Evaluation the effect of mobile information services for public transportation through the empirical research on commuter trains

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A B S T R A C T

Railways play an important role in the way people move around their communities. The purpose of this study is to identify the factors which improve overall satisfaction with railway services in order to increase railway usage. This literature especially focuses on mobile information services on commuter trains. In this study we verified what kind of mobile information services passengers need while using railways, especially while on board, through two empirical surveys on commercial commuting trains. We provided not only rail information but also marketing-related information such as news, shop information, advertising and coupons for smartphones. Content server access logs were then obtained and analyzed, and several questionnaires were conducted in order to evaluate these information services during the test period. We used customer satisfaction (CS) portfolio analysis in order to clarify the relationship between satisfaction with each type of content and overall intent to use the mobile information services.

Both times it was indicated that almost 90% of passengers who answered questionnaires would use these mobile information services if the services were actually introduced, and that satisfaction with railway information content was higher than that with marketing contents. From access logs to installed content servers on board, it was found that railway information is frequently accessed as well. In-station shops information and coupons were accessed as frequently as railway information. This result indicated that there were latent needs for these contents. This result was also drawn from CS portfolio analysis. These contents can be divided into the following types according to different points of view, location-based contents and non-location-based contents. We also found that the satisfaction with location-based information content affected overall intent of using these mobile information services. We also found that content that changes according to time received higher evaluation than other content.

For the second surveys we built a system that can provide information on board connected with the internet. We found that over 60% of passengers who connected to the on-board network used the internet not only for on-board information services but also to browse other websites, using SNS and sending or receiving emails. Moreover, we investigated the relationship between the internet usage in this on-board mobile information service and overall intent to use this service. From this result, it was quantitatively found that offering an internet connection affected overall intent in using the on-board mobile information services.

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1. Introduction

Public transportation plays an important role in the way people move around their communities. Especially, railways provide the most efficient means of moving a large number of people in densely populated urban centers, and, in comparison with other land transport systems, it has some advantages with respect to direct environmental burdens/emissions, such as energy consumption, air pollution, noise, safety, travel speed and congestion [11,15]. Therefore, by helping travelers move from single-occupancy vehicles to railways, communities can reduce traffic congestion and the environmental impact of transportation [18]. Toward this goal, increasing intentions to use railways is one of the solutions. Ref [9] has empirically verified that service quality, service value and

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satisfaction directly influence behavioral intentions. This finding means that improving service quality, service value and satisfaction of railways encourages people to use railways.

Ref. [23] has described customer satisfaction surveys using questionnaires in a railway company in Japan. The survey mainly consists of 5-point Likert scale questions related to the following six categories: amenity, barrier-free, hospitality, security, transport stability and information services. It was found from the survey that satisfaction with items related to information services has an effect on overall satisfaction with railway companies. There are other former studies on effects of provision of information to passengers on public transportation as well. Refs. [26] and [16] have identified the information system as a determinant of customer satisfaction. It is also identified that information was one of the most affected factors in customer satisfaction perception towards Attiko Metro in Greece [35]. Ref. [3] has mentioned that the provision of good quality, reliable, up to date information may be a straightforward way to achieve mode shift. The survey conducted in Dublin, Ireland revealed that 42% of respondents agreed that the lack of information deterred them from using public transportation [4]. Therefore, improvement of quality, value and satisfaction with information services can influence overall customer satisfaction with railway companies and behavioral intentions regarding use of railways.

Railway companies basically provide information to passengers through announcements by train and station staff or through information posters and signboards on trains and in stations. They have also installed various information displays in stations and on trains [12,13]. In recent years, utilization of smartphones has been increasing and high-speed and large-capacity communications environments also have developed. In the emerging environment, detailed and diverse information can be delivered to passengers by using mobile devices. Mobile devices such as smartphones and tablets allow users to control when, where, and how they engage in chosen activities that serve their needs, to save time, complete a task, entertain users, or connect with others [22]. We then focused on mobile information services for railway users in this study.

A location-aware information service for smartphone, providing bus stop and arrival information tailored to the user's location, has already been developed [17]. Real-time bus information system implemented by the Chicago Transit Authority provided various information such as the current location and expected arrival time of buses at a specific stop. This information was available on the website of the authority which could be accessed from mobile devices [34]. However, target users of these mobile services are passengers who are NOT on-board. In other words, these papers have not studied information services while understanding the context in which passengers are on moving public transportation. Moreover, these papers have focused on providing information regarding transportation usage and have not evaluated both transportation information content and marketing information content such as lineside news/topics, information for in-station malls, shop coupons and advertisements simultaneously.

2. Objective

The purpose of this study is to identify the factors which improve overall satisfaction with railway services in order to increase railway usage. This literature especially focuses on mobile information services on commuter trains. The value of an on-board mobile information service we propose in this paper is that content providers can provide information in a state of knowing not only customers' location but also the train they are on. Content providers can recognize the direction to which users are going and assume the place at which they will stop because trains run according to a predetermined route. From the point of view of users, they can obtain context-aware information from an onboard mobile information service without notifying that service about their precise situations. And then, position detection techniques by using Bluetooth beacons or Wi-Fi access points have recently become widely used. These devices make it easy to detect passengers who are on a train.

Therefore, this paper focuses on the following four research questions and identifies factors which influence overall quality, value and satisfaction of on-board mobile information services. (1) Do passengers positively evaluate mobile information services that provide information related to the trains on which they are traveling? (2) What kind of contents affect quality, value and customer satisfaction with on-board mobile information services? (3) What are the specific characteristics of the contents found in question (2)? (4) Are there any marketing information contents which are needed by passengers on commuter trains? In order to obtain the answers to the above research questions, we built a test environment on commercial commuter trains which can provide information while understanding the context in which passengers are on moving public transportation and conducted empirical research. We provided various contents that were related not only to traffic information but also to lineside news/topics, information for in-station malls, shop coupons and advertisements in this environment.

In this paper, we describe the results of the two surveys on commercial commuter trains. We verified what kind of mobile information content passengers accessed while using a railway, especially on board, and obtained an evaluation of each content, through the surveys. For the first survey, contents servers were newly installed on board and passengers' smartphones could access various content connecting with an on-board local network. For the second survey, content servers were located in a data center on the ground and passengers' mobile devices could access the content by connecting to the internet. This second system is a more practical configuration because passengers can not only obtain the original content provided by the new on-board information system but also connect to the internet, read/send emails or use SNS. In order to obtain the answer to research questions (2), (3), (4) from the results of these surveys, we used customer satisfaction portfolio analysis [33]. The further details of this analysis are described in the section 5.2.2 (4).

On-board space is a particular location in which passengers' activities are limited and also they are heading in the same direction. Clarifying what kinds of mobile information services satisfy people in such a space is the differentiator of this research.

3. Related work

Railway companies have already installed various information displays in stations and on trains [12,13], investigating the effect on public transportation customers of real-time information from information displays located at bus stops and rail stations. The main finding of the studies was that the perceived wait time decreased by 20% when passengers were provided real-time traffic information. Ref. [28] proposed a real time congestion information provision system which was supposed to be installed on the platform and show the congestion ratio of each car of an approaching train. Those papers demonstrated that providing congestion information could help in leveling uneven congestion between trains and train cars. However, information displays are expensive, both upon initial purchase and ongoing maintenance. Therefore, as mentioned before, in Ref. [17], a location-aware information service for smartphone was developed that provides bus stop and arrival information tailored to the user's location. Results from a survey of users of this service indicated a set of positive outcomes: increased