationship between perceived ease of use (PEOU), safety (SAFE), environmental impact (EI) and driverless public bus transport ridership (DR). Finding from correlation analysis shows that PEOU and SAFE are not significant at 0.01 level with r=-0.016, $p < 0.05$ and r = 0.030, $p < 0.05$ respectively. Furthermore, findings of correlation analysis show EI is correlated with DR (r = 0.357, $p < 0.05$), which means EI is weak correlated with DR. The correlation analysis shows the existence of a significant relationship between EI and DR while PEOU and SAFE have no significant relationship with DR.

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6.2. Multiple Regressions

Table 02. Model Summary

Model	R	R Square	Adjusted R Square	Std. The error of the Estimate
1	0.593[a]	0.352	0.342	0.63440
a. Predictors: (Constant), Perceived Ease of Use (PEOU), Environmental Impact (EI), Safety (SAFE)				
b. Dependent Variable: Driverless Public Bus Transport Ridership (DR)				

Based on the Model Summary in Table 02, R^2 is 0.352, which means that 35.20% of the variance in the driverless public bus transport ridership is explained by perceived ease of use, safety and environmental impact.

Table 03. ANOVA Table

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	85.749	6	14.292	35.510	0.000[b]
	Residual	158.168	393	0.402		
	Total	243.918	399			
a. Predictors: (Constant), Environmental Impact (EI), Perceived Ease of Use (PEOU), Safety (SAFE)						
b. Dependent Variable: Driverless Public Bus Transport Ridership (DR)						

According to Table 03 for ANOVA analysis, the regression model is statistically significant (R^2 = 0.352, F (6,393) = 35.510, $p < 0.05$). When the p-value is less than 0.05, which means there is a significant difference.

Table 04. Coefficient Table

Model		Unstandardized Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.634	0.421		1.507	0.133
	PEOU	-0.102	0.043	-0.120	-2.358	0.019
	SAFE	0.084	0.045	0.094	1.858	0.064
	EI	0.160	0.048	0.156	3.334	0.001
a. Dependent Variable: Driverless Public Bus Transport Ridership (DR)						

Results show in Coefficient Table (can refer Table 04), suggest that there is a relationship between environmental impact and driverless public bus transport ($\beta = 0.156$, $p < 0.05$), which the environmental impact increased by 1 unit, there will be 0.156 increase in the driverless public bus transport ridership, and we confirmed that this result is consistent to the previous study (Gefen et al., 2000).

Furthermore, the result also shows that there is a relationship between perceived ease of use and driverless public bus transport ($\beta = -0.120$, $p < 0.05$). However, it is a negative relationship, which indicates that the perceived ease of use increased by 1 unit, there will be 0.120 decreases in the driverless public bus transport ridership. This result agreed by Nordhoff et al. (2018), indicated that low rating was obtained for

thinking that driverless vehicles would be more comfortable to use than current transport. Research has shown that perceived usefulness (PU) affects the intended adoption of IT but has mostly failed to do so regarding the perceived ease of use (PEOU) (Gefen et al., 2000). Also, the results show that safety to driverless public bus transport ridership is not significant ($\beta = 0.094$, $p < 0.05$). This result is further supported by past study (Simons, et al., 2013). Simons et al. (2013) point out that the public will not concern on safety issue when they are using the public bus transport for their daily routine. Meanwhile there is no significant relationship between safety (SAFE) and driverless public bus transport ridership (DR).

7. Conclusion

In conclusion, this study aimed to explore the factors that affect the driverless public bus transport ridership in Malaysia, which are including perceived ease of use, environmental impact and safety. This study has achieved the research objectives which are to determine the relationships between (1)perceived ease of use of driverless public bus transport and driverless public bus transport ridership, (2) the environmental impact of driverless public bus transport and driverless public bus transport ridership, (3) the safety of driverless public bus transport and driverless public bus transport ridership. However, there are some limitations along with the research as this study found low awareness and knowledge about the driverless technology among public bus transport users. Thus, recommendations were provided based on limitation, and hopefully, this research can provide useful information and idea for a future researcher on a related topic in order to achieve SDG Goals.

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