

# Mobile User Perception Factors for Express Bus Safety Journey Management System: A Survey Analysis

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**Abstract**— Public transportation represents a higher danger of safety and security as there happen to be more travellers in a single vehicle. In Malaysia, bus accident is the highest that occurred to death. Internet of Things (IoT) has expanded the utilization of 4IR for investigation and research. A 4IR mobile technology app for express bus safety and security system in Malaysia for bus user is suggested and required. It is important to identify the main factors that can be collected via the mobile app before the app is developed. Passenger perception on the used and relevancy of using information technology (IT) tools to increase their safety perception is also required. This information will give the developer an insight on the app usability. In this paper, observation from passengers regarded safety and security factors are gathered and investigated by utilizing the IT and non-IT related issue. From the survey, majority respondent agree with all seven IT related issues (at least 70%) and all eight non-IT related issues (at least 80%). This is important to understand the mobile user perceptions and provides safety to the passengers. From these factors, we proposed a conceptual framework for express bus safety journey management system to be developed in the future. Future speculation by enhancing existing express transport arrangement with varies variable information, for example, waiting time, unwavering quality and travel time. This information can positively affect the nature of express transport administrations. Gathered information is stored in the cloud. The express bus management can collect the information from the cloud to enhance safety and security of bus express.

**Keywords**— express bus; 4IR; cloud; mobile user perception.

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## I. INTRODUCTION

Safety is the condition of being "sheltered", the state of being safeguarded from hurt or other non-advisable results. This study related to the public transportation and it also represents a high degree of danger and security because there are more travellers using public transportation compared to using single vehicle. The issue turns out to be more terrible in developing nations, in view of the absence of appropriate and incorporated methodologies. As per statistics it showed that bus accident is the highest that occurred to death in Malaysia. The aims of this research is to identify, investigate and analysed the impression of safety plus security issues with regards to express bus journey in Malaysia. This work is utilized as a base to build up a motivation change for the specific context in developing nations [1].

Early planning of the changes includes inventing a mobile app for bus user to ensure the safety of the passengers. The entities need to be considered when designing the mobile application are bus passenger, bus driver and transport administrations. Also, the most imperative thing in building this application is the state of the variable in the decision-making process for the mobile app to be utilized by the express transport administrations.

Future speculation by enhancing existing express transport arrangement with variable information, for example, waiting time, unwavering quality and travel time. This information can positively affect the nature of express bus administrations. Where this information will be received continuously and will be stored in the internet cloud. Figure 1 shows the management system development of express bus. Other than that, express bus safety also contributes to customer satisfaction [2]. Hence, the investigation of this study should be checked on.

Numerous street accidents include express bus that reason transport travel time. It is postponed additionally to cause traffic jam. Things to assume the enormous part in this is the attitude and driving strategy of transport driver ignorance. In addition, the terms of the motor and the tire should be considered, and additionally uneven and hollow street conditions can be one reason for the circumstance street accidents.

The main objective of this study is to find out the main factor affects the safety and security of express bus in Malaysia. As per statistics it showed that bus accident is the highest that occurred to death in Malaysia. To suggest and design the prototype for the users that is related to the Fourth Industrial Revolution (4IR) mobile technology App for express bus safety and security system in Malaysia. This study will identify and investigate about the impression regarding the security and protection issue with respect to those gatherings engaged with the activity of express bus. This perception is utilized as a base to build up a change motivation for Malaysia. The user impression data was gathered via survey and have been analysed. User necessity investigation will likewise be directed to decide remarkable factors included.

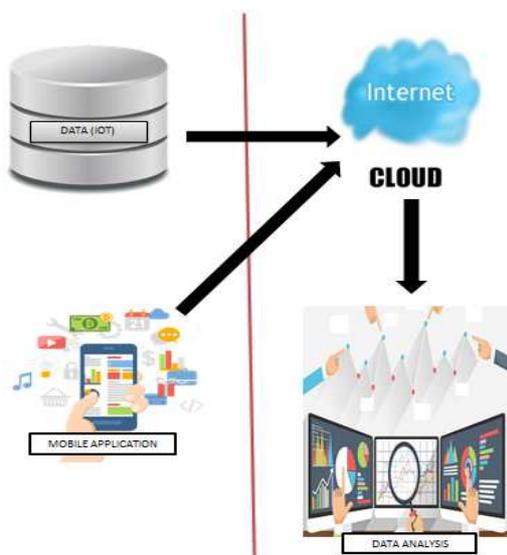


Fig. 1 Management System of Express Bus.

## II. MATERIAL AND METHOD

Due to the rapid development of mobile devices and mobile internet usage, users can access to browse information anytime, anywhere. A mobile user usually has at least a mobile device, such as a smartphone or tablet that allows the user to interact with the device's apps, features, content and functions [3]. Mobile users in Malaysia are including passenger, driver, public, law enforcer and many more. To identify the lack in the public transport management system, factors that related with traffic accidents involving bus express has been discussed in the following section.

### A. Passenger Perception of Safety and Security

Factor for passenger perception of safety and security are firstly, reason of passenger still using public transport, because it is safe and secure, and is available everywhere. Plus, it is also difficult to hear of any accident related to the public transport. Secondly, one of the reason is the bad safety that related to the low awareness from the users, driver, lack of law enforcement and condition of the car that is not fulfil the minimum standard regulations. Thirdly, the entire chain network that in the safety related to the safety transport operation is users, local authority, police enforcement, public (car owner and public driver) and Bureau of Traffic and Road Transport. These party will ensure the road, bus, driver and passenger condition are at best. This will ensure the bus journey will be smooth and safe when all party play their role excellently. Fourth one is related to the continuous changes from many aspect that can enhance safety to public transport operation. This can be done by emphasizing and embedding safety education for users and driver, increase the quality of car and strengthen law enforcement. Lastly, to increase public transport security, the main reason that need to take into account is the improvement of transportation quality, install telecommunication tools and devices plus add more police/security officers. The passenger will feel safe if the transportation is in a good quality condition, installed communication device in the bus will give them opportunity to always share location and messaging with families. In addition, more police or security officers will make they feel secured from crimes and unethical driving attitudes [1].

### B. Driver Perception of Safety and Security

Factor for driver perception of safety and security are firstly, the accident mainly caused by other drivers' behaviour in traffic, the pedestrian's presence on the road, low quality of the car, health issue problems and restricted human capacity. In addition, low law enforcement, low user awareness, and low education by government agencies. The most responsible party involved in managing safety in public transport operation is passengers, bureau of traffic and road transport, police, local government and operator (owner and driver). Thus, to improve safety in public transport is to increase drivers skills and knowledge by conducting training sessions in driving skills and knowledge, improving car standard of quality, improving law enforcement and conducting safety education for the user [1]. [1]. Lastly, first thing to do when experiencing an accident (based on others drivers' experience) is help the passengers and drivers, do nothing, go to the police station.

### C. Vehicle Health

Bus condition is another main factor that cause accident. The bus condition review report should include the tire, windscreen, light, corresponding sticker or document and the driver seat. For example, the tires condition should not be worn, treads at the very least 1mm, no profound splits or sidewall damage, strain to be set apart over the wheel curve. Spare tires are two on light vehicles, one on trucks and transports. The windscreen and mirrors are to be perfect, no genuine splits, vision obstacle. Head/raise and brake lights are altogether working (full and beam). High intensity rear

lights should obvious and in working condition. Driving license is not lapsed and suitable to the vehicle driven. Vehicle examination sticker is not lapsed or affirmed by contractor. Speed limiter is required for vehicles; capacity between 80 to 100km. Seats that should follow driver's customization, others secure with no internal confronting or collapsing seats. General vehicle substance such as jack, medical aid unit, water, no stowage of merchandise or gear in traveller compartment should be keep in proper place [4].

#### D. Driver's Health

Driver's Health factors, which are bus driver's everyday working conditions are challenging. There are few causes affect the driver health condition such as the absence of driver ergonomics for driver seat, plenty of secondary duties, high psychological load, stress caused by factors out of their control (clogs, cooperation with travellers and so on.), risk of threats and violence can happen. Driving the bus is a somewhat low status work, shift work should be split and shift is normal, working alone, physical wellbeing should keep monitoring to avoid the accidents. There are four classification of morbidity that are common to the bus driver such as cardiovascular illnesses (heart and so forth.); Gastrointestinal scatters (stomach and so forth) musculoskeletal issues and fatigue [5]. The nature of the job exposes the express bus driver with long hours, fatigue, noise, vibration obesity and sleep apnea [6]. Obstructive sleep apnea (OSA) has been identified as one of the significant risk factors for motor vehicle crashes (MVCs) [7].

#### E. Bus Factors

In this research, transport factors were just constrained to the kind of transports and number of drivers. The kind of transport monitored is single deck express bus and double deck express bus. The number of driver that led to the factor is either the express bus with one driver or two drivers. Speeding violation between the two kinds of transports and the quantity of driver were not fundamentally extraordinary. Speeding violation was more pervasive regardless to the sort of transport or the quantity of driver [11].

#### F. Bus Journey Factors

Table 1 demonstrates that the dominant part of adventures was made during weekdays (61.5%). Be that as it may, there was no huge distinction as far as speeding violation amongst weekday and end of the week ventures. Speeding was habitually seen during night journey contrasted with the day time, as transport drivers were 2.5 times more probably to drive above speed limit. Besides, 50 out of 270 transports deferred their leave-taking. Nonetheless, deferred take-off did not fundamentally affect speeding conduct among the drivers [11].

#### G. Driver's Performance Factors

The research that related to the safety based on driver perspectives depends on the

Research on safety related driver conduct depends on the reasonable structure that there are numerous elements that influence the driver's execution. Poor driver execution may affect a higher danger of accident hazard. For this situation, some driver execution factors are examined whether they

have provided to the impact of crushes. Driver factor variables incorporate speed, stamina, well-being, and training and driver capability. Driver's factor comprises of five factors, to be specific: speed, stamina, wellbeing, training and capability. The factors are divided into two classes. The primary classification is a condition identified with accident avoidance and the second class is a mischance trigger. Accordingly, the components that reason mishaps are affected by weakness conditions, undisciplined, and inadequacy of the driver [12].

Table 2 indicates the factors, its strength, weakness and the opinion/suggestions that will help to create framework of the public bus management.

TABLE I  
JOURNEY FACTORS AFFECTING SPEEDING AMONG TRANSPORT DRIVERS  
(DATA FROM [11])

| Factors                | Total (%)<br>(n=270) | Speeding    |      |            |      | Odd<br>Ratio | P-<br>value |
|------------------------|----------------------|-------------|------|------------|------|--------------|-------------|
|                        |                      | Yes (n=160) |      | No (n=110) |      |              |             |
|                        |                      | n           | %    | n          | %    |              |             |
| <b>Week</b>            |                      |             |      |            |      |              |             |
| Weekday                | 166 (61.5)           | 102         | 63.8 | 64         | 58.2 | 1.26         | 0.356       |
| Weekend                | 104 (38.5)           | 58          | 36.3 | 46         | 41.8 |              |             |
| <b>Time of the day</b> |                      |             |      |            |      |              |             |
| Daytime                | 221 (81.9)           | 123         | 76.9 | 98         | 89.1 | 2.46         | 0.01        |
| Night-time             | 49 (18.1)            | 37          | 23.1 | 12         | 10.9 |              |             |
| <b>Delay</b>           |                      |             |      |            |      |              |             |
| Yes                    | 50 (19.7)            | 31          | 20.5 | 19         | 18.4 | 1.14         | 0.682       |
| No                     | 204 (80.3)           | 120         | 79.5 | 84         | 81.6 |              |             |

#### H. Law Enforcement

In Malaysia, there are several laws that related to the road safety such as (a) Land and Public Transport Act 2010, (b) Commercial Vehicle Licensing Board Act 1987 (c) Commercial Vehicle Licensing Board Amendment Act 2010 and (d) *Suruhanjaya Pengangkutan Awam Darat 2010* (SPAD). The roles of law here is to provide guideline and protection for the driver, passengers and bus company from any accidents occurs via enforcement of law and regulations. Under the law, the government officers such as police and SPAD officers have been given power to arresting offenders and setting up blocks.

TABLE II  
THE STRENGTH, WEAKNESS AND OPINION/SUGGESTION OF THE FACTORS

| Factors                                     | Strength   | Weakness   | Opinion/Suggestion  |
|---|--|--|---|
| Passenger Perception of Safety and Security | Availability of police or security officers is ways to overcome the security problems.                           | The improvement of technology, management, and institutions.                         | To improve passenger knowledge, which will create better traffic behaviour. |
| Driver Perception of Safety and Security    | Driver needs to be train and provide with information about how to operate the public transportation in safe and | Limitation of resources allocated for public transportation in developing countries. | Improving safety and security can be reached by training and education.     |

|                             |  |  |  |
|-----------------------------|--|--|--|
|                             | secure ways.   |  |  |
| Vehicle Health              | Authority should review the report of the Bus condition.                             | Maintenance and improvement or replacement of roads is an ongoing major challenge. | Old model and neglected buses should be rejected due to avoid the accidents.     |
| Driver's Health             | Data analysis about the driver sleepiness and performance.                           | Driver's fatigue and the stress are the major problem of the driver.               | Split shift working should provide to the drivers to get rid of the problems.    |
| Bus Factors                 | Drivers of larger bus felt better protected compared to drivers of smaller vehicles. | Speed violations for buses with dual drivers were higher to single driven buses.   | One driver is better than the dual driver to avoid the accident.                 |
| Bus Journey Factors         | During the daytime had significant correlation with speeding.                        | During night time drivers are to display risky behaviour including speeding.       | Drivers should follow the speed limit during the day and night time.             |
| Driver's Performance Factor | Accidents are associated with speed, stamina, health, and competence.                | Not good enough to control the vehicle, poor health and less competent.            | Driver should be skilled and well behaved towards passengers and road situation. |

As stated in *Akta Suruhanjaya Pengangkutan Awam Darat 2010*, penalties for offences such as breaches of licensing conditions where the maximum fines are RM 500,000 and imprisonments of 2 years. However, there are still unclear jurisdiction regarding law enforcement in Malaysia for express bus in determining the duties and job scopes and liabilities that give difficulties for public especially passengers in managing their rights. Hence, there should be a good management system for express bus to prevent and commuting accidents based on the clear guidelines.

To confirm the significant factors gathered in the literature, we conduct a survey from bus user. In the survey we focus on passenger perception on bus express journey safety and security. Selected significant factors from the literature were used since not all factors relevant to be perception factors of passengers. We apply two level sampling techniques. In the first level, we apply cluster sampling while in the second level, we apply random sampling technique. Thirty respondents with experience of travelling with express bus in Malaysia were chose.

We construct a questionnaire on the IT related issue and non IT related issue that relevant to safety and secured journey. The questionnaire applies the five point likert scale format; i.e. Strongly disagree = 1, Disagree = 2, Not sure = 3, Agree = 4 and Strongly agree = 5.

### I. Other Factors

Factors that increase risk on the road while driving are, tired or drowsy, drinking, following in front vehicle too close, high speeding, taking medicines, consuming drugs and using a mobile phone (hand held or hands-free). In addition, poor road infrastructure and traffic light, un-control traffic

congestion, bad weather conditions, poor vehicle maintenance such as brakes/brake failure, bad tyres condition, unfunction steering, lack of seat belt, defective horns, wind shield (poor visibility), absence of rear view [8][9] and other mechanical failure. Furthermore, Impatience of road users and children playing on the road can also cause accidents.

## III. RESULTS AND DISCUSSION

The respondent opinion on IT and non-IT related questions that relevance to safety journey was analysed via statistic descriptive approach since ordinal data involved. The purpose is to discover the factors that will be included to prevent bus accidents based on the respondents' opinion.

### A. IT Related Issue Contribute to Safety Journey

First statement was intelligent transportation system (ITS) technologies are important to increase safety in a journey using express bus. From the 30 respondents, 19 respondents (63.3%) are agreed and 9 respondents (30%) are strongly agreed whereas only 2 (6.7%) respondents are not sure about this statement. Figure 2 shows the percentage of the first statement of IT related issue.

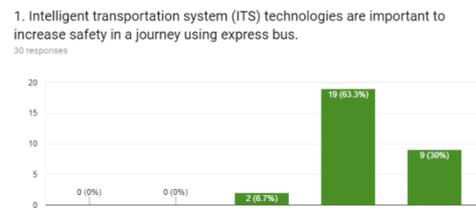


Fig. 2 User opinion on the relevancy of Intelligent transport System technologies to increase safety perception

Second statement was a Journey Planner service/app (JPS) allows users to plan their journeys online. From the 30 respondents, 18 respondents (60%) are agreed and 8 respondents (26.7%) are strongly agreed whereas only 4 (13.3%) respondents are not sure about this statement. Figure 3 shows the percentage of the second statement of IT related issue.

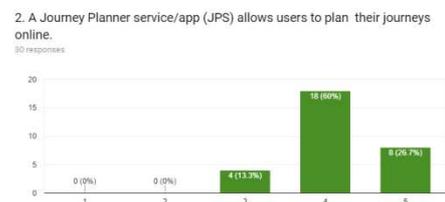


Fig. 3 User opinion on the relevancy of Journey Planner Application to increase safety perception

Third statement was using any GPS mobile application is convenient to check the length of time to reach the destination. From the 30 respondents, 14 respondents (46.7%) are agreed and 14 respondents (46.7%) are strongly agreed whereas only 1 (3.3%) respondents are not sure and only 1 (3.3%) respondent is disagree about this statement. Figure 4

shows the percentage of the third statement of IT related issue.

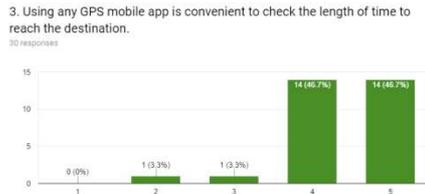


Fig. 4 User opinion on the relevancy of GPS based mobile application to increase safety perception

Fourth statement was eCall application helps to request rapid assistance when we got into an accident. Using it will increase my journey safety. From the 30 respondents, 14 respondents (46.7%) are agreed and 7 respondents (23.7%) are strongly agreed and 7 (23.3%) respondents are not sure, whereas only 1 (3.3%) respondent is disagree and only 1 (3.3%) respondent is strongly disagree about this statement. Figure 5 shows the percentage of the fourth statement of IT related issue.

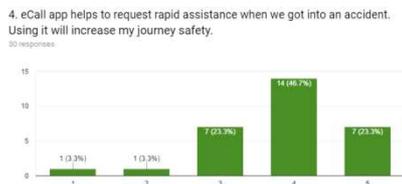


Fig. 5 User opinion on the relevancy of eCall application to increase safety perception

Fifth statement was using marker scanning (QR Code) provide easy access to bus information online. I think users will install it. From the 30 respondents, 18 respondents (60%) are agreed and 5 respondents (16.7%) are strongly agreed whereas only 4 (13.3%) respondents are not sure and only 3 (10%) respondent is disagree about this statement. Figure 6 shows the percentage of the fifth statement of IT related issue.



Fig. 6 User opinion on the relevancy of bus information easy access to increase safety perception

Sixth statement was sharing my location (real - time) with my family will increase my journey safety; I think users will install it. From the 30 respondents, 14 respondents (46.7%) are strongly agreed and 12 respondents (40%) are agreed and whereas only 4 (13.3%) respondents are not sure about this statement. Figure 7 shows the percentage of the sixth statement of IT related issue.

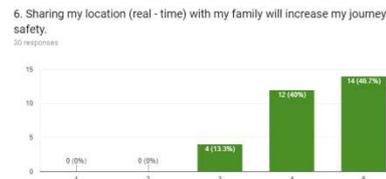


Fig. 7 User opinion on the relevancy of sharing location with family to increase safety perception

Seventh statement was public transport should provide Wi-Fi. From the 30 respondents, 21 respondents (70%) are strongly agreed and 5 respondents (16.7%) are agreed and whereas only 2 (6.7%) respondents are not sure, only 1 (3.3%) respondent is disagree and only 1 (3.3%) respondent is strongly disagree about this statement. Figure 8 shows the percentage of the seventh statement of IT related issue.

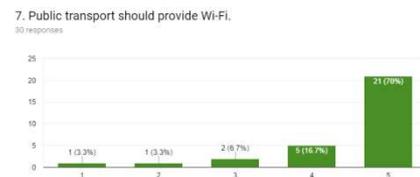


Fig. 8 User opinion on the relevancy of WiFi to increase safety perception

### B. Non IT Related Issue That Contribute to Bus Accident

First statement was the road condition is affecting the driver while driving. From the 30 respondents, 18 respondents (60%) are strongly agreed and 11 respondents (36.7%) are agreed whereas only 1 (3.3%) respondents are disagreed about this statement. Figure 9 shows the percentage of the first statement of non IT related issue.

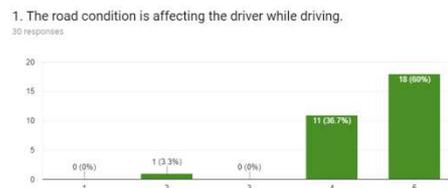


Fig. 9 User opinion on the road condition causing accident perception

Second statement was malfunction traffic light will cause accident. From the 30 respondents, 15 respondents (50%) are agreed and 14 respondents (46.7%) are strongly agreed whereas only 1 (3.3%) respondents are not sure about this statement. Figure 10 shows the percentage of the second statement of non IT related issue.

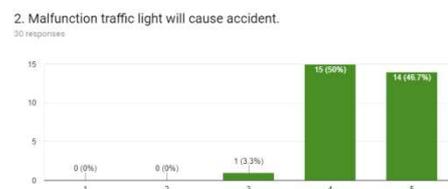


Fig. 10 User opinion on the traffic light condition causing accident perception

Third statement was driver always uses emergency brake will cause accident. From the 30 respondents, 13 respondents (43.3%) are agreed and 11 respondents (36.7%) are strongly agreed whereas 4 (13.3%) respondents are not sure and only 2 (6.7%) respondent is disagreed about this statement. Figure 11 shows the percentage of the third statement of non IT related issue.

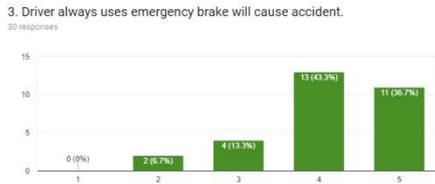


Fig. 11 User opinion on using emergency brake causing accident perception

Fourth statement was driver overtakes dangerously will cause accident. From the 30 respondents, 16 respondents (53.3%) are agreed and 13 respondents (43.3%) are strongly agreed whereas only 1 (3.3%) respondents are not sure about this statement. Figure 12 shows the percentage of the fourth statement of non IT related issue.

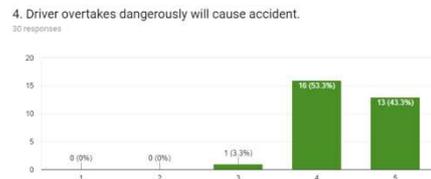


Fig. 12 User opinion on overtaking dangerously causing accident perception

Fifth statement was driver use the phone while driving will cause accident. From the 30 respondents, 16 respondents (53.3%) are strongly agreed and 12 respondents (40%) are agreed whereas only 1 (3.3%) respondent is not sure and only 1 (3.3%) respondent is strongly disagreed about this statement. Figure 13 shows the percentage of the fifth statement of non IT related issue.

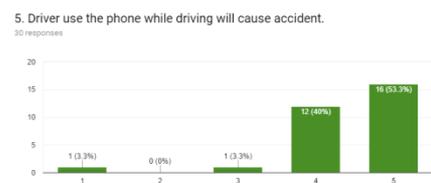


Fig. 13 User opinion on using phone while driving causing accident perception

Sixth statement was driver follows the vehicle in front too closely will cause accident. From the 30 respondents, 15 respondents (50%) are strongly agreed and 14 respondents (46.7%) are agreed whereas only 1 (3.3%) respondents are not sure about this statement. Figure 14 shows the percentage of the sixth statement of non IT related issue.

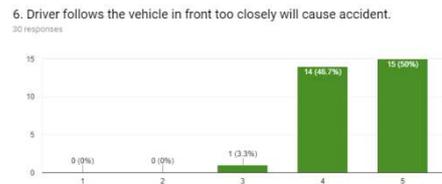


Fig. 14 User opinion on following front car too closely causing accident perception

Seventh statement was driver changes the line frequently will cause accident. From the 30 respondents, 12 respondents (40%) are strongly agreed and 12 respondents (40%) are agreed whereas 5 (16.7%) respondent is not sure and only 1 (3.3%) respondent is disagreed about this statement. Figure 15 shows the percentage of the seventh statement of non IT related issue.

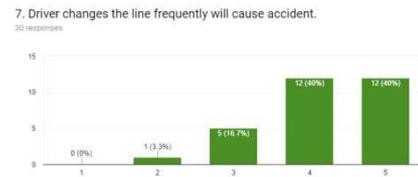


Fig. 15 User opinion on driver changing line frequently causing accident perception

Eighth statement was driver fails to follow traffic light will cause accident. From the 30 respondents, 17 respondents (56.7%) are strongly agreed and 12 respondents (40%) are agreed whereas only 1 (3.3%) respondents are not sure about this statement. Figure 16 shows the percentage of the eighth statement of non IT related issue.

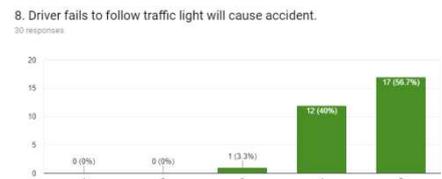


Fig. 16 User opinion on failing to follow traffic light causing accident perception

The survey results show that most of the respondents believes that all statements which is IT and non IT related that can save the passengers and also lead to the bus accidents. These non IT factors are easy to measure by passengers and could be used to predict accidents. The IT technology shall be used to aid the prediction of accident and increase safety perception to bus passenger. More specifically, in all the statements with the prevention of level of accidents and give more safety to the passengers, it can be concluded as IT related issues and Non IT related issues.

IT related issues:

- I. Intelligent transportation system (ITS) technologies are important to increase safety in a journey using express bus.
- II. A Journey Planner service/app (JPS) allows users to plan their journeys online.
- III. Using any GPS mobile app is convenient to check the length of time to reach the destination.
- IV. eCall app helps to request rapid assistance when we got into an accident. Using it will increase my journey safety.
- V. Using marker scanning (QR Code) provides easy access to bus information online. I think users will install it.
- VI. Sharing my location (real - time) with my family will increase my journey safety.
- VII. Public transport should provide Wi-Fi.

Non IT related issues;

- I. The road condition is affecting the driver while driving.
- II. Malfunction traffic light will cause accident.
- III. Driver always uses emergency brake will cause accident.
- IV. Driver overtakes dangerously will cause accident.
- V. Driver use the phone while driving will cause accident.
- VI. Driver follows the vehicle in front too closely will cause accident.
- VII. Driver changes the line frequently will cause accident.
- VIII. Driver fails to follow traffic light will cause accident.

Based on the survey results, improvements can be made to current systems to accommodate passengers with better safety applying IT technology to monitor and predict the safety of express bus journey. A possible design of the conceptual framework is proposed here. Figure 17 illustrates the proposed conceptual framework for passenger's safety and accidents perception.

#### IV. CONCLUSION

This study has been observed some reliable factors related to safety on express bus in Malaysia. Quality factors for the public transport are politeness of driver, expertise of drive, considerateness of driver, keeping of order and driving style [10]. What's more the effect of different statistic information on IT and non IT related issues, has been explored. Based on these findings, a conceptual framework is created for passengers' safety on the express bus in Malaysia. Later, we will continue our research by validating this framework with experts and relevant authorities. Then, we will construct a mobile application to gather information based on this framework in real time for monitoring and prediction purposes.

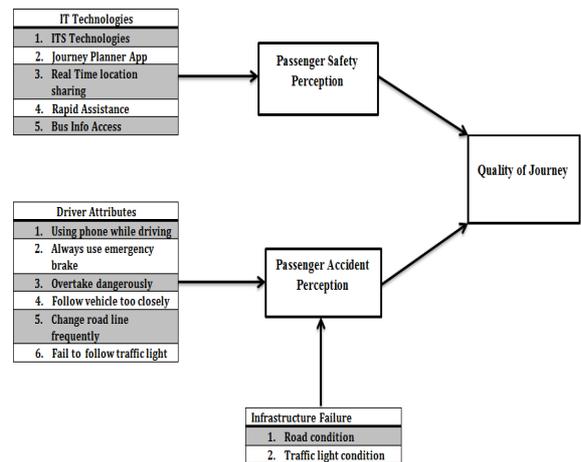


Fig. 17 Proposed conceptual frameworks for passenger safety and accident perception

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