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User requirements and route choice response to smart phone traffic applications (apps)

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ABSTRACT

Alongside the advent of smart phones, the development of traffic information applications (apps) has revolutionized the way drivers obtain the latest traffic information and guidance. Traffic information dissemination via apps show added advantage and is believed to have positive effects on changing travel behavior. This study aims to investigate user requirements on apps feature that are likely to contribute to a higher market penetration rate. Besides, it aims to evaluate the impact of traffic apps on drivers' route choice behavior. Two separate stated preference questionnaire studies were conducted at major spots in the Klang Valley region of Malaysia. Drivers are shown with various scenarios that consist of different characteristics of apps and routes. Bivariate probit models were developed to assess the drivers' choices. It is anticipated that the findings from the study would be useful to the authorities when formulating traffic information dissemination policies.

1. Introduction

In recent times, the revolution of telecommunication technologies not only brings about convenience but also changes the way on how people communicate. The advent of smart phones, since the last decade, allows people to share and obtain information in a timely manner. Smart phones are advanced mobile phones with computing capabilities and connectivity, as opposed to basic mobile phones that are utilized only for making and receiving calls. Besides offering various forms of (media) entertainment to users, smart phones provide internet connections that allow the users to browse the websites at convenient time.

According to the Mobile Movement Study (2011), activities that smart phone users would usually conduct comprise of emailing (82%), looking up for direction (69%), accessing social networking website (63%), reading news article (56%), listening to radio/music (45%), and watching online videos (41%), amongst others. In recent years, smart phone market penetration in Malaysia has increased exponentially, charting the third highest country after Hong Kong and Singapore (Livemint, 2014) in Asia. In comparison to developed countries such as America (60%), United Kingdom (72%), Germany (62%) and France (64%), smart phone penetration rate is high in Malaysia.

The development of smart phone applications (abbreviated as apps) with expanding functions could be one of the boosting factors that contribute toward an elevated penetration rate. Apps comprise of software that is designed to carry out certain tasks and available for downloads in apps store. Some apps could be downloaded free-of-charge, while others are chargeable apps. The top three most popular apps are weather, social networking, maps or navigation types of apps (Sutherland, 2013).

The advent of smart phones provides a new way of traffic information dissemination system to travelers. Traveler needs of receiving traffic information from smart phone apps are high as it was mentioned that about 69% of smart phone users look for information on direction when using smart phones (The Mobile Movement Study, 2011), whilst the map or navigation types of apps appear as the top three most downloaded apps (Sutherland, 2013). Traffic information apps are broadly classified into two types, i.e. informative and guidance. Informative apps provide traffic information to users without route guidance advices and information is delivered in the form of traffic images or maps. Snapshots of traffic images are continuously uploaded online which allow apps users to keep check on the latest traffic condition. Examples of such apps are MyEyes Traffic (Kuala Lumpur, Malaysia) (Chew, 2014a), JamCam (England, United Kingdom) (Exploding Phone, 2014), NYEyes Traffic (New York, USA) (Chew, 2014b), Traffic Wales (Wales, United Kingdom) (Parsons, 2013), view2road (ITS America, 2014), and others. Besides the traffic

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image snapshots, some apps also provide additional information such as road closure due to events or road works, incident updates, delay and waiting time estimation, and suggestion on alternative routes. Other types of informative apps provide real time traffic information in the form of maps in which colored bars are used to represent traffic speed and road condition. Examples of these apps are such as Sigalert (ITS America, 2014), and Beat the Traffic (ITS America, 2014).

The guidance type of traffic apps provides route guidance and advice to users to avoid traffic congestion. These apps give detailed rerouting advice and turn-by-turn guidance with voice instruction. Besides, it also offers additional features such as speed limit display, road alerts, weather report, and speed camera warning. Examples of these apps are Waze (ITS America, 2014), Inrixtraffic (ITS America, 2014), Trapster (ITS America, 2014), Wisepilot (ITS America, 2014), Sygic (ITS America, 2014), Papago (ITS America, 2014), Google Map (ITS America, 2014), and others. Some of these apps are free for download with full features, while others are charged for specific features. Other transport related apps provide information on parking lot availability (e.g. Parking Mate (ITS America, 2014), PrimoSpot (ITS America, 2014), ParkMobile (ITS America, 2014), ParkMe (ITS America, 2014)); ridesharing (e.g. Real-time Ridesharing (ITS America, 2014)); fuel consumption (e.g. Gas Hog (ITS America, 2014), GasBuddy (ITS America, 2014)); and transit information (e.g. Anystop (ITS America, 2014), Matemate (ITS America, 2014), Roadify (ITS America, 2014), iTrans (ITS America, 2014), and Transit (ITS America, 2014)). Table 1 summarizes the features of several popular apps available in the market.

This paper addresses two important issues in relation to traffic information apps. First, on the investigation of user requirements on traffic information apps that could encourage high acquisition of traffic information via smart phone apps. The must-have apps features are studied and their willingness to pay for these features is investigated. Second, upon receiving traffic information from travel apps, an investigation on how drivers utilize the information in making route choice decision is carried out. The contributing factors are studied using discrete choice modeling. Two separate stated preference survey studies are carried out to interview drivers in the Klang Valley. The reason for conducting separate questionnaire surveys is to ensure that respondents were not burdened with prolonged questions and scenarios.

2. Literature review

Conventionally, transport authorities utilized advanced traffic information system (ATIS) such as: radio, television, websites, and variable message signs (VMS) to deliver up-to-date traffic information to travelers, with the aim of changing their traveling behavior (i.e. route, mode, and departure time choice). Numerous research efforts were carried out to investigate the drivers' awareness of these ATIS tools and its effectiveness in changing driver traveling behavior in Europe and North America as well as in Asia. Table 2 summarizes the findings from these studies. It could be observed that drivers' willingness to change their traveling behavior is influenced by the types of ATIS tools and their characteristics (e.g. VMS content and location), apart from drivers' socio-demographic and trip characteristics. As such, it is vital to have an effective tool that allows drivers to obtain updated traffic information conveniently and fast. As summarized in Table 2 below, drivers are skewed toward listening to radio for traffic information whilst driving. In recent times, more drivers prefer to source for road traffic information from website to help them plan their journey and also make the necessary route choice/change. Also noted that drivers who perceived higher traffic information reliability are more prone to route change. Socio-economic standings and education levels contribute toward a higher dependency on traffic information dissemination tools.

Traffic information dissemination via smart phone apps has significant advantage over conventional tools, taking cognizance that it provides more convenience and flexibility to travelers in obtaining traffic information. With travel apps, drivers are able to assess traffic information at any time and on a wider network unlike VMS where it can only be installed at certain hotspot locations (due to site limitation and budget constraint) and thus only provide localized traffic information. As such, VMS provides en-route information only while its effectiveness is heavily dependent on its location (preferably at the roadway bifurcation point). Drivers have limited response choice in which they can only divert to an alternative road and yet are uncertain on traffic conditions on alternative roads. Such uncertainty has reduced travelers' willingness to divert (Khoo and Ong, 2011).

In contrast to VMS, traffic information apps provide network-wide traffic information in which drivers will have better understanding on the overall traffic condition and thus able to make both pre-trip and en-route decision. While en-route, their willingness to divert will be higher if they know that the traffic condition on the alternative road is better. Compared to commercial radio, traffic apps allow drivers to access traffic information almost 24/7 with short update intervals. This helps drivers to avoid non-recurrent traffic congestion (such as accident or vehicle breakdown) during off-peak hours. In addition, traffic information could be better disseminated if drivers share the information obtained via social media.

Khoo and Ong (2011) conducted a research study on the willingness of drivers in the Klang Valley region of Malaysia to divert to alternative routes, having received traffic information from the conventional advanced traffic information system (ATIS) tools. It was found that 26% of the respondents (out of 1506 respondents surveyed) would choose to divert to alternative roads if traffic condition is slow moving or heavy. Among the reasons cited by others who do not change to alternative routes are: not convinced that the alternative routes have better traffic conditions (45%), alternative roads are toll roads (18%), not knowing the availability of alternative routes (13%), afraid of losing way on alternative routes (12%), and that alternative routes are longer in distance (12%).

These reasons reveal that conventional ATIS tools have limitations in delivering traffic information which is not comprehensive enough to encourage drivers to divert. However, traffic information apps could overcome these limitations by providing network-wide traffic information and turn-by-turn guidance to drivers. As such, it is interesting to investigate how drivers would respond if they are able to access more comprehensive information through various apps. In addition, it is also of interest to understand user requirements on the types and features of the apps that could serve as encouraging factors to divert. To our best knowledge, none of the existing studies have looked into this matter.

In concluding that Table 2 only illustrates limited studies on traffic information dissemination tools in Malaysia, it is imperative to conduct a detailed review as desired within the context of this study. The following sections have deliberated on the usage of traffic applications in the Klang Valley of Malaysia to understand user requirements and route choice response about receiving traffic information via smartphone apps.

3. Study area

The study area chosen for this study is the Klang Valley region, which comprises Kuala Lumpur (the capital of Malaysia) and its neighboring sub-urban cities and towns. This region is located in the state of Selangor and is the nation's main industrial and