A Log Analyzer of Public Transit Guidance Service to Improve a Route Bus Service

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Abstract. We developed a log analyzer for public transit guidance service, and clarified the pattern of the usage of public transit guidance, and actual demand to the public transit service. In recent years, there is a growing demand for public transit guidance for mobile devices, such as smartphones. Therefore the usage of public transit guidance service strongly reflects the demand to the public transit. It is possible to find potential demand to the railway services and route bus services by observing the access to the public transit guidance service. We developed a log analyzer of public transit guidance service as a Hadoop cluster for Bus-net, a popular public transit guidance service in Tottori Prefecture, Japan, and discussed the way to improve public transit service more convenient with the result of the analysis.

Keywords: public transit guidance service, log analyzer, route bus.

1 Introduction

In recent years, there is a growing demand for public transit guidance service to the development of high-speed networks and the spread of mobile devices, such as a smartphones. These services is a web service that suggests the best itinerary to the destination by trains or bus with search criteria, such as origin, destinations, time. Especially, the service is used as a real-time navigation [1] to the destination from the current position using the mobile device with GPS.

In this way, public transit guidance service is becoming strongly associated with real traffic. We think that it is important to understand the relationship between a public transit guidance service and real traffic because of analysis of route bus service from the log data of public transit guidance service.

The paper attempts to improve a route bus service by designing the log analyzer of a public transit guidance service, and implements the analyzer on a public transit guidance service called “Bus-Net”.

2 A Public Transit Guidance Service

There are many public transit guidance services on the web in recent years such as Google Maps [2], Deutsche Bahn [3], and Navitime [4]. The basic functions of these

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web services are to provide a route map of public transport, to provide a timetable at a bus stop or a station, and to search for the best itinerary between any stations or bus stops. Usually these services are available for smartphones and PCs. You can use the guidance service from your PC when you are planning your trip with trains or route buses. Also you can use the service on your smartphone when you get lost while you are traveling.

Nowadays, people in the train spend much of their time with their mobile devices, and the close relationship with mobile devices is changing the form of services [5] including the guidance for public transit. Today, most users of the public transit strongly depend on the guidance service while moving with trains or buses especially in advanced countries or large cities. They do not search for the exact itinerary beforehand, instead, they are moving with searching and gazing the screen of the smartphone. As the result, much closer coupling between online services and actual railway and route bus service is going to be important.

With the development of information technology, railway services and route bus services is considered to have a possibility to change their forms of the service to be more useful for the users [6]. In the challenge to improve the service, it is important to understand the demand to the public transit services. There are many techniques to investigate the demand, but as the public transit service is getting to have strong relationship with online service, the method of analysis of online service is also going to be applicable to the survey of public transit service.

In summary, the online public transit guidance service influences to the offline activities of users of public transit service by suggesting itineraries of users. In this way, these services are significantly different typical web services by the point with a strong association with a real traffic. We think it is possible to analyze the use of public transport from the user behaviors of public transit guidance service.

3 Analysis of Activities of Public Transit Users

As discussed in Section 2, it is important to analyze the use of public transport from behaviors of the users of public transit guidance service. The important differences between a general web analysis and the analysis for a public transit guidance services is, that the activity of the user does not end within the online service, but continue to the offline activities such as taking a train. Therefore, it is important to deal with both online and offline activities of users. Also it is important to deal with the actual conditions of public transit services such as the statistics of railway and route bus services, actual delay of vehicles. In the following, we discuss the possible analysis to improve route bus service, and we define requirements for log analyzer of public transit guidance service.

3.1 The Situation of Use

In order to improve the route bus service to understand meanings of the use of public transit guidance service, we examine the relationship between the users of each the

route bus service and the public transit guidance service. Of course, users of the public transfer guidance service are users of public transport almost, but it does not mean that users of the public transport use the public transfer guidance service. For example, it is not considered to search for the route using on a daily basis, such as commuting. In order to understand meanings of the use of public transit guidance service we examine the situation of use.

3.2 The Potential Demand of Users

After examining the relationship between the service and route bus transit service, we need to understand the potential demands of the user in the route bus service. Many people use the route bus to arrive at a given time to a destination, however, there are few buses arrived just that time direct to that destination. We know the time a lot of the user data from the actual use of the bus route, but we could not get a potential demand such as, origin, destination and departure time. Therefore, we investigate the demands of user from the search condition of public transit guidance service, and the coverage of route bus service for demand from the search results. Thus, we identify the points of the timetable to be improved from the coverage of the timetable for high demands of users.

3.3 The Accuracy of Bus Services

Some public transit guidance services are reflected in the search results to get transit information of route buses and trains in real-time. We can create a timetable that is hard to cause suspended service and delay by quantitative analysis of elements for season, weather and day of the week from transit information.

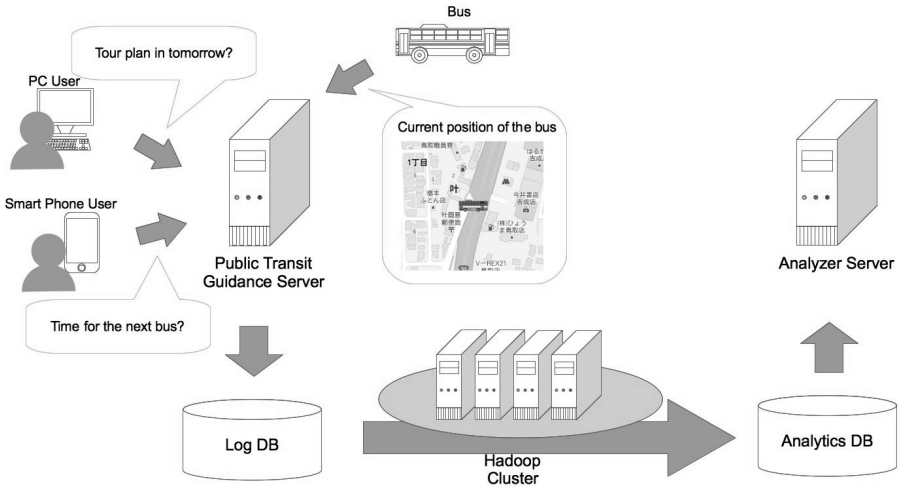

Fig. 1. The system of analyzer

4 Implementation

We implement the log analyzer discussed in chapter 3 of in the public transit guidance service called “Bus-Net"[7,8,9]. As shown in Fig. 1, logging data of “Bus-Net" users' access and the data of bus location system, and these data is processed using a Hadoop [10] cluster, published analysis results in the "Analytics-Server”.

As shown in Fig. 2, user behavior in the “Bus-Net” is recorded as log in the “Log DB”, and be analyzed by the Hadoop cluster. Analysis result is recorded in “Analytics DB”, therefore, published by the web service in “Analyzer ” server.

4.1 “Bus-Net”

“Bus-Net” is one of the public transit guidance service has two features “Timetable Search” function gives you a single view of the timetable of bus routes multiple runs between the bus stops and “Route Search” function to search for the best route to the destination. The “Route Search” function shows the best route to the destination using public transportation of which, as shown figure 1. To assist the movement of the user to the destination in a part of walking, this service shows path using guide map, in a part of bus or train, shows the transit bus stop.

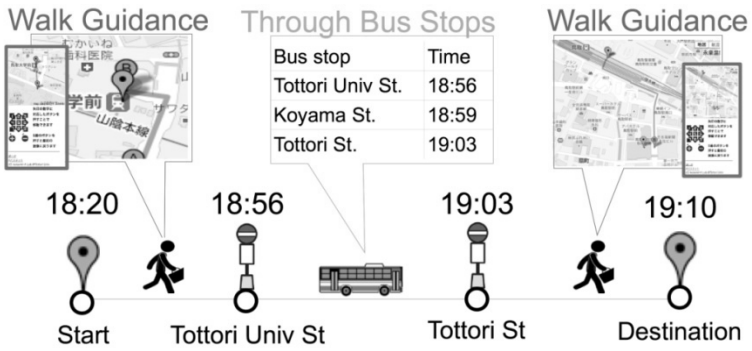

Fig. 2. The example of "Route Search"

4.2 Logger

For analysis of the use of public transit guidance services, we require not only page transition and search conditions but also search result user get.

In addition, the behavior is recorded whether to move to any page from any page, but as the analysis is considered to be what you are, using the available information, such as time of use. Therefore, we propose that the tag as its attributes to each behavior. For example, we will need to enter your departure place in timetable search and route search, by tag named "departure place", can be analyzed without considering the feature pages. In addition, the tag is also useful in terms of maintenance and management because it is easy to add or delete later.

4.3 Analyzer

The analysis of log data are used Hadoop, showed in the web service analysis results. The analyzer shows the analysis results of the Hadoop cluster using charts and maps like Fig. 3, web server will display the data easy to understand for those of the bus company and the developer of the service transit.

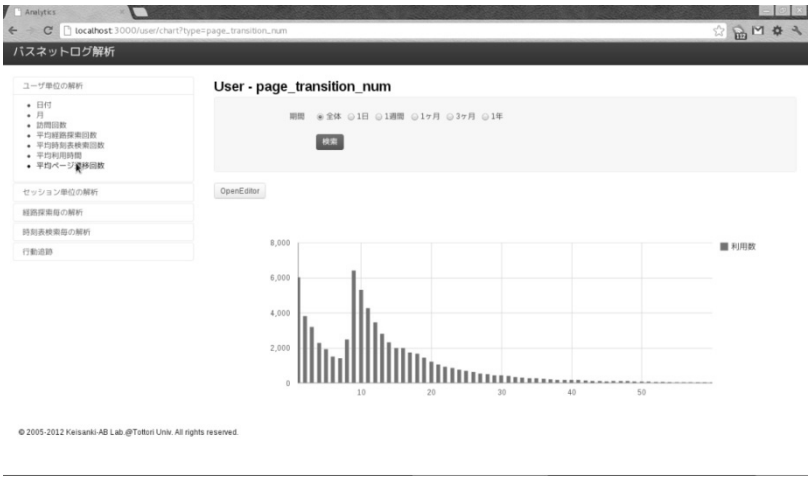

Fig. 3. one of screenshot of the analyzer

5 Analytics Result

We implemented the analyzer of public transfer guidance service "Bus-Net" that we have developed, designed in Section 3. In this chapter, we investigate the use of public transit guidance services using this analyzer and, considering the reality.

5.1 Everyday Use Is More Than the Other

By analyzing the search frequency of each combination of departure place and destination of the route search function, we have to analyze whether it is used for what purpose. As a result, there are few route search to the location where you do not usually like to go for sightseeing, many route search to the location of the many times that you have used, such as for shopping and daily commuting. This is considered to be one of the reasons also that most of the users of the "Bus-Net" is residents of the prefecture, in the case of the used day-to-day, user know what do he get on the bus which routes go any bus stop, but he forget the departure time of the bus.

5.2 Users Tend to Enter Only the Origin and Destination

We have counted the frequency of the "Route Search" of the items other than the starting point and destination, separately from the use of mobile devices and PC. In the route search, it was found that changing the search conditions as small as can be seen from hypotheses, Fig. 4, 5. However, the use of mobile devices has had less change in departure dates compared to the use of from the PC, because it was used while moving, which is provided with because there is no problem has become departure dates the current date considered.

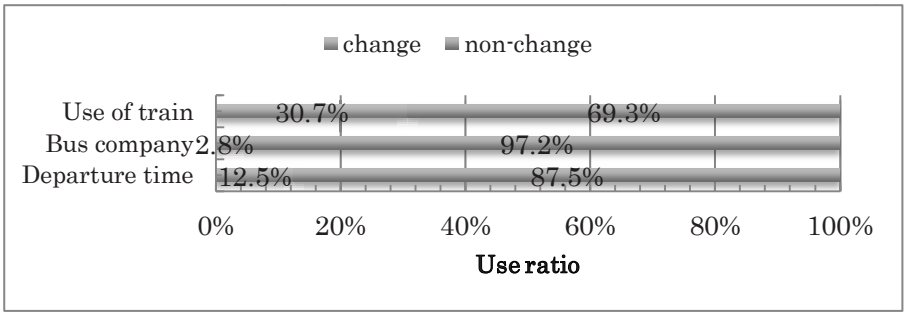

Fig. 4. The number of change conditions (PC)

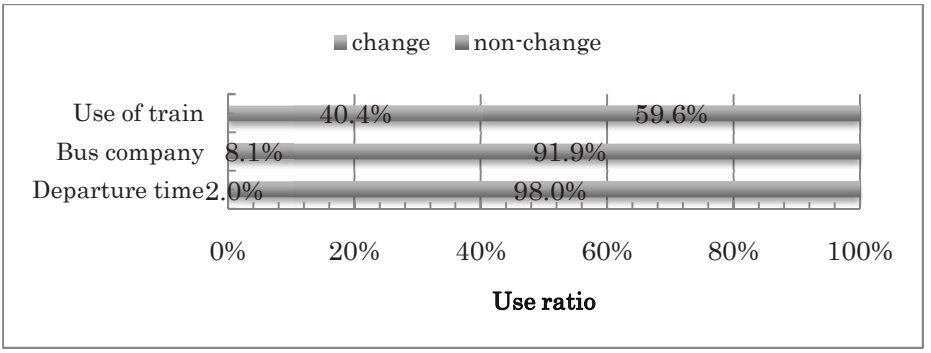

Fig. 5. The number of change conditions (Mobile Devices)

5.3 The Users of Mobile Device More Than PC

As a result, the person who uses mobile phones and smartphones is more than PC. In addition, it is resulted in a transition period from mobile phones to smartphones, appeared on the ratio of the number of each used.

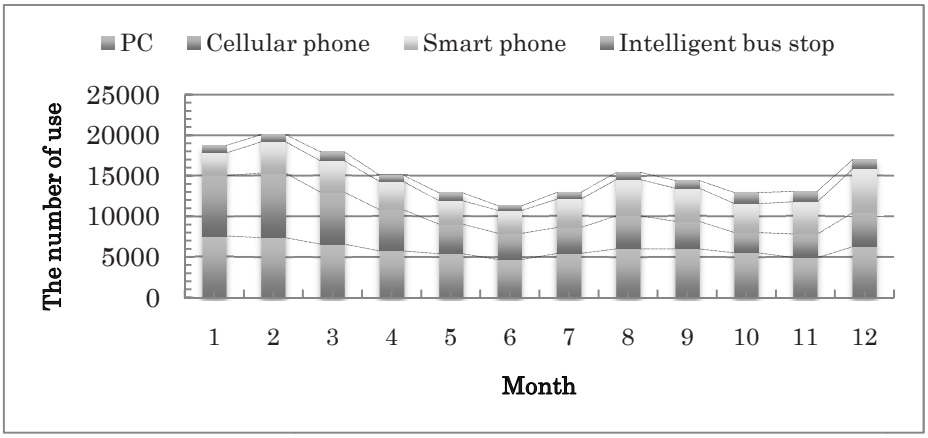

Fig. 6. The ratio of use each devices

6 Conclusion

We build the system for analysis the reality use of public transit guidance such as, "Bus-Net" for the purpose of feedback to the public transportation. In the future, we will validate the movement of user after "Route-Search" from the data of public transit user. Therefore, we investigate the relation between public transit and guidance service, the purpose of the analysis of the intention of the user movement more.

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