The Relationships among App Attribution, User satisfaction, Trust, and Continuous Use Intention: Focused on Mobile App of Bus Information

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[Abstract]

The objective of this study is to identify the relationships among app attribution(perceived usefulness, design, information quality, and mobility), user satisfaction, trust, and continuous use intention of bus information apps; The structural equation of AMOS 21.0 was used to test the hypothesis of this study. The results of the analysis are as follows. First, perceived usefulness, design, information quality, and mobility positively impact user satisfaction. Second, only mobility has a positive effect on trust, but the remaining perceived usefulness, design, and information quality have no effect at the significance level of 5%. Third, user satisfaction has a positive impact on trust and continuous use intention. Fourth, trust has a positive impact on continuous use intention. Therefore, it was confirmed that the characteristics of the bus information mobile app are important influencing factors for the improvement of user satisfaction, trust, and continuous use intention. Local governments and bus companies will be able to establish strategic directions for the activation of bus information mobile apps. The limitation of this study is that it is somewhat lacking in generalizing the study results, so future research needs to focus on improving this part.

▶Key words: App attribution, User satisfaction, Trust, Continuous use intention, Mobile app

[요   약]

본 논문의 목표는 버스 정보 모바일의 앱속성(유용성, 디자인, 정보품질, 이동성), 사용자만족, 신뢰, 지속적 사용의도 간의 관계를 확인하는 것이다. 본 연구의 가설을 검정하기 위해 AMOS 21.0의 구조방정식이 사용되었다. 분석의 결과는 다음과 같다. 첫째, 유용성, 디자인, 정보품질 및 이동성이 사용자만족에 긍정적인 영향을 미치는 것으로 나타났다. 둘째, 이동성만이 신뢰에 긍정적인 영향을 미치고 나머지 유용성, 디자인, 정보품질이 유의수준 5%에서 영향을 미치지 않는 것으로 나타났다. 셋째, 사용자만족이 신뢰와 지속적인 사용의도에 긍정적인 영향을 미치는 것으로 나타났다. 넷째, 신뢰가 지속적인 사용의도에 긍정적인 영향을 미치는 것으로 나타났다. 따라서 버스 정보 모바일앱의 특성이 사용자만족, 신뢰, 지속적 사용의도 등의 개선을 위한 중요한 영향요인임이 확되었으며, 특히 이동성이 다른 앱 특성요인보다 중요한 역할을 하고 있다. 지방정부와 버스회사는 버스 정보 모바일 앱의 활성화 위한 전략적 방향을 수립할 수 있을 것이다. 본 연구의 한계점은 연구결과를 일반화하는데 다소 부족함이 있어 향후 연구에서는 이 부분을 개선하는데 초점을 둘 필요가 있다.

▶주제어: 앱속성, 사용자만족, 신뢰, 지속적 사용의도, 모바일앱

Ⅰ. Introduction

Bus companies, large cities, and local governments are developing and operating a bus information system(BIS) to provide convenience to citizens. Existing bus stops with no bus information system are also undergoing BIS construction. Numerous local governments such as Changwon, Jeju, Geoje, and Jinju have competitively introduced the bus information system[1], and have rapidly spread and are operating[2]. Using BIS, citizens can efficiently manage the acquisition time of bus arrival prediction information.

The previous studies related to bus information apps were as follows: the technical functions of the bus information system[3] and the effect of real-time information on bus customers[4], and the passenger effect of real-time bus information systems[5]. It can be said that there are few studies that approach from the point of view of consumers who use the bus information app. Bus companies, local governments, and app developers are involved in the operation of the bus information app. However, in order to improve the efficiency and effectiveness of operation, it is necessary to develop and manage the bus information app based on the evaluation of users.

Therefore, in this study, the intention of continuous use is presented as a result of bus information application operation. Trust is presented as a variable to evaluate honesty, competence, and good deeds of it. In addition, the perceived usefulness, design, information quality, and mobility of the app characteristics, which are essential to consumers who are bus information app users, are presented as factors affecting user satisfaction and trust. The paper analyzes the influence relationship between bus information app characteristics, user satisfaction, trust, and continuous use intention. It identifies the difference between the groups of teens (high school students) and 20s (university students), who are the primary users of the bus information app (moderating effect). The implications according to the results of the research analysis are presented.

Ⅱ. Theoretical Background and Hypothesis

1. App Attribution
1.1 Perceived Usefulness

App usefulness is defined as the degree to which a mobile app can be used efficiently, effectively, and satisfactorily in a specific situation in which a user finds himself in order to achieve the purpose[6]. Barnes and Vidgen[7] stated that perceived usefulness is designing so that users can achieve their goals and that it provides ease of use and convenience of use to accomplish their goals. It is defined as the concept of optimality that minimizes waste by allowing users and providers to share values.

Kim et al.[8] presented the relationship between perceived usefulness, enjoyment, and intention to use in tourism information application applying the extended technology acceptance model. Akdim et al.[9] argued that perceived usefulness and ease of use have a positive effect on satisfaction. Suki and Ramayah[10] suggested that perceived usefulness has a significant effect on user satisfaction with information system. Choi and Kim[11] conducted a study on behaviors after accepting mobile Internet service and found a causal relationship between perceived usefulness, satisfaction, and intention to use.

Lee et al.[12] found that ease of use and connectivity in a mobile environment are factors that affect trust. Choi and Cho[13] confirmed that convenience, perceived usefulness, and pleasure affect user satisfaction and trust in the smartphone application usage environment. Agag and El-Masry[14] stated that perceived usefulness has a positive effect on trust in the study of consumer intention to participate in the online travel community.

1.2 Design

As mobile devices become popular in the digital age, the interface design of websites is also changing according to the mobile environment. The bus information app design is accepted as a core value when users first recognize it and serve as a bridge to induce continuous use[15].

Kang[16] suggested that the utility of the smartphone-based entertainment application design affects satisfaction. Jung[17] identified that the convenient design of the iPhone affects satisfaction, usage patterns, and purchase patterns. Chung[18] argued that mobile application design affects consumers as a marketing tool.

Chun and Lim[19] found that customer service, design, connectivity, and usability have an effect on customer satisfaction in the order of service quality of app shopping malls. Kim[20] set the evaluation elements of web interface design into five categories: color, layout, navigation, typography, and graphics, and argued that design elements affect satisfaction. In a study by Hwang and Lee[21], it was found that the design of mobile devices affects the satisfaction of smartphone users.

Kim[22] found that among the factors that form online trust in pension websites, website design has the greatest influence on online trust. Kang[16] confirmed that smartphone-based gameplay application design is crucial for trust.

1.3 Information Quality

Content quality, which means information quality of mobile content, refers to the quality that an individual acquires when using a mobile device service. Five factors such as clarity, reliability, timeliness, diversity, and relevance were suggested as the internal quality of mobile content[23].

The previous studies explaining information quality are as follows: completeness, understandability, structure, searchability[24], playfulness, content quality, and situational dependence[25].

Ham[26] suggested that the expected consistency of web information quality has a positive effect on web information quality satisfaction and that web information quality satisfaction has a positive effect on overall satisfaction.

Jung[27] argued that the information quality of the open market has a positive effect on cognitive trust. Ahn et al.[28] suggested that the higher the information quality, the greater the user's pleasure and positive behavior.

1.4 Mobility

Mobility in mobile refers to ubiquitously accessing services while moving through wireless networks and various mobile devices[29]. A technology to which this concept of mobility is applied in information and communication is location-based service technology.

With the expansion of smartphones, applications and content using location-based services continue to increase, enabling users to obtain various information in real-time based on their current location through mobile devices[30]. The core of this location-based service technology is a map, and the mobile application market using this technology is expanding. It provides services to bus drivers, bus companies, and bus information app users with telematics that provides necessary information while driving.

Han[31] provided the relationship between mobility and satisfaction in a study on restaurant app service quality and user reviews on app satisfaction and reuse intention. She empirically studied the effects of information usefulness, mobility, reliability, and empathy, which are service quality factors, on satisfaction and reuse in smartphone restaurant apps.

Kyung and Kim[32] suggested that SNS services affect trust. Sun et al.[33] argued that social commerce attributes have an essential effect on trust.

2. User Satisfaction

In information systems research, satisfaction is defined as how users believe that information needs are met[34]. In information systems, user satisfaction is a widely adopted variable in measuring the effectiveness and success of information systems. Users who perceive that an information system provides value to users are more likely to be satisfied with the information system[35].

Park and Shin[36] argued that smartphone users' perceived usefulness has a positively significant effect on user satisfaction. In addition, it was found that user satisfaction with smartphones has a positive effect on continuous use intention.

Lee[37] found that accuracy is the factor that had the most significant influence on the trust of the Internet map service, and accuracy, professionalism, scope, and up-to-dateness are all significant variables. Trust and user satisfaction are found to have a significant effect on intention to use.

Yoon and Lee[38] argued that user satisfaction with e-government has a positive effect on government trust.

In information systems and marketing, it is suggested that user satisfaction is a reliable antecedent of continuous use intention[39]. Hsiao et al.[40] found that satisfaction has a positive effect on continuous use intention. Therefore, the following hypotheses are proposed to confirm the relationship between app characteristics and user satisfaction.

H1-1: Perceived usefulness of bus information app characteristics will have a significant effect on user satisfaction.

H1-2: Design of bus information app characteristics will have a significant effect on user satisfaction.

H1-3: Information quality of bus information app characteristics will have a significant effect on user satisfaction.

H1-4: Mobility of bus information app characteristics will have a significant effect on user satisfaction.

3. Trust

Trust in information technology is generally described as a concept that includes both the expectation of interaction with a specific partner and the belief and acceptance of exposure invulnerability by the transaction medium or environment[41]. In addition, trust is an essential factor in accepting information technology and has been described as a variable that can have a positive effect on product or service evaluation[42].

Sun[33] presented the attributes of social commerce as reputation, price, ease of use, and enjoyment, and investigated whether they have an effect on trust and commitment. Kyung and Kim[32] suggested that perceived usefulness and customization among SNS service characteristics have a positive effect on trust, but perceived ease of use has no effect. Sarkar et al.[43] suggested perceived usefulness, perceived ease of use, system quality, information quality, service quality, user interface, perceived risk, perceived security, structural assurance, ubiquity, and disposition as antecedent variables of Trust. In addition, Martinez-Navalon et al.[44] argued that user satisfaction positively affects trust in environmental social media publications. Therefore, the following hypotheses are proposed to confirm the relationship between app characteristics, user satisfaction, and trust.

H2-1: Perceived usefulness of bus information app characteristics will have a significant effect on trust.

H2-2: Design of bus information app characteristics will have a significant effect on trust.

H2-3: Information quality of bus information app characteristics will have a significant effect on trust.

H2-4: Mobility of bus information app characteristics will have a significant effect on trust.

H3: User satisfaction of bus information app characteristics will have a significant effect on trust.

4. Continuous Use Intention

Continuous use intention indicates the degree to which a person who has used a product or service in the past is willing to continue using it in the future[45]. It is defined as the intention of consumers to continue to use a product or service and to inform their friends or people about their experience[46].

Lee and Kang[47] suggested tha user satisfaction has a positive effect on continuous use intention. Pereira et al.[48] revealed that satisfaction determines continuous use intention. In addition, Tsai and Hung[49] argued that trust has a positive impact on continuous use intention of online community. Therefore, the following hypotheses are proposed to confirm the relationship between user satisfaction, trust, and continuous use intention.

H4: User satisfaction of bus information app characteristics will have a significant effect on continuous use intention.

H5: Trust of bus information app characteristics will have a significant effect on continuous use intention.

III. Research Method

1. Research Model

A research model is presented as shown in Fig. 1 to confirm the relationship between app characteristics (perceived usefulness, design, information quality, and mobility), user satisfaction, trust, and continuous use intention in app characteristics of bus information.
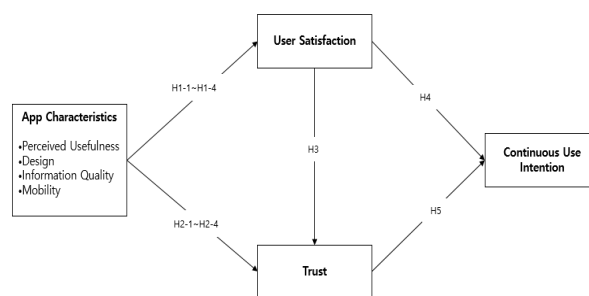

Fig. 1. Research Model

2. Procedure

A suitable sample for this study was selected for high school students and college students, who are the primary users of bus information apps. Five hundred questionnaires were distributed to the selected sample, and 461 questionnaires were used for the final analysis, excluding insincere answers. SPSS 21.0 and AMOS 21.0 were used for the analysis of the collected data.

3. Measurement Items

The measurement items of Table 1 used in this study were borrowed and modified from previous studies whose validity and reliability were confirmed. App characteristic factors, user satisfaction, trust, and continuous use intention were measured on a 7-point Likert scale.

Table 1. System Environment

Constructs	Items	Sources
Perceived Usefulness	There is no difficulty in using the bus information app.	[13], [14]
	The service contents are easy to understand when using the bus information app.	
	Bus information app is easy to check bus information.	
	It is easy to use bus information app.	
Design	Bus information design represents bus-related apps well.	[16], [22]
	It is a familiar design to use the bus information app.	
	It visually accurately represents the bus information design.	
	The design of the bus information app is attractive.	
Information Quality	Bus Information app provides accurate information.	[26], [27]

	Bus Information app provides reliable information.	
	Bus Information app provides timely information.	
	The information in the bus information app is easy to understand.	
Mobility	The bus information app can be used when necessary.	[31], [33]
	It is easy to use the bus information app while on the move.	
	The bus information app can be accessed from any required location.	
	Users can easily check the arrival time of bus information while moving.	
User Satisfaction	The use of the bus information app is satisfactory.	[37], [38]
	I am satisfied with the function of using the bus information app.	
	Using the bus information app does not disappoint.	
	I am satisfied with bus information and service quality.	
Trust	I can trust real-time bus route information.	[41], [42]
	The bus information app is reliable.	
	I believe that the information provision of the bus information app is perfect.	
	I trust the app that provides bus information.	
Continuous Use Intention	I will continue to use the current bus information app.	[48], [49]
	If possible, I will continue to use the bus information app.	
	I will continue to use the bus information app without stopping.	
	I will continue to have the bus information app on my smartphone screen.	

IV. Results

1. Sample Characteristics

The characteristics of the sample of 461 questionnaires used for the final analysis are as follows. Males were 43.0% and females 57.0%, and the age group was 60.7% for teenagers and 39.3% for the 20s, indicating a high percentage of teenagers. The grades were 20.4% in the first year of high school, 17.8% in the second year of high school, 22.6% in the third year of high school, 25.8% in the first year of university, 7.6% in the second year of university, and 5.9% in the third year of university. The weekly bus use rate was 3.3% less than two times, 23.2% more than three times, 41% more than five times, and 32.5% more than seven times. The purpose of using the bus was commuting to school 55.7%, shopping 22.1%, and socializing 22.1%.

2. Reliability and Validity of Measures

Cronbach's alpha was used to test the reliability of internal consistency of the constructs. Cronbach's alpha value was found to be perceived usefulness(0.796), design(0.783), information quality(0.807), mobility(0.796), user satisfaction(0.775), trust(0.805), and continuous use intention(0.778), indicating that the internal consistency is satisfactory[50].

Confirmation factor analysis was performed to evaluate the overall fit of the measurement model. The fit indices of the model were CMIN=280.815, DF=148, CMIN/DF=1.897, GFI=0.948, NFI=0.980, TLI=0.985, RMSEA=0.044, indicating that the model is overall goodness. In Table 2, composite reliability(CR) values are higher than the suggested value of 0.7 by Nunnally and Bernstin(1994), indicating that the measurement model has good construct reliability. In addition, since the standardized coefficient value exceeded 0.5, convergent validity was identified[51].

In Table 3 discriminant validity was identified because this study's AVE square root value was higher than the correlation coefficient value[52].

Table 2. Confirmatory Factor Analysis

Construct	Item	Std. Estimate	S.E.	t-value	α	C.R.	AVE
Perceived Usefulness	u3	0.830	–	–	0.796	0.983	0.951
	u2	0.860	.052	19.159			
	u1	0.735	.049	16.585			
Design	d3	0.946	–	–	0.783	0.993	0.979
	d2	0.965	.023	43.654			
	d1	0.863	.031	30.677			
Information Quality	in3	0.953	–	–	0.807	0.994	0.983
	in2	0.967	.021	46.751			
	in1	0.893	.026	34.753			
Mobility	mo3	0.717	–	–	0.796	0.979	0.939
	mo2	0.906	.067	17.593			
	mo1	0.816	.063	16.477			
User Satisfaction	sa3	0.974	–	–	0.775	0.997	0.992
	sa2	0.999	.011	89.313			
	sa1	0.992	.012	80.451			
Trust	tu4	0.920	–	–	0.805	0.994	0.978
	tu3	0.926	.028	35.985			
	tu2	0.977	.027	44.009			
	tu1	0.971	.026	42.910			
Continuous Use Intention	cu3	0.975	–	–	0.778	0.996	0.988
	cu2	0.974	.016	62.665			
	cu3	0.948	.019	51.368			

CMIN=280.815, DF=148, CMIN/DF=1.897, GFI=0.948, NFI=0.980, TLI=0.985, RMSEA=0.044

Table 3. Correlation and Discriminant Validity

	1	2	3	4	5	6	7
1	**0.975**						
2	0.454	**0.990**					
3	0.310	0.444	**0.991**				
4	0.339	0.372	0.288	**0.969**			
5	0.436	0.495	0.404	0.479	**0.996**		
6	0.289	0.298	0.232	0.460	0.410	**0.989**	
7	0.484	0.508	0.336	0.586	0.514	0.488	**0.994**

1 Perceived Usefulness, 2 Design, 3 Information Quality, 4 Mobility, 5 User Satisfaction, 6 Trust, 7 Continuous Use Intention
*The square root of AVE value is in bold type on the diagonal.

3. Hypothesis Testing

The fit of the path model was investigated to test the research hypothesis. The fit indices of the model were CMIN=283.289, DF=155, CMIN/DF=1.828, GFI=0.948, NFI=0.970, TLI=0.986, RMSEA=0.048, indicating that the model is overall goodness.

The relationship between the perceived usefulness of bus information app characteristics and user satisfaction(H1-1) was supported by an estimate of 0.191(p<0.01). The relationship between the design of bus information app characteristics and user satisfaction(H1-2) was supported by an estimate of 0.234(p<0.01). The relationship between the information quality of bus information app characteristics and user satisfaction(H1-3) was supported by an estimate of 0.145(p<0.01). The relationship between the mobility of bus information app characteristics and user satisfaction(H1-4) was supported by an estimate of 0.277(p<0.01).

The relationship between perceived usefulness of bus information app characteristics and trust(H2-1) was not supported by an estimate of 0.071(p<0.05). The relationship between design of bus information app characteristics and trust(H2-2) was not supported by an estimate of 0.027(p<0.05). The relationship between information quality of bus information app characteristics and trust(H2-3) was not supported by an estimate of -0.001(p<0.05). The relationship between mobility of bus information app characteristics and trust(H2-4) was supported by an estimate of 0.425(p<0.01).

The relationship between user satisfaction with bus information app characteristics and trust(H3) was supported by an estimate of 0.153(p<0.01). The relationship between user satisfaction with bus information app characteristics and continuous use intention(H4) was supported by an estimate of 0.384(p<0.01). The relationship between trust in bus information app characteristics and continuous use intention(H5) was supported by an estimate of 0.425(p<0.01).

Table 4. Results of the Path Model

Hypot hesis	Path	Std. Estim ate	S.E.	t-value	Reuslts
H1-1	Perceived Usefulness→User Satisfaction	0.191	0.089	5.708	Accepted
H1-2	Design→User Satisfaction	0.234	0.041	4.822	Accepted
H1-3	Information Quality→User Satisfaction	0.145	0.048	3.552	Accepted
H1-4	Mobility→User Satisfaction	0.277	0.089	5.708	Accepted
H2-1	Perceived Usefulness→Trust	0.071	0.045	1.306	Rejected
H2-2	Design→Trust	0.027	0.030	0.517	Rejected
H2-3	Information Quality→Trust	-0.001	0.038	-0.023	Rejected
H2-4	Mobility→Trust	0.425	0.069	7.666	Accepted
H3	User Satisfaction→Trust	0.153	0.037	2.829	Accepted
H4	User Satisfaction→Cont inuous Use Intention	0.384	0.026	9.434	Accepted
H5	Trust→Continuous Use Intention	0.425	0.038	8.656	Accepted
CMIN=283.289, DF=155, CMIN/DF=1.828, GFI=0.948, NFI=0.970, TLI=0.986, RMSEA=0.042					

V. Conclusions

This study investigated the relationship between bus information app characteristics (usability, design, information quality, and mobility), user satisfaction, trust, and continuous use intention for high school students and college students who are major users of the apps. The results of the analysis are summarized and presented as follows.

First, as a result of examining the relationship between bus information app characteristics and user satisfaction, it was found that the perceived usefulness, design, information quality, and mobility of the app characteristics have a positive effect on user satisfaction. Also, it was found that mobility has the most significant influence on user satisfaction compared to other factors. This shows that high school students and college students who use the bus information app evaluate mobility service more than information quality.

Second, as a result of examining the relationship between bus information app characteristics and trust, it was found that mobility has a positive effect on user satisfaction. However, perceived usefulness, design, and information quality had no effect. This may be because trust-building requires long-term evaluation.

Third, as a result of examining the influence relationship between user satisfaction, trust, and continuous use intention, it was found that user satisfaction has a positive effect on trust and continuous use intention, and trust has a positive effect on continuous use intention. In addition, it was found that trust has a more significant effect on continuous use intention than user satisfaction does.

Based on the empirical analysis results of this study, the implications are presented as follows. First, based on mobile app or smartphone app characteristics of previous studies[53], perceived usefulness, design, information quality, and mobility as a sub-dimension of bus information app characteristics were derived. In addition, perceived usefulness, design, information quality, and mobility were found to have a positive effect on user satisfaction, confirming that it can be valid as a sub-dimension of the characteristics of the bus information app.

Second, user satisfaction, trust, and continuous use intention were presented as consequent variables of bus information app characteristics. Since trust is a significant variable for consumers to evaluate whether an online service provider has fulfilled its transactional obligations[49], extending the research area for bus information app by including it in this research model would be meaningful.

Third, in the relationship between user satisfaction, trust, and continued use intention, it was found that trust has a more significant effect on continued use intention than user satisfaction. It can be seen that this is partially consistent with previous studies[54].

Fourth, the results of this study suggest that bus information app operators (bus companies, local governments, and app developers) can benefit from improving perceived usefulness, design, information quality, and mobility based on the needs of bus information app users.

Fifth, local governments and bus companies should improve the convenience and connectivity of the bus information app to make the screen operation more convenient and enhance the accuracy of bus arrival times, dispatch by time, and the quality of bus information.

Because the results of this study have some limitations, they should be interpreted with caution. First, because the study sample is limited to the Gyeongnam region, there is a limit to suggesting the implications of the study. Second, since this study is a cross-sectional study limited to the time of the survey, it is not possible to confirm the change in the degree of influence over time. Therefore, a longitudinal study will be needed in future studies. Third, it will be necessary to select a sample that includes various customer groups using the bus information app in future research.

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