Research and Development on Providing Easy-to-Understand Train Operation Information

The Frontier Service Development Laboratory of the Research and Development Center of JR East Group is developing a service that utilizes information technology (IT) to provide passengers with train operation information in an easier-to-understand way. While much information is provided using IT in the greater Tokyo area, there is still room for improvement in providing train operation information on regional lines and at home and the workplace. Accordingly, we have been working on the ideal way to provide train operation information service on regional lines, having carried out field tests at Makuta station on the Kururi line in Chiba Prefecture to verify usability. Furthermore, we have developed an operation information web interface as a user-friendly system to provide train operation information at home and the workplace. This article will also cover that favorably received interface.

Keywords: Train operation information, Information design, XML, GPS, Interface

1 Introduction

Accurately providing train operation information to passengers is one mission of railway operators. Recent advances in Internet technology, price reduction of large flat-panel displays and other factors are allowing for provision of that information to passengers in a more visual and more understandable manner. The Frontier Service Development Laboratory had thus developed a display for operation disruption information that was put into practical use starting at Akihabara station in February 2007.

While information-providing services in the greater Tokyo area have been improved, looking at the situation for the home and workplace and for regional lines reveals little improvement made compared to in the greater Tokyo area and websites of other railway companies.

We have therefore conducted development of a new system for providing train location information for regional lines and R&D on providing easy-to-understand train operation information via the Internet for the home and workplace, aiming at improvement of our services.

2.2 Information Terminal

As displays viewed by passengers, we placed all-new “IT scarecrow” next-generation information terminals on platforms and 32-inch LCD displays in waiting rooms. We made repeated reviews during development to achieve interface designs for the individual displays that are easy for passengers to understand.

2.2.1 IT Scarecrow

For information terminals set on the platform, we came up with ideas to provide more understandable train location information and also thought of a design that matches well with the scenery of unstaffed stations. The result was a terminal jointly developed with Uchida Yoko Co., Ltd. that has an easily accepted design. We dubbed that terminal evoking an image of watching over the station like a scarecrow watches over a rice field the “IT scarecrow”.

The IT scarecrow has the following functions (Fig. 2).

- Displaying train locations with LEDs
- Audio guidance from a speaker in the arm
- Station security using a web camera
- Lighting up at night according to sensor information

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The Kururi line is a regional line that extends from Kisarazu station to Kazusa-Kameyama station in Chiba Prefecture, having a total of 14 stations. Service frequency is about one train per hour. Trains on this line usually consist of two cars, with four cars in peak hours. Since JR East was conducting a “Destination Campaign” rail travel promotion event in Chiba Prefecture at the time of the field test, we chose the Kururi line on that occasion. The reason for choosing Makuta station for the field test was because Makuta station is a rare station where community volunteers support its upkeep. We hoped that this relationship between the community and the railway station would be a useful example to other communities.

We provided test services to passengers who used Makuta station in an approx. one-month field test period from the end of April to the end of May 2007 (Fig. 4).

3.1 Measures Taken on Troubles that Occurred in the Test
Since on-train UPS (Uninterruptible Power Supply) for mobile phones had a body grounding function, train cars sometimes detected leak current when the UPS touched the car, and that caused runaway of current control ICs, resulting in blown fuses. We therefore replaced the securing screws with insulated screws and added felt insulator when securing to trains. Those measures successfully prevented the above-mentioned trouble.

We also faced large positioning errors by GPS at the beginning of the field test. Since inappropriate placement of the GPS mobile phone often caused that error, we moved the phone to a place where the GPS satellite signal could be received well. That enabled accurate train positioning (Fig. 5).
3.2 Customer Assessment Result

We carried out a customer assessment survey for customers who used Makuta station in the field test period.

Individual interviews and postcard questionnaires were combined in the survey of male and female users 15 years and older, and we received 149 replies in the period of two days from May 23 to 24 2007.

The replies showed that customers understood well the display content on the LCD display in the waiting room and IT scarecrow on the platform. The top-ranked replies included “legible text”, “understandable audio guidance” and “understandable train location”. We also found that secondary functions related to station security were highly viewed from responses such as “sense of security given by the security camera” in the free comments.

The percentage of responders who replied that train location display was necessary at unstaffed stations was as high at 70%. But we also saw a trend where that percentage was relatively low in the segment of frequent users. That result told us that we should consider expanding the content displayed to include items such as operation information in case of train delays and train connection information from the transfer station.

We regard results as showing that the system was generally seen favorably by users.

4 Development of the Train Operation Information Website

4.1 Overview of the Development

Outside of stations and trains, we have been providing information on train operation, timetables and transfer guidance in our website. But problems such as those shown below have been brought up.

(1) Dispersed information
(2) Mixing of required information personally and information not needed
(3) Difficult in identifying information as it is mainly in text

Accordingly, we developed a website with an aim of that being an easy-to-understand total operation information website based on the following three points (Fig. 6).

1. Concentrated railway information

To put all railway information together, we concentrated train operation information, information on alternative routes, transfer search functions and timetables of stations in a single page, providing that in an easy-to-understand design.

2. Personalized information service

We developed a function (My-Station Registration) that provides the following three types of real-time information according to the nearest station and line that the user registers.

• Weather information: The latest weather information around the registered station
• Train operation information: The latest train operation information for the registered line
• Timetable: Times for the soonest five trains at the registered station and on the registered line

Once registered, the registered information is automatically reflected on the website in subsequent accesses.

3. Visualized train operation information and alternative route information (in a route map form)

Train operation information, which is provided only in text in our current website, was made to display visually in the website developed (in route map form). We applied the system for operation disruption information displays that are set up in stations to the system for the website to create route maps that show delays and operation suspension.

Currently, the flow of providing train operation information starts with voice information by dispatchers, then XML (a computer language usable for data exchange between different computer systems) data is generated from the voice information at the Train Operation Information Center, and finally that file is distributed to locations such as displays at stations. In the newly developed system, the XML data is sent to the train operation information route map.
generation system (server), then the server generates the image file (png format) of the route map for that train operation information and distributes that file along with the original XML data to the web server. Using the same method, train substitution information provided only in text on the operation disruption information displays is visualized in a map indicating the line or section where substitution is done and shown on the new website.

4.2 Empirical Test
To evaluate the developed system, we invited test subjects to monitor the system and conducted the empirical test as follows.

- **Targets:** Greater Tokyo area (Tokyo, Kanagawa, Saitama, Chiba) residents who use JR on five days of a week or more frequently
- **Sex and age:** Male and female users 15 – 59 years old
- **Total number of valid questionnaire responses:** 491
- **Monitoring period for the website:** 12 days from October 9 to 20, 2007
- **Test method:** Test subjects freely used the website in locations such as at their home and workplace in the test period. After the test, we conducted a questionnaire survey.

4.3 Assessment of the Developed Website
The questionnaire survey results are shown below. On general satisfaction of the website, 76.6% of the responders replied that they were satisfied (satisfied + somewhat satisfied). As for the level of satisfaction of each of contents provided, the satisfaction rate for train operation information was 85.8% and that for the substitution information was 72.0%. The satisfaction rate of the information included in My-Station-Registration (weather, train operation and timetable) was more than 80% for each type of information.

Regarding intention to use the developed website in the future, 75.2% of the responders replied they intended to use it "(will use + will probably use)" (Fig. 7).

The results show generally favorable assessment, with high satisfaction and intention to use for each type of content and the website overall. Regarding the alternative route information in a route map form, we recovered favorable comments such as it being "visual and easy to understand", "helpful in changing the route in advance" and "useful to predict the level of congestion when route substitution is made for on the commute line". On the other hand, some replied they "have no time to start up the PC to get information before leaving for work" and that "it is difficult to judge which the quickest alternative route to the destination is". Those comments tell us that future issues are providing information other than on PC and improvement of route substitution information service.

![Fig. 7 Intention to Use the Train Operation Information Website](image)

**5. Conclusion**

Providing train operation information that will become increasingly complex in the future in an easy-to-understand fashion is a high priority theme in R&D that we must continue to work on. Since both providing train location information for regional lines and the train operation information website worked on in this round of development were fairly successful, we will make further efforts to put them into practical use.

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