Roughly speaking, there are two approaches to initiatives having to do with providing information to passengers. One is the method of providing an environment in which the passenger is able to obtain information personally. The other is the method of providing information through station staff. With respect to the former, development is underway for a guidance system (information agent) that the passenger may operate in the station. On the other hand, with respect to the latter, the work of station staff in providing guidance is being analyzed and systems to support such work are being developed. The objective of these initiatives is "providing accurate information to passengers."

1. Introduction

JR East positions "providing accurate information to passengers" as a concrete objective in the future development of the new train system e@train. Many requests that are actually received in the form of "Passenger Feedback" have to do with providing information and the trend in fiscal 2003 is for such requests to continue to increase (Figure 1).

Roughly speaking, there are two approaches to initiatives having to do with providing information to passengers. One is the method of providing an environment in which the passenger is able to obtain information personally. The other is the method of providing information through station staff.

As initiatives for providing an environment in which the passenger is able to obtain information personally, an experiment at stations in wireless Internet connectivity is currently underway in nine major stations in the Tokyo Metropolitan area. Currently, about 17,000 passengers are acting as monitors in the experiment.

On the other hand, in providing information through station staff, "Service managers" whose principal role is to provide guidance to passengers have been deployed at major stations since fiscal 1999. However, due to the diversification of passenger needs, more information support than in the past is becoming necessary.

JR East is working towards enhancing the provision of information to passengers through both these approaches.

2. Survey of Information Required in Providing Guidance at Stations

2.1 Overview of the Survey

In order to grasp the type of information that the passenger needs in a station, the following survey was conducted targeting service managers and information centers.

- What type of query is most often received?
  Also, the ease of responding to such queries.
  (Content and frequency of the query and difficulty of the response)
- What is being utilized in providing guidance? What would be useful in providing guidance?
- What difficulties are experienced in providing guidance?
The survey was conducted at nine stations and a total of 104 responses, 39 from service managers and 65 from staff at information centers, were retrieved.

2.2 Results of the Survey

2.2.1 Content and Frequency of Queries; Difficulty of the Response

The frequency of queries and evaluation of the difficulty of the response during normal operations are shown in Figure 2 and those during abnormal operations involving disruption of services are shown in Figure 3.

The evaluation points have been quantified with the frequency of the query evaluated using a 5-tier system and the difficulty of the response using a 3-tier system involving "simple, ordinary, difficult" where "simple = 1 point," "ordinary = 3 points," and "difficult = 5 points."

As a result, during normal operations, it is seen that the most frequent queries were those concerning guidance with respect to the station (railway facilities), guidance concerning areas in the vicinity of the station and timetable (JR lines). With respect to the difficulty of the response, there is tendency for queries that are frequently made to be simple to answer. Next, looking at the situation during abnormal operations, the most frequent queries were those concerning the status of operations, guidance on changing trains, and timetable and it can be seen that the difficulty of the response is high for these queries. In particular, during abnormal operations, it may be said that the demand for dynamic information related to accidents and that constantly changes with the changing status of the accident is high.

2.2.2 Materials and Sources of Information

The major sources of information in providing guidance were the timetable, station diagram, list of stores, map of the vicinity of the station, pamphlets on tourist attractions, pamphlets on discount tickets, Suica portable display, and other such materials. Moreover, listed as items that are useful in providing guidance were information terminals that clarify the status of trains during abnormal operations, information terminals with Internet connectivity, and railroad route diagram that provides easy access to time and distance information.

2.2.3 Difficulties being Experienced

Listed as queries that are difficult were queries having to do the inadequacy of information during abnormal operation, the extensive time required in checking routes involving multiple train changes, the fare between other stations, and other queries concerning matters other than the station at which the query is made. Also listed were queries having to do with matters other than the railway such as frequent searches for lost articles and guidance on facilities and stores in the vicinity (operating hours, items handled, etc.).

2.3 Circumstances with respect to Providing Information to Passengers

It is believed that for information that is in high demand among passengers, the formation of a scheme whereby the passenger is able to obtain the information personally will be effective. Moreover, for information that presents difficulty in response that is in high demand among passengers, a scheme for supporting station staff in providing such information is believed to be required. From these perspectives, research and development are being undertaken on the following matters:
3 Development of the Information Agent

3.1 Development Concept
While information is being provided to passengers in stations in a variety of manners, the current status is one in which “fragmentary information is being provided at diverse places”. Therefore a situation in which “one can get comprehensive information on the station and trains” has not been realized. On the other hand, looking at the environment of information in recent years, the widespread dissemination of mobile phones and personal computers has facilitated access to the Internet. This has made “obtaining desired information or required information through access to one’s own information source” pervasive. Given these circumstances, it is believed that creating an information environment of “a one stop source of information on the station and trains” in the station through easy-to-use information terminals is necessary.

For this reason, towards enhancing the services of the guidance function, a decision has been made to develop an information system called “information agent” whereby various contents are embedded in a dialog type agent to provide guidance and information using easy-to-understand expressions suitable for diverse passengers.

3.2 Overview of the Development

3.2.1 Hardware Configuration
As a system to be installed in stations to provide guidance and information services, it is believed that a design that attracts the eyes of numerous people and is familiar and symbolic is desirable. For this reason, the hardware shown in Figure 4 was developed as the prototype. By employing a streamlined form at the leg, the design allows passengers in wheelchairs to operate the system from the front without the legs getting in the way. The part used by the passenger in operating the system consists of an 18-inch touch panel liquid crystal display positioned at 120 degrees in three directions on the conical main unit. For each liquid crystal display, two microphones for speech recognition have been installed at the upper part of the display and through the use of two microphones, they have been made directional in order to eradicate background noise. Moreover, on both sides of the liquid crystal display, there are scroll controllers for scrolling the information displayed and on the left of the display, there is a speaker for providing guidance using voice synthesis. All operations may be performed using these simple interfaces and a “user friendly system” has been achieved that even people who are not adept at handling information equipment may use with facility. Moreover, a sign lamp and plasma display have been installed at the upper part of the main unit for providing information widely to passengers in the vicinity. The sign lamp can provide information on the status of operations with, for example, a green lamp lit when operations are normal and a red lamp lit when operations are abnormal. On the other hand, the plasma display may provide guidance information or display advertising.

3.2.2 System Configuration
Figure 5 shows the system configuration of the information agent. A speech recognition application that is equipped with a speech recognition engine is incorporated into the microphone. On the other hand, a voice synthesis application that converts text information into audio signals is incorporated into the speaker while a character display application is incorporated into the touch panel monitor. In the user interface application, the system grasps the information that the passenger is searching for based on condition obtained from such
input equipment as the touch panel, microphone, and scroll controllers and the details of the information are determined. Next, information search is undertaken targeting the content of the information and the results are displayed through such output devices as monitor or speaker. With respect to the content, development is being undertaken assuming that guidance on the station will be newly developed as local content while existing Internet content will be utilized for guidance on the vicinity of the station and the Intranet will be utilized for the timetable for the station.

3.2.3 Application

The software is configured so that the flow of guidance progresses with a mascot character providing easy to understand instructions in order to allow passengers who are not accustomed to information equipment to operate the system. By incorporating such interactive operability, the system aims to become one that creates the impression of being "fun to use" and "familiar" in addition to providing a function that allows "obtaining the desired information." The starting page of the software is shown in Figure 6.* In Figure 6, four buttons, one each for "Guide on the Station and Vicinity", "Guide on Changing Trains," "Station Timetable," and "Discount Tickets" that are assumed to be the content of the information agent have been deployed. However, at the present time only the "Guide on the Station and Vicinity" button for Shinjuku Station is operable. Moreover, in order to respond to multilingual needs, at the right side of Figure 6 there is a "Language Conversion" button for switching among the Japanese, English, Chinese, and Korean languages. Below the "Language Conversion" button are buttons for directly skipping to "Restroom," "Information Center," and "Station Office" that comprise guidance content that may require some urgency. Figure 7 shows the screen when "Guide on the Station and Vicinity" is selected in Figure 6. First, there is a list on the left side of the screen in which the content of the guidance has been categorized into various genres. In Figure 7, "Platform" has been selected as the genre. A guidance

*The copyright of the mascot character belongs to a company other than JR East.
diagram appears when the position is selected in the detailed content screen (Figure 8). Figure 8 shows the screen when "Restroom" has been selected. With emphasis on ease of understanding, the guidance diagram has been produced in 3D. In Figure 7, the detailed content screen may be scrolled up or down using the scroll controller. Alternatively, the user may speak the word "Restroom" into the microphone when the screen is in the Figure 7 state. The speech recognition application will then function and the guidance diagram of Figure 8 will appear without the need to make the selection using the touch panel. A total of 130 expressions for the 'Guide on the Station and Vicinity' content are registered in the speech recognition application. The application also has a function for dealing with synonyms (such as "restroom = toilet") or for eradicating unnecessary expressions (such as eradicating "Um" when the passenger says "Um, restroom"). Furthermore, when the 'Send to PDA' button at the upper right corner of the guidance screen in Figure 8 is pushed, the information may be downloaded to a mobile information terminal via the wireless LAN. Figure 9 shows the situation when the information has been transmitted to a PDA.

3.3 Future Schedule

In the future, the content will be fortified through the development of software for "Guidance on Changing Trains," "Station Timetable," and "Discount Tickets." Moreover, the rate of successful speech recognition will be enhanced in order to raise the integrity of the man-machine interface towards realizing a "system that allows the passenger to obtain the desired information without hassle."

4 Development of a Support System for Station Guidances

4.1 Background to and Overview of the Development

With respect to providing information via station staff, since fiscal 1999 Service Managers whose principal task is to provide guidance to passengers have been deployed at stations. In order to handle the diversified needs of passengers, even more information support than in the past has become necessary. For this reason, a support system for station guidances is currently being developed that supports operations by providing station staff with information and knowledge required to provide guidance to passengers.

4.2 Feasibility of Passenger Guidance using Information Terminals

In order to identify problems that may be encountered by station staff when using a PDA for obtaining information in actual operations and to obtain the opinions of such staff, content was produced for Tokyo Station. A feasibility study was conducted among the station staff as part of a review of a system that involves support for a function for PDAs to provide guidance as information terminals.

Figure 10 shows the system configuration used in this experiment. The local (Tokyo Station) communications infrastructure used was the same as the infrastructure used in the wireless station Internet connectivity experiment under way at the station. Moreover, with respect to information on operations and tickers, the scheme involved obtaining data from the existing company server. Table 1 shows the specifications of the Web server and information terminal used in the experiment.

With respect to content, in addition to information on operations and tickets for which demand is high, information on the station and manuals that in the past were carried in hard-copy form were digitized and added to the menu. The reason for this was to conduct an evaluation on searchability compared to the hard-copy version.

The design of the portal page of the content gave emphasis to the list format aspect of the menu. Figure 11 shows an example of content and a scene from the experiment.

The evaluation was undertaken through questionnaire surveys and hearings targeting station staff who participated in the feasibility test. Operations involving providing guidance may be roughly categorized into two types. The first type is one in which the questioner
(passenger) desires immediate response such as on the conditions of operation or information on facilities (immediate response type) and second type is one in which the questioner requests information on routes or comparative prices (consulting type). It was found that about 80% of questions are of the immediate response type, and through experiments, it was also found that if 10 seconds or more pass before a response is provided, the questioner tends to decide that "even the station staff don't know."

At Tokyo Station, the area of the wireless LAN does not cover the entire concourse and there were cases in which the mobile terminal of the target of the test who walks around the concourse providing guidance left the covered area and automatically went offline from the wireless LAN. For this reason, when searching for content, in many instances it was first necessary to log in to the wireless LAN. In guidance involving the immediate response type, this login operation proved to be troublesome. As a result, it become clear that as information support for responding to immediate response type queries, a system that ensures full time connectivity with real time updating of the content or providing notices based on changing conditions would be particularly effective.

Among consulting type queries, it was found that content that searches for routes involving train changes was effective. As an example of the scenario in the use of this content, reports were made on cases of consultation on the choice from among the two routes (via the Sobu Line or via the Keiyo Line) in travelling from Tokyo Station in the direction of the Boso peninsula.

With respect to existing hard-copy information that was digitized, in the case of the manual that has little data (such as responding to situations of confusion in services), no particular advantage through digitization was identified. However, for information on the station and vicinity (such as business hours of shops) involving voluminous data, it was advantageous to search by alphabetical order.

<table>
<thead>
<tr>
<th>Use</th>
<th>CPU</th>
<th>Memory</th>
<th>OS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server</td>
<td>Pentium III, 1.26GHz</td>
<td>1GB</td>
<td>Windows2000 Server</td>
</tr>
<tr>
<td>PDA for station personnel</td>
<td>StrongArm, 206Mhz</td>
<td>64MB</td>
<td>WindowsCE PocketPC2002</td>
</tr>
<tr>
<td>Wireless LAN</td>
<td>Compact Flash type wireless module conforming to IEEE802 11b</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Specifications of the Experiment System

As methods of providing information to passengers, research and development has been conducted from two approaches, the scheme of directly providing information to passengers and providing information via station staff. In the future, in addition to reviewing the integration of information tools used by station staff, in the method of providing information to passengers, a scheme that allows the individual to obtain the desired information in a timely manner will be researched and developed under the concept of ubiquitous availability.