ICT-Based Information Services for Customers

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Introduction

JR East's Frontier Service Development Laboratory is aiming for innovation in station and onboard services by novel ideas and working from the standpoint of customers. R&D on ways to provide information by utilizing ICT is thus being promoted to achieve “provision of services in line with individual customer needs”.

This paper covers the history of providing information through ICT, focusing on R&D carried out up to now, future efforts, and the Smart Station Vision promoted by the Frontier Service Development Laboratory.

Information Providing and Interactivity

In providing information to customers using railways, the methods of providing information and how users obtain that information must be considered. The horizontal axis in Fig. 1 shows interactivity with information and the vertical axis shows the number of users. Moving upward to the right expresses more personalized information being providable. It is important to properly analyze general purpose ICT and railway-specific content along with the sorts of situations users obtain information in and to design with a clear idea of what information is expressed in what way. In order to design information in an easy-to-understand manner, the interface that bridges users and information in particular is very important.

The following chapters introduce efforts in R&D for ICT-based information services in line with the concept of providing information while taking a customer perspective.

Efforts in Providing Operational Information

R&D commenced in 2003 for displays designed to provide information in times of service disruptions—information devices utilizing large displays set up in major stations in the greater Tokyo area. When providing information by audio or scrolling LED text, it is difficult for users to immediately know if that information is relevant to them. The idea thus came up of using a route map for the greater Tokyo area, which users are familiar with, and expressing information visually on a large flat panel display so they would be able to understand the operational status at a glance.

Development proceeded, and the first field tests were held at Ueno Station in November 2004. Improvements were subsequently made and field tests held at Tokyo Station in December 2005. The results of questionnaire surveys showed that many users had favorable views of the system.

The system later came to be deployed by JR West as well as Tokyo Metro, Odakyu Electric Railway, and other railway operators. It has now become the standard for providing information in times of service disruptions.
5.2 Yamanote Line Train Net
The train cabin can be seen from the viewpoint of users as being an inconvenient space where movement is restricted. It was thus assumed that using ICT to provide information to the smartphones carried by users could increase the level of satisfaction in railway use and create new business.

Suburban trains of JR East are equipped with the Train Information Management System (TIMS) to manage onboard information. The development concept for the system to provide information to smartphones—the Yamanote Line Train Net system—is to provide information held by TIMS to passengers in an easy-to-understand manner according to their location (Fig. 4).

Content that can be obtained onboard is composed mainly of the two categories of “railway information” and “marketing-related information”. Railway information is made up of operational information, stations and transfer routes, and cabin conditions. For operational information, real-time information on delays is displayed; for stations and transfer routes, a list of stops and guidance on platform facilities are displayed; and for cabin conditions, congestion and temperature inside and outside the cabin are displayed. For marketing-related information, shop information (ekinaka in-station commercial spaces), information on the area around stations, entertainment information, news for areas along the line, coupons, and more are displayed (Fig. 5).

Two trains for the Yamanote Line were modified to employ the system, and field tests in which actual passengers used the system were conducted for five months from September 2009. Popular content was cabin conditions, operational information, and ekinaka in-station commercial space information. Cabin conditions seems to have been most popular content due to the novelty of the function visualizing conditions in the car one is riding. Questionnaire results showed that customers saw the attempt as being interesting and that they wanted the system to be a little easier to connect to.
5.3 Creation of the JR East App and a Common Network

The long-awaited official JR East App for providing information to smartphones was released on March 10, 2014 after elaborate preparation. It included functions of displays designed to provide information in times of service disruption and the Yamanote Train Net. That and the bold content of providing Keihin-Tohoku Line train line occupation information directly to passengers proved to be a sensation.

Moreover, a station common network was put in place at Tokyo station as the system common interface to make introduction of the system in stations easier and create a stress-free environment for providing information. This way, a high-speed Wi-Fi environment could be provided and new service for quickly providing new information could be built (Fig. 6).

Fig. 6 System Conceptual Diagram for Provision of Information

6. Future Efforts

6.1 Efforts in Open Data

Open data is data that can be freely used, reused, and redistributed by anyone. It often refers to geospatial data and statistical data with a highly public nature held by government agencies, and Japan too is promoting a national e-government open data strategy.

JR East is actively cooperating in the “Open Data Distribution Platform” open data efforts being carried out by the Ministry of Internal Affairs and Communications. Specific efforts are establishment and international standardization of a common application programming interface (API), setting down rules for secondary use of data (data governance method), and promoting proving tests for visualization of making data open.

YRP Ubiquitous Networking Laboratory is building an information distribution platform and developing apps to utilize such railway and bus information. Specific projects are Dokosil, which provides real-time location information for trains and buses, and Kokosil Tokyo Station, which gives guidance within Tokyo Station (Fig. 7). Questionnaire surveys show that those are well accepted by actual users, demonstrating high expectations for the future of open data.

Movements are also underway for promotion of open data in railway business with its highly public aspects, and the “Study Group of Open Data for Public Transportation” was launched on August 1, 2013. That group plans to consider information technologies and business models such as for data formats, APIs, and security.

Fig. 7 Dokosil (Left) and Kokosil Tokyo Station (Right)

6.2 Efforts in Big Data

Much information is utilized in railway operations for day-to-day railway business, but the level at which that is utilized is unfortunately not sufficient. Big data technology spurred on by Google in recent years has allowed diverse types of large volumes of data, as the name “bit data” implies, to be handled. And new services can now be provided by uniformly managing data used by railways and analyzing that data from a variety of perspectives.

The Frontier Service Development Laboratory launched the Data Science Project Team to fully promote big data. A dedicated server was also set up in the laboratory to analyze big data, and research for a new era is going forward.

Railway information services up to now have focused on telling about the “current situation” in an easy-to-understand manner, but big data and machine learning to come will allow provision of information predicting the future based on the current situation. The goal for efforts to come is to provide accurate information on “what to do next” by processing much information such as on train movement, human movement, weather, and events.

6.3 Providing Indoor Location Information

Outdoor location positioning is generally done by GPS and cell tower triangulation. Rough positioning can be done indoors by using Wi-Fi signal strength, but accuracy of about 10 m is considered good in a station environment. Other methods include technologies such as Bluetooth tags, Indoor MEssaging System (IMES) indoor GPS, sound wave beacons, augmented reality (AR), and camera images, but a conclusive solution has yet to be found.

Even though a specific technology providing location information has not been decided on, Apple released its iBeacon location-based service, and that is currently gaining much attention. This location information service from Apple utilizes Bluetooth technology, and the Frontier Service Development Laboratory too is looking into possibilities for utilizing it.

Location-based provision of information is still a developing field, so the Frontier Service Development Laboratory plans to screen out technologies while closely following technical trends.
6.4 Providing Information for Station Personnel
Providing information to customers is important, but providing information to station personnel is also an important topic. Tablets such as iPad have proliferated rapidly, allowing traditionally paper-based media to be digitized. Possibilities for providing information have also broadened with the ability to acquire Internet-based information and real-time information such as railway operational information (Fig. 8).

Fig. 8 Example of Providing Information for Tablets
Information with real-time aspects is particularly important. For railway operational information, train delay information, information from JR East’s ATOS (Autonomous Decentralized Transport Operation Control System) and COSMOS (Computerized Safety, Maintenance and Operation Systems of Shinkansen) operation management systems and reserved seat congestion information from MARS (Multi Access Seat Reservation system) are important content. An important point for future tablet killer apps will be the ability to communicate such real-time information to station personnel with good response.

7 Aiming to Fulfill the Smart Station Vision

7.1 Overview of the Smart Station Vision
The Smart Station Vision is the concept of the Research and Development Center of JR East Group for creating next-generation stations with the “customer playing the lead role”. The aim is to achieve “smart” stations that can meet diverse customer needs with high value-added services employing various technologies and ideas.

In order to quickly achieve this Smart Station Vision, the Smart Station Lab simulating an actual station was constructed on the grounds of the Research and Development Center of JR East Group in June of 2010 (Fig. 9). This experiment space in the form of a station was built to efficiently test, verify, and assess new technologies and revolutionary ideas to allow them to be put into practical use.

7.2 Outlook for Future ICT Services
How “smart” will stations become by utilizing ICT? One possible outlook is for the station itself to become a robot with artificial intelligence (AI) functions. Necessary information will be provided to each individual through data and automatic voice guidance by identifying station conditions through camera images and sensor technologies and then identifying train operation and data of individual users using big data processing. Moreover, the environment will be controllable by the station itself judging various conditions to perform operations such as providing a comfortable environment through automatic air conditioning control.

By the station becoming smart, the station will allow railway users to appropriately navigate by simply stating a destination without them needing to be aware of details such as complex station layouts and lines.

To accomplish that goal, R&D needs to be further promoted. Specific areas for R&D include information platform construction and big data processing as well as sensor networks and building a Smart Engine to measure and judge the networks (Fig. 10).

Fig. 9 Exterior of Smart Station Lab

8 Conclusion
The Frontier Service Development Laboratory will continue with creative R&D using cutting-edge technologies and new ideas to create new services for customers. In those efforts, the laboratory will actively incorporate open innovation with universities and research agencies in Japan and other countries.