Mobile Time Tracker in Transportation Service: A Survey

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Abstract: Bus delay in transportation service is a common issue to be addressed. This issue is verified in a preliminary study conducted earlier among the bus riders. With the proliferation of mobile technology particularly in mobile application development, transportation service providertoday is able to address delay issue usingmobile application. In this study, a GPS based mobile application (App) is proposedto estimatetime arrival (ETA) of buses and an user acceptance test is used to verify the usability of the App. 76 bus riders have completed bus App testing and follow by a survey. The overall results show mobile time tracker is usable and able to solve issue of bus delay and reduce long waiting time. In future work, mobile time trackers associate with other ETA prediction models will be explored and issues such as ETA accuracy will also be addressed.

Keywords:mobile technology, smartphones, technology acceptance test, global positioning system

1. Introduction

With the rise of mobile technology in the modern world, smartphones have become the must have device in the household. According to Statista.com (Statista, 2020), the statistics shown number of smartphones users in the world has pass three billions today. Nowadays, smartphones are not only used for communication, they are being used for providing direction through global positioning system (GPS), internet surfing, take photos, play music, play game, keep track of appointments and contacts and many more. Furthermore, software applications designed to run on smartphones (in short 'App') are expanding fast and already included scientific application. Mobile App such as MyTaxi and Grab have eased the life of passengers as it is able to engage Taxi service and also tracking the location of Taxi using GPS. It helps users in reducing time and efforts when engaging with public transport services.

Based on the preliminary study it is found that passengers prefer to use smartphones to perform their routine operations such as tracking location of public transport using smartphones. The statistics show that 95% of the respondents are regular shuttle bus passengers (or riders). Among them, 58% of the respondents have issues on arrival time of shuttle bus. The most notable statistics from the survey is that 75% students have stressed the fact waiting time for buses could be as long as one hour waiting at the bus stop. The respondents indicated their frustration in the survey as they faced difficulties in planning their journey effectively (Chit et al., 2017; Lee et al., 2016;Hussain et al., 2017; Thong et al., 2016 and Thong et al. 2019). The issue raised by the riders in the preliminary study will be addressed in this paper using mobile time tracker.Besides, this study also explores prediction models that associate with mobile time trackers App.

2. Literature Review

There are numerous mobile time trackerApp in transportation service and theyprovide services for long distance and short distance journey. Some of the popular App used by riders are GrabCar and Grabtaxi. Grab is theprominent ride-hailing platform for taxi booking, car hiring and car pooling in Southeast Asia's (Grab, 2018; Hussain et al., 2018) and it appears as one of the most popular public transits being used in Malaysia especially when the passenger is in rush and heading to a place where other public transits are not available. Grab Malaysia offers multiple services such as MyTeksi, GrabCar, GrabShare, JustGrab and GrabFood. Riders are given options to choose among these services which match their needs and budget. The operations of Grab App is rather simple where riders will have to install the app into their mobile phone and they will be able to book a ride afterward with just two simple steps: (i) fill in the desired location and get the nearest driver and, (ii) track the driver in real-time until getting onboard. While tracking the current location of the driver, there is a real-time location tracking map shown on the mobile screen together with driver's information such as photo of the driver, car plate number, description of the vehicle, estimated fare, and rating of the driver. Riders are able to contact through message the driver for extra information or make a direct call to the driver with just a single click.

EzCab is Malaysia e-hailing mobile App which covers Kuala Lumpur, Klang Valley area, Penang, Perak, Seremban, Johor Bahru, Melaka and Sabah (Ezcab, 2018). Riders are able to choose among five services provided by EzCab such as EzGO (Fixed fare), TOYOTA Luxury, Budget Service (by meter), Executive service and MPV Taxi whichever match their requirements. A significant difference between EzCab and Grab is EzCab allows rider to book their ride in advance and these records are kept and tracked by the 24/7 operated call center. Once rider is on board, EzCab will inform their person in contact regarding their riding information. The App also provides real-time map to verify pick up location and estimated arrival time. The operation of EzCab is as simple as Grab where riders select their destination and vehicle types before tapping the book button.

Although estimated arrival time (ETA) of vehicles in transportation service is one of the key features of Grab and EzCab, and these features are available on the company website, the prediction model used for ETA is not indicated. As a result, researchers are not able to know the effectiveness of the prediction modelsassociate with the App in predicting ETA. Hence, one of the widely used measurement of effectiveness is usability and it is measured by usefulness, ease of use, intention to use and attitude in using the App (Davis, 1989). Based on literature findings, global positioning system (GPS) is a crucial technology enables effective trip planning for riders particularly in reducing long waiting time (Altinkaya and Zontul, 2013). With the location information supplied by GPS such as location, latitute and longitute; speed and altitute of tracking vehicles, ETA for vehicles can be estimated.There are many navigational app using GPS in the market,one of the popular Apps used by most Malaysian to estimate arrival time of desired destination is Waze. Waze is a mobile App that installed in mobile devices running on Android, iOS and Windows Mobile Platforms. It is used to guide riders through the shortest route possible to arrive at their destinations.Waze isalso a GPS app to track the current location of the vehicles and provide ETA to the drivers and riders (WAZE, 2020). Figure 1 shows the drivers is able to preview direction and arrival time before they begin their journey.
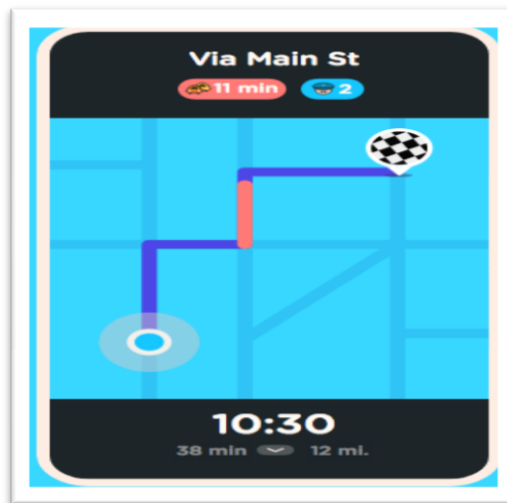

Figure 1. Preview ETA and Direction using WAZE (Source: http://www.waze.com/waze)

There are many prediction or computational models associate with navigational apps used to predict ETA. One of the popular models isArtificial Neutral Network (ANN). According to Altinkaya and Zontul (2013),ANN provides exceptional performance in predicting variable arrival time. It learns from historical data and do prediction.

In this study, the proposed mobile time tracker App is adoptingGoogle Maps on riders' Android-based mobile devicesin plotting location-based information.Google Map is a mobile web service application. GPS technology for arrival time estimation making use of GPS location data in the form of longitude and latitute.GPS is used to provide accurate location information. It is originated from U.S in 1973 which was then used for military purposes, GPS uses constellations of earth orbit satellites and permits GPS receiver to calculate latitude and longitude of a location by computing radio signals received from at least three satellites (Bojan et al., 2014; Dhumai et al., 2014). Using the three satellites transmissions, location can be obtained through triangulation, and altitude tracking is possible if more than three satellites are available. The information receivable by a GPS module are location, latitude and longitude, altitude and speed (Bojan et al., 2014).The key components of the proposed mobile time tracker App is presented in Figure 2.The proposed mobile time tracker is a bus app which enables riders (in this study riders are known as students) to track bus location and ETA. Bus drivers needs to share their location before ETA is obtain by the riders. The App takes the GPS coordinates of the bus location and continuously transmit them to database server. The app also continuously updates for location changes

within the interval time of 5 seconds. If it finds a change in bus location, GPS updated coordinates of the current bus location transmits to the database server (MySQL).
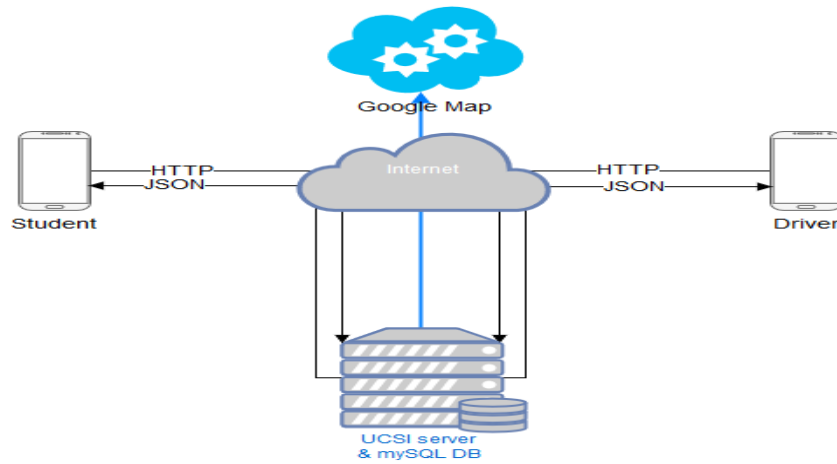

Figure 2. The Overall Mobile Time Tracker Architecture

3. Methodology

The research methodology are: review of relevant literature, development of mobile App and conduct user acceptance test. Firstly, literature review covers review analysis of relevant literature, and it takes into consideration of requirements gathered in a preliminary study conducted earlier (Chit et al., 2017; Thong et al., 2016; and Lee et al., 2016). As a result, the important features of mobile App is proposed. Secondly, a mobile time tracker App (or known as bus App) is developed using rapid application development approach (RAD). Thirdly, user acceptance test is conducted to gauge user acceptance of the App in terms of usability. Five hypotheses is adapted based on TAM (Davis, 1989). The hypotheses are determined based on research question: "what is the usability of the mobile App?". Simple regression analysis is used to gauge the acceptance or rejection of the hypotheses.

In addition, a survey was conducted using online and paper based questionnaire. A total of 68 valid responses was used to analyse the data. The main purpose of the survey is to confirm user acceptance of the mobile bus App based on two (2) main determinants of TAM theory (Davis, 1989): Usefulness and Ease of use and its outcome that is intention to use. The details of the results are discussed in the following section.

4. Result and Discussion

This section is divided into two parts: descriptive analysis and inferential analysis.

4.1 Descriptive Analysis

Reliability test has performed on the questionnaire and the results shown Cronbach's alpha value are more than 0.8. In general, the value of Cronbach alpha with the range of more than 0.60 is considered acceptable and good. A total of 68 responses (8 missing valuesare eliminated): 21 female respondents (30.9%) and 47 male respondents (69.1%) are analysed. Based on the statistics of the survey, it is noted that of all of the respondents' average time engage bus service is least 1-4 times per week. The average mean score for each construct such as mobile characteristics, perceived usefulness, perceived ease of use, attitude and intention to use is more than 3.0. This indicates that the bus riders' general acceptance of the mobile bus App.

4.2 Measurement of Scale

One of thethree approaches in evaluating validity of measurement tool is construct validity (Hair et al., 2011). According to Cavana et al., (2001), construct validity is taken as validity measurement. Factor analysis is used to measure validity of the variables andit is found suitable in this study. This is because the value of Kaiser-Meyer-Olkin (KMO) is greater than 0.7 which is between 0.5 – 1.0 indicating sufficient items for each factor. The Bartlett test is significant (i.e., a significance value of less than 0.05); this means that the variables are correlated highly enough to provide a reasonable basis for factor analysis. It is important to test the appropriateness of factor model before further analysis is conducted. This study uses simple regression analysis which isalso known as inferential analysis. According to Hair et al. (2006),inferential analysis is used to draw

conclusions on population characteristics based on sample data. Inferential statistics include hypothesis testing. Simple regression analysis is used in this paper. Simple regression analysis is defined as "a statistical technique that uses a single numerical independent variable X to predict the numerical dependent variable Y" (Levine, et al., 2005). Hence, there are no overlappings in the items, and they supported respective variables.

4.3 Inferential Analysis

Likert scale (5 points: 5- strongly agree to 1- strongly disagree)in the questionnaire is used to measure: usefulness (5 items) ease-of-use (5 items), attitude (5 items) and intention to use (5 items). The outcomes of inferential analysis is supported by regression analysis.The summary of hypotheses testing presented in Appendix shown that the outcomes of hypothesis 1, 2, 3 and 5 are supported except hypothesis 4. The findings also show that attitude has a direct or positive impact on intention to use which is not supported by (Davis, 1989)and (Masrom, 2007)in their prior research. This implies that perceived usefulness and intention to use the App are of two different constructs. Another implication shown thatin mobile environment the original TAM is not completely suitable to be used. This is in-line with research findings of (Ooi and Tan, 2016), they opined that TAM constructed based on e-commerce literatures but not mobile commerce literature due touser behave differently in mobile environment. Therefore, user behaviour is one important factor to be considered in mobile environment. For future research, other researchers can explore further how user behaviour affects usability in mobile environment.

5. Conclusion

This study concluded that mobile time tracker App is usable and able to address bus delay issue. Moreover, Google Map and GPS are suitable mobile technologies to be used for ETA prediction in transportation service. In future work, mobile Apps that associate with other prediction modelswill be used to predict ETA of vehicles in transportation serviceand a comparison study can be conducted to gauge the accuracy of ETA of mobile time tracker App developed using otherETA prediction models.

6. Acknowledgement

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Appendix

Summary of Hypothesis Testing

Number	Hypotheses	Unstandardized Beta	p-value (<0.05 =sig)	Outcome
1	H1: Perceived ease of use has a significant positive effect on the perceived usefulness of the system	0.611	0.000	Supported
2	H2: Perceived ease-of-use has a significant positive effect on attitude towards the system	0.484	0.000	Supported
3	H3: Perceived usefulness has a significant positive effect on attitude towards the using of the system	0.240	0.017	Supported
4	H4: Perceived usefulness has a significant effect on intention to use	0.129	0.074	Rejected
5	H5: Attitude towards using of the system has a significant effect on intention to use	0.787	0.000	Supported