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The Wayfinding Technology Application Dependability and its influential factors on Millennials

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Abstract. The use of navigational applications is getting famous among riders. With the development of the internet, routes information is easily at the fingertips. From a fundamental perspective, routing could not be completed without navigational applications. The performance of navigational applications can be considered as one of the determinants that influence dependability on navigational applications. This paper presents the factors that influence the dependability of technology application in way-finding. In this study, three factors influence the dependability of navigational applications in way-finding which consists of social influence; accurateness and system reliability have been adopted. Using a quantitative approach via online survey design; about with 406 usable data derived from the population sample and they were identified to be dependent on navigational apps in their wayfinding needs. As a result, the findings indicated that all of the independent variables such as social influence, accurateness and system reliability have a significant relationship with dependability on navigational applications.

1. Introduction

The term “wayfinding” was first coined by Lynch in 1960, in his seminal book on spatial cognition and municipal planning [1]. Wayfinding is the process of identifying a current location and knowing how to get to the desired destination as quickly and effortlessly as possible [2]. Also, wayfinding is the process of moving oneself from a current location to the desired destination on time. Humans’ travelling or wayfaring tools depended on the stars, maps, and compass had gradually advanced to global positioning systems (GPS) in order successfully reached their destination. Hence, it is included GPS, audio-guides, interactive maps, 3D visualisations and virtual environments [3] which can be used to provide positional information directly or to guide the user through a route using directions. However, [4] argued that navigation applications were perceived differently from traditional maps and could potentially change people's wayfinding behaviour [3]. [5] reported a concern that the use of navigation applications might have negative impacts on people's geospatial literacy and awareness [3]. Remarkably, findings from past research suggest that such technologically advanced systems do not necessarily assist the user in navigation and environmental learning. Along with advanced technology application, wayfinding becomes increasingly easier to continuously compute and display rider's position everywhere [4]. Currently, most of the riders are depend more on navigation technologies than paper maps or road sign to navigate their way especially for the new generation who own



smartphones. People rely on technology application to tell them where to will make it harder to remember where they have been and how they got there [6]. Besides that, researchers found the variables such as social influences, accurateness, and system reliability are believed to be important factors to affect technology application dependability on wayfinding.

1.1. Literature Review

1.1.1. Dependability

According to [7], the dependability of a system is the ability to deliver service that can justifiably be trusted. It reflects the user's degree of trust on that system. Dependability is an umbrella concept which is evolved from reliability and availability considerations. Many authors describe the dependability of a system as a set of attributes, such as reliability, maintainability, safety, availability, confidentiality, and integrity. According to [8], technology adoption can be defined as the stage of selecting a technology for use by an individual or an organisation. Technology adoption is not only related to the aspects of technology only, but it also involving dimensions of user attitude and personality, social influence, trust, and numerous facilitating conditions. The adoption of technology at individual and organisational levels will lead to mass adoption which is termed as the diffusion of technology [9]. In the end, this technology adoption will eventually bring to dependability when the evaluation of technology is giving convenient and trust to human.

In Theory of Planned Behavior (TPB) model [10], the term "stickiness" used to measure the attitude toward an application. For technology application, stickiness refers to the user's behavioural intention to re-use and prolong the duration of each user on an application. According to [11], stickiness is usually described as the user's dependence on the website. By increasing the number of times a user visits an app and the duration of each visit, increased dependency is seen as increasing the potential for in-app purchases. Both stickiness and dependability on technology application reflect essential dimensions of the app's value. Usually, an application that is not dependable will consider as unreliable, unsafe or rejected by users. The dependability of technology application on way-finding is becoming common in Malaysia especially in urban areas such as Penang, Kuala Lumpur, and Johor Bahru. Hence, the present study will focus on how the situational and personal factors affect the dependability of technology application on way-finding by riders in Malaysia.

1.1.2. Social Influence

Social influence refers to the importance of others such as family and peers that believe they should adopt a particular technology that perceived behaviour [12]. Social influential factors found that it has a significant effect on the use of technology including the blog, social media, mobile applications, and so forth [13]. In other sense, when someone participates actively in a social system, the more they can recognise themselves as part of the system [14]. Social influence at a different "level" in term of differences in the process an individual accepts influence could change an individual's attitudes and action. Furthermore, social influence in the process of compliance is relevant with underlying subjective norms (SN) which is an individual looking forward to a favourable reaction from others [15]. For example, in research of mobile banking applications found SN have a significant relationship on intention to use the application [16].

1.1.3. Accurateness

According to the Mobile Marketing Association [17], the term "accuracy" refers to the closeness of a measured location to the reallocation of the device at the time of the measurement. It is how close the position is to reality. Nowadays, accuracy is important in every aspect to increase the user's efficiency from one place to the desired destination. The term "accurateness" refers to the state of quality of being accurate and accuracy whereby it is essential when landmarks used as wayfinding aids [18]. Previous studies defined accurateness as the degree to which drivers of automobiles are becoming aware of their accurate, current locations and related environments [19]. By using navigation

applications such as Google Maps or Waze, drivers can find their locations and desired directions in displayed electronic maps and an arrow-typed figure. From previous research, accurateness in transport system included visualisation method and distance measurements that needed to deliver the right traffic and road map information.

For example, a car navigation system is one of the technology application used in wayfinding. In previous research to test driver acceptance of car navigation system with Technology Acceptance Model (TAM) by [19] shown that perceived locational accuracy significantly contribute to user acceptance of car navigation system. The users had ranked that accurateness in navigation system let them become aware of the surroundings. Riders can find their current locations and desired directions by using navigation system during way-finding. Riders believe that satellite navigation system provides efficient routes and final destination for them [19].

1.1.4. System Reliability

Reliability, flexibility, integration, accessibility and timeliness are importance constitute in the service quality. Reliability refers to the dependability of system operation [20]. Perceived system reliability has been defined as the users' perception that the system provided reliable technical services that allowed them to achieve their intended purposes [21].

Furthermore, in the finding of [22] by using Technology Acceptance Model (TAM), their results revealed that the service and display quality components of the systems were the most significant determinants of driver attitude and intention to use car navigation systems. Moreover, both satisfaction and service and display quality were affected by perceived system reliability. Hence, compatible system reliability is the driver toward a satisfied user and better service and display quality. In accordant to [23], reliability refers to the ability to perform the promised service dependably and accurately. Online stores must provide mistake-free service and secure online transactions to make customers feel comfortable using online shopping [24]. Further, the reliability dimension is a significant predictor of overall service quality, customer satisfaction and purchase intentions in online shopping [24].

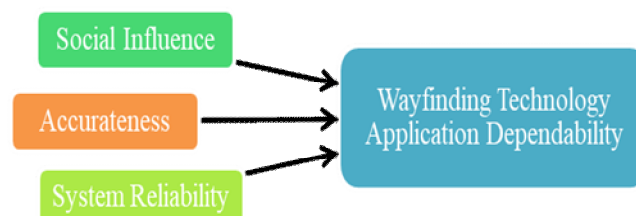


Figure 1. Conceptual Framework.

The underpinning theory for this particular research is the extended technology acceptance model (TAM2) in exploring the technology application dependability in millennial users in wayfinding [25]. The conceptual framework suggested by the study as illustrated above (figure 1) whereby the chosen variables have a direct influence on application dependability.

2. Research Method

2.1. Sampling Method and Data Collection

The sampling method used in this study is a non-probability convenience sampling method. The sample size chosen in this paper is 464 respondents, but only 406 were usable. The paper and online questionnaire with Likert seven-point scaling were used to collect data on variables. The Likert scale used to provide more accurate investigation between the independent variables and dependent variable

by bipolar scale “Extremely Disagree, Strongly Disagree, Disagree, Neutral, Agree, Strongly agree, Extremely Agree” in the statement.

2.2. Research design

This research applied a correlation study to determine the relationship between independent variables (social influence, accurateness, and system reliability) and the dependent variable (wayfinding technology application dependability).

Table 1. Demographic Background (n=406).

	Frequency	Percentage
Age		
18~25	380	93.6
26~35	25	6.2
46~55	1	0.3
Total	406	100.0
Gender		
Female	261	64.3
Male	145	35.7
Total	406	100.0
Year of Experience with Smart Phone		
< 1 year	12	3.0
1 ~ 2 year	69	17.0
3 ~ 4 year	113	27.8
5 ~ 6 year	112	27.6
7 ~ 8 year	55	13.5
9 ~ 10 year	18	4.4
Above 10 Years	27	6.7
Total	406	100.0
Driving Experience		
< 1 year	69	17.0
1 ~ 5 years	276	68.0
5 ~ 10 years	57	14.0
11 ~ 15 years	2	0.5
16 ~ 20 years	2	0.5
Total	406	100
Year of Experience Using Navigation Apps		
< 1 year	61	15.0
1~2 year	234	57.6
3~4 year	85	20.9
Over 4 years	26	6.4
Total	406	100.0

Based on table 1, it is shown that the majority in this sample consist of female riders (64.3%) and dominated by riders aged between 18 and 25 years old; that are 380 riders. Most of the respondents comprised of riders who have driving experienced between 1 to 5 years (68.0%). With experienced smartphone between 3 to 4 years (27.8%); and the number of riders who have experience using navigation apps between 1 to 2 years (57.6%).

2.3. Data Analysis

Cronbach's alpha reliability analysis was used to measure internal consistency or reliability. Based on table 2, the five variables Cronbach's Alpha value are considered good because the value is between 0.8 and 0.9 for each variable. The reliability coefficient that less than 0.6 are considered weak, 0.7 is acceptable, and those over 0.8 is good [26]. Hence, the variables have been proven to be reliable, excellent and consistent.

Table 2. Reliability Test of each variable (n=406).

Variables	Number of Items	Cronbach's Alpha Value
Social Influence (H1)	7	0.895
Accurateness (H2)	6	0.918
System Reliability (H3)	8	0.933
Dependability	5	0.866

Next section, statistical analyses that cover correlation and multiple regressions to explain and confirm the four variables that have an influence on wayfinding technology application dependability (WTAD) among road users. Pearson's correlation analysis is a statistical measure of the strength of a linear relationship between the dependent variable and the independent variable [28]. Moreover, a multiple regression analysis refers to a set of techniques for studying the straight-line relationships between two or more variables. The variables influence toward WTAD is expected to be identified in the study.

3. Results

Based on Table 3, the p-value for all the four variables is equal to 0.000 at which it is less than α value of 0.01. Thus, it indicates a statistically significant correlation between independent variables and dependent variable. There is a positive relationship between all the independent variables to navigation applications dependability.

Table 3. Correlation Analysis (n=406).

Item	Navigational Apps Dependability	
	r	p-value
Social Influence (H1)	0.622	0.000
Accurateness (H2)	0.710	0.000
System Reliability (H3)	0.636	0.000

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

From table 4 below, the coefficient of multiple determinations (R^2) value is 0.614 which means social influence, accurateness and system reliability explain 61.4% of navigational applications dependability. Besides that, the table shows that the set of predictors of navigational applications dependability are statistically significant at the 0.01 level $F(4, 401) = 159.719$, $p < 0.05$) and therefore, it confirms the fitness of the model.

Based on the findings, H1 (social influence), H2 (accurateness), H3 (system reliability) are supported by the respective p-value of $0.000 < 0.05$ (H1, H2 & H3). Thus, it can conclude that the independent has a positive relationship with the dependent variable (H1, H2 & H3 are accepted). Besides, it can be

seen that accurateness has the highest beta at 0.351, which indicated that this variable is the most influential factor in influencing navigational applications dependability. In summary, the relationship between dependent variable and independent variables are as follows:

Table 4. Model Fits and Univariate ANOVA (n=406)

MODEL FITS				
Model	R	R Square	Adjusted R Square	Standard Error of the Estimation
1	0.784	0.614	0.611	3.32827

ANOVA					
Model	Sum of Squares	Df	Means Square	F	Sig
Regression	7077.074	4	1769.269	159.719	0.000
Residual	4442.019	401	11.077		
Total	11519.094	405			

4. Discussion

The objectives of this research are to investigate the relationship between social influence, accurateness, and system reliability with wayfinding technology application dependability. The findings result showed that the four factors have a positive relationship with wayfinding technology application dependability. Social influence had a consistent result with previous studies whereby social influence was a significant relationship in mobile application usage [10, 27-28]. Besides, accurateness also showed positive and had the most influential relationship between other variables. The relationship is supported by existing research that perceived locational accuracy would contribute to the acceptance of the car navigation system. Following with [12, 18-19], extended their research found that system reliability as the most crucial determinants in-car navigation system. This is consistent with this research whereby system reliability also reflects a prominent relationship in the wayfinding technology application dependency. Thus, this research showed that people what is considered essential to them, is accurateness of the apps, and the reliable system would affect dependency on wayfinding technology application.

5. Conclusions

Based on the research, social influence, accurateness, and system reliability have a positive and strong relationship to wayfinding technology application dependency. Wayfinding technology has its perks. However, more research should address the issues of dependability of assisted technology in smart driving. Sometimes losing the grasp of reality could deter simple tasks such as reading maps and asking for directions among millennials. Several limitations had been encountered in the study such as the limits of time-spend in the field work which would work best if it uses a longitudinal approach as well as adopting a qualitative approach in getting the data from the users. The results, however, would be indispensable for local agencies; infrastructure engineers and town planners in providing insight for the future smart city or traffic management.

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