

Optimizing Urban Mobility: Assessing the Impact of Selangor's Intelligent Transport System (SITs)

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Abstract. This paper addresses Malaysia's public transport system, primarily managed by small operators in its developing state. Efficient transportation management relies on collaborative information sharing. Systems must provide an easy and effective way to manage staff and registered users, including students and community members. Working passengers require efficient route information to minimize delays. Therefore, systems should cater to all users' needs. Registered users, such as students, also require real-time bus updates to avoid long waits and inform the organization of delays via SMS. Implementing and managing these services collectively presents challenges. Mobile technology, including smartphones and laptops, offers a solution through location-based applications for managing transportation with map navigation. The recent mobile technology revolution has intensified competition among developers, resulting in similar yet distinct applications. Modern transit services now offer virtual access to schedules and advanced features like integration with Google Maps and real-time tracking. Despite benefits, implementing a Smart Transportation Application (STA) with GPS and digital route maps can be daunting and costly for smaller operators.

Keywords: Selangor Intelligent Transport system (SITs), Time, Route Map, Schedule

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1. Introduction

STA stand for Smart Transportation Application. This is a key Internet of Things (IoT) vertical application, refers to the integrated application of modern technologies and management strategies in transportation systems. The function is to provide innovative services relating to different modes of transport and traffic management and enables users to be better informed and make safer and smarter use of transport network, for example are buses operator. Intended for transportation industry, IT professionals and solution providers, this technology overview reviews smart transportation system features and capabilities. It shows how the IoTs will help optimize the movement of people and improving economics, public safety and the environment [1]. STA also explains key criteria for implementing highly scalable, reliable and secure IT systems [2]–[4].

Whereas, GPS stand for Global Positioning System. It develops in 1970s and 1980s by the U.S Department of Defense (DoD) and global navigation satellite system that provides location and time information to a GPS receiver anywhere [5]. The Global Positioning System (GPS) is a satellite-based navigation system made up of at least 24 satellites. GPS works in any weather conditions, anywhere in the world, 24 hours a day, with no subscription fees or setup charges. The GPS receivers use this information to calculate a user's exact location. With distance measurements from a few more satellites, the receiver can determine a user's position and display it electronically to measure your running route, map a golf course, find a way home or adventure anywhere. Potential challenges for STA among bus operators and researches are related to economic feasibility.

As with any other information system, smart card system benefits are difficult to estimate [6]. There is a need to better assess the gains related to fraud reduction, staff reorganization, fare management, and other potential benefits. In terms of the equipment, reducing the cost of the electronic devices making up these systems will help considerably in improving their viability. Another challenges for STA among bus operators and researches are new modeling approaches. For the mass of data available on individual trips, new modeling methods will be needed, such as the totally disaggregate approach, because classical models cannot be used at such detailed level of resolution. The first task is to link appropriate socio-demographic information to the anonymous database (without question, data privacy will continue to be required).

2. Methodology

This study used questionnaire to identify the percentage of respondent's agreement towards the service that provide by bus Selangor. The data will be analyzing by using Statistical Package for Social Science (SPSS). Questionnaire is the most evident method of data collection, which is comprised of a set of questions related to the research problem. This method used because the data are collected from the diverse population. It mainly includes the printed set of open-ended questions, which the respondents are required to answer on the basis of their knowledge and experience with the issue concerned.

Besides, the unstructured interview also conducted to bus operator at the central location as mutually consent by them. Interview also conducted in this study to ask questions about the feasibility of smart transportation application bus operator in Nilai. The primary data collection was collected through various methods like surveys, observations, physical testing, mailed questionnaires, questionnaire filled and sent by enumerators, personal interviews, telephonic interviews, focus groups, case studies and others.

In this study, self-administered questionnaire were applying and distributing to the MyBAS workers, Politeknik Nilai student and residents nearby.

There are total 150 respondents respond and return back the complete set of questionnaires. Generally, the questionnaire is divided into four sections. In section A, questionnaires were focused more on demographic data that were include of age, gender, level of education, experience and position. Respondent was given multiple choice of answer to been chosen. For the next section, questionnaires were included on the variables studied. It was focus on dependent variable. The structure of the questionnaires is carried out in simple English for better understanding of question descriptions to prompt critical thinking and analytical behavior of the respondents. This will encourage higher degree of accuracy in the respondent's answers due to the prevention of confusion in answering the questions given. For sampling technique, this study uses simple random method technique. Simple random sampling is the basic technique where this study selects a group of subjects from larger group. Each individual is chosen entirely by chance and each member of population has an equal chance of being included in the sample to simplify the process of determining the sample size for determinate population.

The data measuring technique used in five-point Likert scale measure with the anchors ranging from strongly disagreed to strongly agree in this study [7]. Data were collected through questionnaires and analyzed according to question quantitatively. Then, the findings compiled and present in a form that is easily can be understood. The results of this research were obtained by analyzing data from statistic descriptive method and calculation of mean. This tool was used to gather data from a majority of the respondents. The simple random method technique was very suitable since it allowed equal representation of the views from entire population. The questionnaires were administered to the concerned people who had been identified as part of the sample population to ensure that many respondents fully participated in the study. The questionnaire had both the close ended and the open-ended questions. In answering the closed-ended questions, the respondents were presented with a multiple-choice answer. This tool was found to be the best way for the researcher since it allowed the researcher to reach out many respondents as possible within the shortest time available. This made the study to be completed within the scheduled time. The respondents were required to express their own thought and fill according to four scales point from the range of strongly agree to strongly disagree based on the given statement.

Table 1 Likert scale

Strongly Disagree	Disagree	Neutral	Agree	Strongly Disagree
1	2	3	4	5

The mean is the average value of the observation or variables and were influenced by extreme values obtained data either in population or sample. This shows the mean average of the number of respondents who gave feedback on the effect of SITs. Hence, the interpretation the range of means were used to see whether the respondents can respond to the question given. In this study, the researcher put into three levels which were low, medium, and high that was done by previous.

Table 2 The levels of agreement were categorized into three groups

Score Mean	Result	Level
1.00 - 2.33	Disagree	Low
2.34 - 3.66	Less agree	Medium
3.67 - 5.00	Agree	High

The data will be analyzed and transfer into the statistical packaging for the Social Science Software (SPSS). The descriptive statistics analysis is conducted as to obtain some general observation about the respondent's background and the knowledge about Smart Transportation Application system. The mean and frequency analysis, on the other hand will be perform in order to predict the effect between the time, schedule and route map on the feasibility of STA among bus operator in Nilai.

2.1. Research Framework

The framework of this paper is constructed between the feasibility of STA that is considered in this paper which is time, schedule and route map among bus operator in Nilai that was constructed based on comprehensive literature review. Figure below presented the research framework model for this paper.

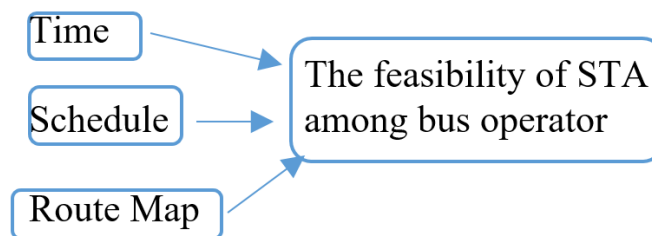


Figure 1. Framework of the feasibility of STA among bus operator in Nilai

3. Results and Analysis

This section describes the analysis of the data followed by a discussion of the research findings. The findings related to the research questions. Data were analyzed to identify, describe and explore the relationship between independent variable and dependent variable. All the data are analyzed by Statistical Packages for the Social Science (SPSS) version 23.0. These questionnaires have divided to two sections which is section A is about background of the respondent and for section B is about the independent variable and dependent variable.

3.1. Reliability Test

Initially, this survey was conducted by using pilot study to determine whether the information or data collected from the instrument were related to the objectives of this study. A pilot study on the instrument can detected and corrected any error in questionnaires before the actual study done. Accordingly, a pilot study to determine the level of reliability of questionnaire was conducted. A pilot study involved collaboration with official staff from Smart Selangor Free Shuttle Bus to distribute sets of questionnaires to passengers. There are 16 respondents were randomly selected. Through this study, the researchers can determine whether respondents had difficulty in answering the questions or not. All respondents were asked to returned the questionnaires when they done completing all the questions. All 16 sets of questionnaires then tested and analyzed using Statistical Package for Social Science (SPSS) version 23.0 to get the alpha value for the study. The purpose of Cronbach Alpha is to access and carried out the reliability of the questionnaires. The questionnaires were tested through Cronbach Alpha method and gets the

value of at least 0.6 (=0.6) showed that the questionnaires are consistent reliability. The reliability of the constructs is being assessed by using.

Cronbach's Alpha values. Table below presents the Cronbach's Alpha test results from the study. As recommended by Peterson (1994), the value is between 0.50 and 0.95 is acceptable.

Table 3 The results of Cronbach's Alpha for Pilot Test

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.789	.792	22

Table 3 above shows the Cronbach's Alpha for each factor for dependent and independent variables. It was proven that the questionnaires were easily understood by the respondents and no item in the questionnaires were dropped. Questionnaires were distributed to the respondent quantitatively in order to collect the information and data. Furthermore, the information and data were collected and transferred to SPSS in order to gain the results of Cronbach's Alpha for pilot test. Based on this pilot test, it can be concluded that the respondents understood those questionnaires and it show that this pilot test is valid and acceptable. The suitable statistical tools were applied in order to achieve the objectives of the study.

3.2. Frequency Analysis

3.2.1. Gender

Different gender has different opinions about various issues. This study tends to find out the views from different gender. The findings are in indicated in table 4. the finding shows 52.5% of the respondents were female and only 47.5% of the respondent male. This implies that more female was using of the SITs.

Table 4 Frequencies and Percentage of Respondent's Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	38	47.5	47.5	47.5
	female	42	52.5	52.5	100.0
	Total	80	100.0	100.0	

3.2.2. Age

The age of the respondent is important in research because people from different age may have varying ideas about certain issues. This study wants to determine age of the respondent and the results are as indicated in table 5.

Table 5 Frequencies and Percentage of Respondent's Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<17	10	12.5	12.5	12.5
	18-25	44	55.0	55.0	67.5
	26-33	18	22.5	22.5	90.0
	34-41	8	10.0	10.0	100.0
	Total	80	100.0	100.0	

Based on the table 5 above, the findings indicate that there is almost equal age distribution. The age between 18–25 years old had the highest number of the respondent with 55%, 26–33 years old had 22.5%, and below 17 years old had 12.5%, while 34–41 years old had 10%. It is shown that the age between 18–25 years old more using the SITs compare to others.

3.2.3. Level of Education

Education level has an impact on how people responded to different opinions. This study sought to establish the education level of the respondent. The findings are indicated in table 6. Based on the table 7 above, the finding shows the level of education SPM reached 55%, Diploma had 31.3%, PMR had 7.5%, while Degree had 6.3%. The total of the percent will be 100%. The result show that, respondents who had SPM level achieve high percent and it shown that this group of residents had always use the buses.

Table 6 Frequencies and Percentage of Respondent's Level of Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	PMR	6	7.5	7.5	7.5
	SPM	44	55.0	55.0	62.5
	Diploma	25	31.3	31.3	93.8
	Degree	5	6.3	6.3	100.0
	Total	80	100.0	100.0	

3.2.4. Marital Status

The findings about marital status are indicated in table 7. Based on the table 8 below, the finding shows that respondent who has not married reached a high of frequency with 81.3% from 65 respondents always using the bus (SITs) compare with married respondent.

Table 7 Frequencies and Percentage of Respondent's Marital Status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Single	65	81.3	81.3	81.3
	Married	15	18.8	18.8	100.0
	Total	80	100.0	100.0	

3.2.5. Frequency of Using Bus Service

Next, the questionnaire regarding the frequency of using SITS is used to collect the data about the frequent of time the passenger (respondents) spend for bus service whether daily, weekly, monthly or annually. The findings are indicated in table 8. According the table 8 above, the finding indicates that 41 respondents use the bus every single day, followed by monthly 22 respondents, weekly 12 respondents and lastly annually is 5 respondents. It shown that there are many people using the SITS daily that represented of 51.3%.

Table 8 Frequencies and Percentage of Respondents of using bus service

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Daily	41	51.3	51.3	51.3
	Weekly	12	15.0	15.0	66.3
	Monthly	22	27.5	27.5	93.8
	Annually	5	6.3	6.3	100.0
	Total	80	100.0	100.0	

3.2.6. Purpose of using SITS

The question regarding the purpose of using SITS is to discover the kinds of benefit of the bus to passengers around. The findings are indicated in table 9.

Table 9 Frequencies and Percentage of purpose using SITS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	School	5	6.3	6.3	6.3
	Travel	1	1.3	1.3	7.5
	Working	32	40.0	40.0	47.5
	Sightseeing	33	41.3	41.3	88.8
	Others	9	11.3	11.3	100.0
	Total	80	100.0	100.0	

According the table 9 above, the finding indicates that the purpose of using SITS is more to the sight-seeing 41.3% and working 40%, to go to school 6.3%, and only 1% using this system of transportation for the travel. The respondents those using the bus for working and sightseeing because might want to avoid traffic jammed, toll charges and others.

3.2.7. Another Purpose of using SITS

Based on the table 10 below, some of respondents using the SITS to go back to their hometown (village) 1.3%, an emergency case 1.3% and for important business 1.3%, meet oldest friend 1.3%, visit family 1.3%, going to ERL 2.5% and attend to tuition class 2.5%. This is a few of reason and purpose why some of respondents using the bus services (SITS).

Table 10 Frequencies and Percentage of purpose using SITS for others

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		71	88.8	88.8	88.8
	Back to Village	1	1.3	1.3	90.0
	Emergency	1	1.3	1.3	91.3
	ERL	2	2.5	2.5	93.8
	Important Business	1	1.3	1.3	95.0
	Meet Oldest Friend	1	1.3	1.3	96.3
	Tuition	2	2.5	2.5	98.8
	Visit Family	1	1.3	1.3	100.0
	Total	80	100.0	100.0	

The questions in demographic section were used to obtain the respondents data regarding the respondent's knowledge about Selangor Intelligent Transport System, gender, age, marital status, level of education, frequency of using bus service and purpose of using SITS. The information is required to get an accurate statistic of the right respondent. This general information of the respondent for this study was showed in table 10 and all of respondent give a good response. The percentage of the questionnaires that were returned back is 53.33% with a full marking from respondents. The table below explain the number of the respondent for this study.

Table 11 The Number of Respondent and Percentage

Number of Respondents		Percentage%
Questionnaires that were distributed	Questionnaires that were returned	53.33%
150	80	

3.3. Descriptive Analysis

3.3.1. Analysis of Dependent Variables

A total of 16 questions for all variables were given to respondent regarding the effect of SITS.

Table 12 Analysis of the Selangor Intelligent Transportation System

Variable	No	Question	Mean	Level
Selangor Intelligent Transportation System	1	The application of SITS can get a benefit from passenger because it will enable them to plan their bus journey better and reduce time	4.09	High
	2	The privilege of SITS application makes it easy to travel because it has set itinerary. at the same time, people can plan their trips by making initial arrangements	4.10	High
	3	SITS has a bus route across Selangor. it has many facilities like no need to pay fares and also have WI-FI	4.38	High
	4	SITS has routes in every remote area it is easy for user movement	4.33	High

The table 12 shows that the mean of dependent variables which is the effectiveness of SITS. All the questions were shared the same level which is high. The highest mean results are 4.38. Whereas, the lowest mean is 4.09.

3.3.2. Analysis of Independent Variables for Time

Table 13 Analysis of for Time (IV1)

Variables	No	Question	Mean	Level
TIME	1	The time table displayed is very accurate for user	4.30	High
	2	Timeliness can reduce the waste of time	4.33	High
	3	Proper selection of time can prevent undesirable problems	4.54	High
	4	Time allocated for a bus trip to its passengers is appropriate	4.46	High

According to the table 13 shows the independent variables in section B which is about the time effect of SITs. the descriptive statistic shows that the total number of mean for time is 4.41 with the number of respondents is 80. Based on the questionnaires above, the results of time displayed is very accurate for user. That is because the most of respondent agrees and using public transport especially bus SITs. The respondent known that when they are using the SITS service it can reduce daily timeliness. Most of respondent in Selangor chooses this bus because of the statement given. Besides that, SITs show that the proper selection of time can prevent undesirable problems. This statement gained the highest mean for 4.54 and it proven that respondents agree with the benefit when using the SITs. Last but not least, the time allocated for a bus trip to its passengers is 4.46 which is the second highest mean and appropriate gained. It can reduce waiting time and prevent undesirable issues such as kidnapping, pick pocketing, and others.

3.3.3. Analysis Independent Variable for Route

Table 14 Analysis for Route (IV2)

Variables	No	Question	Mean	Level
ROUTE	1	The information provided very clear for looking the public transportation routes	4.48	High
	2	The language provided easy to understand	4.26	High
	3	Easy to get about a map of the bus route	4.46	High
	4	Easy to get the bus at right time	4.59	High

Based on the table 14 shows the independent variables in section b about the route. The descriptive statistic shows that the total number of mean for route is 4.44 while the number of respondents is 80. The identity of the SITs is respondent would get the information provided very clear for looking the public transportation routes and it became reasons why of the respondent using of SITs. The entire respondent absolutely had an app that will help them to take out the bus. Besides that, the route provided by the apps is the language that easy to understand by the passengers. The route can be understood from level of age. Next, the SITs provide a benefit in term of the facilities to get a map of the bus route correctly without any arrows. This is a highest mean 4.59. Last but not least, SITs always provide an easy system to get the bus at right time and the right location for the right passengers.

3.3.4. Analysis Independent Variable for Schedule

Table 15 Analysis for Schedule (IV3)

Variables	No	Question	Mean	Level
SCHEDULE	1	The schedule displayed is very accurate for user	4.33	High
	2	The daily trip set by bus is exactly same as the scheduled given	4.04	High
	3	Easier for users to understand the scheduled set by the bus	4.21	High
	4	The transit schedule of the bus is safe	4.41	High

According to the table 14 shows the independent variables in section b about the schedule. The descriptive statistic shows that the total number of mean for this independent variable is 4.24 with the number of respondents is 80. The second highest mean is 4.33. The schedule displayed from SITs is very accurate for passengers and the indicate respondents basically an agreed from this statement. It will reduce a lead time and can cut cost. Secondly, the daily trip set by bus is exactly same as the scheduled given at it called official scheduled. Mostly, the passengers understand the scheduled given and they believe on SITs whenever they pick up the passengers and the bus will be transit at the safe place.

4. Conclusion

The comprehensive analysis of data collected through questionnaires and interviews reveals a high level of agreement among respondents regarding the effectiveness and reliability of Smart Transportation Applications (STA) among bus operators in Selangor Intelligent Transport System (SITs). Features such as accurate time tables, clear route information, and facilities like Wi-Fi are perceived positively, indicating a strong acceptance and adoption of STA among bus users. Despite acknowledging challenges such as economic feasibility and the need for new modeling approaches, stakeholders are optimistic about the potential of STA to enhance the efficiency, reliability, and user experience of public transportation systems in the region. The reliability test conducted on the data collection instruments further strengthens the credibility of the findings, suggesting that STA holds promise for transforming the transportation landscape in Selangor Intelligent Transport System (SITs) by addressing key issues and improving overall accessibility and convenience for passengers.

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