2020 Airport/Station—Hospitality for Foreign Visitors at Airports and Train Stations

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Abstract

The number of foreign visitors to Japan is rapidly increasing, and determining how to provide information adapted to the needs of various nationalities in various languages has therefore become a critical issue. Accordingly, airports—the gateways of Japan—and train stations—key points along visitors' transit routes—will not only require technologies that enable easy access to information for foreign visitors but will also become places that showcase Japan's cutting-edge technologies around the world. In this article, we describe our collaborative efforts with various businesses to conduct demonstration tests in order to improve the way information is provided at airports and train stations.

Keywords: airport, station, showcase

1. Introduction

For visitors to Japan, differences in language and culture in matters such as eating and traveling in unfamiliar places cause a great deal of stress. Visitors may also have difficulty with transit routes, including the airports at which they just arrived and the connecting train stations to their target destinations, and thus, many problems remain to be solved. For example, the guidance information on most signs is limited to major languages such as Japanese and English. In addition, visitors cannot quickly think of their next means of transport and find out how to use it.

At NTT, we are targeting the year 2020 as we aim to solve the problems experienced by visitors at airports, train stations, sports stadiums, and other facilities. Namely, we hope to accommodate differences in cultures and achieve multilingualization of guidance information. We also hope to optimize guidance methods to ensure that visitors can transit smoothly in recognition of the fact that not only physical measures such as conventional human responses and signboard but also measures that utilize ICT (information and communication technology) are required. Moreover, we aim to provide innovative hospitality through user interface/user experience (UI/UX) design by utilizing cutting-edge technologies such as image analysis and big-data analysis. We are thus actively researching and developing such technologies in collaboration with various transport-terminal facility operators, related agencies of government ministries, and equipment manufacturers.

With airports, train stations, and their surrounding environments as target areas, demonstration tests were done in 2015 and 2016 in three locations: Haneda Airport International Passenger Terminal, the area around Tokyo Station, and commercial facilities around Namba Station in Osaka. The effectiveness of the technologies was evaluated, and problems involved in introducing the technologies were clarified.

Point-and-search guidance Projection signage Intelligent sound sign

Fig. 1. Collaborative tests at Haneda Airport International Passenger Terminal.

2. Demonstration tests at Haneda Airport

We carried out demonstrations of an upgraded universal design for providing information at Haneda Airport. We describe the tests and their results here.

2.1 Overview of collaborative tests

Haneda Airport International Passenger Terminal (international flights terminal) is based on the concept of universal design that involves user participation from the design stage. The airport combines *hard* features such as buildings and facilities and *soft* features such as human services and is one of the world's leading airports that achieves universal design with high dimensionality.

However, the environment is rapidly changing and exceeding expectations; examples of this include the recent rapid increase in visitors to Japan and the huge increase in the number of international flights in and out of Haneda Airport. Consequently, it is forecast that the existing hard and soft facilities will become insufficient in the near future, and new efforts aimed at reducing congestion and further accommodating multilingualization will be needed. It is difficult to address these issues with conventional fixed guidance signs and face-to-face guidance, so new methods of computerization that will help further improve accessibility and the customer experience of various airport users will be required.

In view of the above-described circumstances, NTT has been collaborating with Tokyo International Air Terminal Corporation to upgrade the airport's *information universal design*. In December 2015, NTT started demonstration tests [1] of the upgraded information universal design of the terminal with the following three services: (1) information provision in multiple languages by utilizing *point-and-search UI*; (2) congestion reduction by inducing people-flow through utilization of dynamic signs; and (3) clarification of audio guidance using speech processing technology (**Fig. 1**).

2.2 Technical points

(1) Information provision in multiple languages by utilizing point-and-search UI

This information-provision service utilizes angle-free object search technology developed by NTT. This service is based on a UI that acquires appropriate and useful information by enabling the user to intuitively point their smartphone's camera at advertising signs and guidance signs in the arrival lobby, at retail buildings in shopping areas, and at food samples and products in order to access information in situations where suitable keywords or inquiry methods cannot be thought of quickly. In these demonstration tests, actual feedback from the test targets—namely, foreign nationals—was evaluated, and challenges to be addressed in the future—that is, clarification of required information services—were identified.

(2) Congestion reduction by inducing people-flow through utilization of dynamic signs

This service helps people avoid congestion within facilities and induces the optimum flow of people by foreseeing the ever-changing state of congestion and dynamically varying guidance signs accordingly. Demonstration tests were carried out in 2015 in places where people tend to accumulate, for example, arrival lobbies and departure gates. In these tests, dynamic guidance signs utilizing projection mapping were provided, and their effectiveness was evaluated, knowledge about the most-appropriate presentation (e.g., signage, color, and timing) was acquired, and the effects of inducing people-flow were measured in terms of quantitative values.

(3) Clarification of audio guidance using speech processing technology

For visually impaired people who cannot easily gather information visually, sound plays an important role in helping them understand their surrounding environment. Accordingly, intelligent sound signs* were developed with the aim of supporting smooth transit of visually impaired people and utilizing a speech intelligibility enhancement technique developed by NTT. These signs provide guidance using a voice that can be heard easily even in noisy environments. They take their environment into account so that the sounds of the sign itself do not become unwanted noise in that environment. The effectiveness of these signs was demonstrated by measuring the hearing and movement of actual visually impaired people.

2.3 Future development

NTT aims to expand the above-described services as a case model for Haneda Airport and therefore collaborated with Panasonic Corporation, Tokyo International Air Terminal Corporation, and Japan Airport Terminal Co., Ltd. in establishing the Information UD Exploratory Committee for Airports (chairperson: Professor Tetsuo Akiyama of Chuo University) in November 2015. From now onwards, we plan to improve the individual technologies that were shown to be effective through the collaborative tests as well as to upgrade the visuospatial and audio designs across the entire airport and appeal to other businesses to join us as partners in collaborative testing.

3. Demonstration tests of seamless navigation near Tokyo Station

We describe here demonstration tests done at Tokyo Station to evaluate technologies designed to achieve seamless navigation.

3.1 Overview of demonstration tests

By the year 2020, thanks to advances such as the four-satellite-set of the Quasi-Zenith Satellite System (with the fourth satellite scheduled to be launched in 2018) and indoor positioning technology, the so-called high-accuracy positioning society will be realized. The Ministry of Land, Infrastructure, Transport and Tourism launched a project called the High-Accuracy Positioning Society Project. This project is involved in carrying out studies and demonstration tests on spatial-information infrastructure in order to produce various services by utilizing indoor and outdoor positioning technologies and mapping information, as well as the methods and systems for efficiently and effectively maintaining that infrastructure. The NTT Group aims to meet the demands of such a society and has therefore been part of this project since its inception and has been participating in the demonstration tests since 2014. NTT Service Evolution Laboratories is playing a key role in those tests [2].

At the Seamless Indoor/Outdoor Navigation Feasibility Tests near Tokyo Station, which were supported by the High-Accuracy Positioning Society Project, a pedestrian-movement support concept was proposed and demonstrated. In this concept, pedestrians acquire navigation information by using natural gestures rather than menus and buttons by simply pointing their smartphone at a target of interest while walking and holding their smartphone in the usual way [3]. Consequently, precise map information and the status of the positioning environment are applied to seamlessly connect indoor and outdoor environments.

3.2 Technical points

In these demonstration tests, two distinctive functions were created by applying NTT's parametric map platform technology and angle-free object search technology. These functions were a 2.5-dimensional (2.5D) map (flat plane + multiple floor levels), which presents indoor and outdoor maps and routes in a concise and unobstructed manner, and point-and-search guidance, which pinpoints the standing position of the user taking a photo and presents information related to the location of the sign or landmark that they photographed (**Fig. 2**). Moreover, when we applied actual map information to these functions and measured an on-site positioning environment, we gained a lot of knowledge and know-how through collaboration with external business vendors familiar with the indoor spaces and facilities of Tokyo Station and its environs and also familiar with the creation of map information.

3.3 Future development

Through these demonstration tests, the feasibility of these two functions (i.e., 2.5D-map display and point-and-search guidance) in an actual environment was verified. However, many issues—such as the need for a scheme for improving the instinctive understanding by 2.5D-map representation and measures for volatile positioning measurement and the

* Sound signs: To aid the transit of visually impaired people, guidance is given by providing information concerning toilet facilities, escalators, and other details in the form of sound (voice and audio).

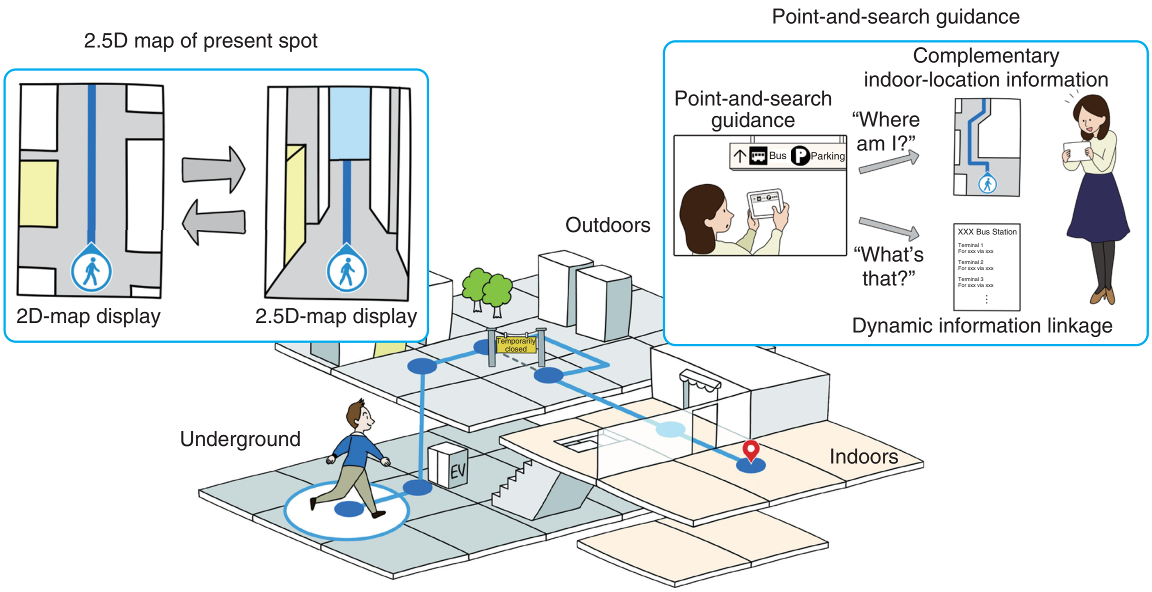


Fig. 2. Image of demonstration test of seamless indoor and outdoor navigation technology.

effects of noise—became apparent as a consequence of the actual environment. We will address these issues in technical developments as we continue our efforts in projects initiated in 2016.

4. Demonstration tests of O2O2O transmit-to-customer service

Here, we describe demonstration tests carried out on our transmit-to-customer service in the Namba area.

4.1 Overview of demonstration tests

Aiming towards 2020, NTT is continuing demonstration tests under a wide range of application scenarios ranging from transit guidance in airports, train stations, towns, and stadiums to drinking and eating, shopping, sightseeing, watching sports, going to the theatre, and appreciating art.

As a first step, in collaboration with Nankai Electric Railway Co., Ltd. and Takashimaya Company, Limited, NTT and NTT DATA conducted demonstration tests of O2O2O services in June 2016. Abbreviated as O2O2O, *out-of-home to online to offline* refers to a system for providing information (*online*) to users via signs outside of the home (OOH signs) and guiding them to their destinations (*offline*) based on that information. In these tests, when the users read an OOH sign via their smartphone with the downloaded app, they were able to receive information about nearby shopping facilities and to be guided to their destinations (**Fig. 3**).

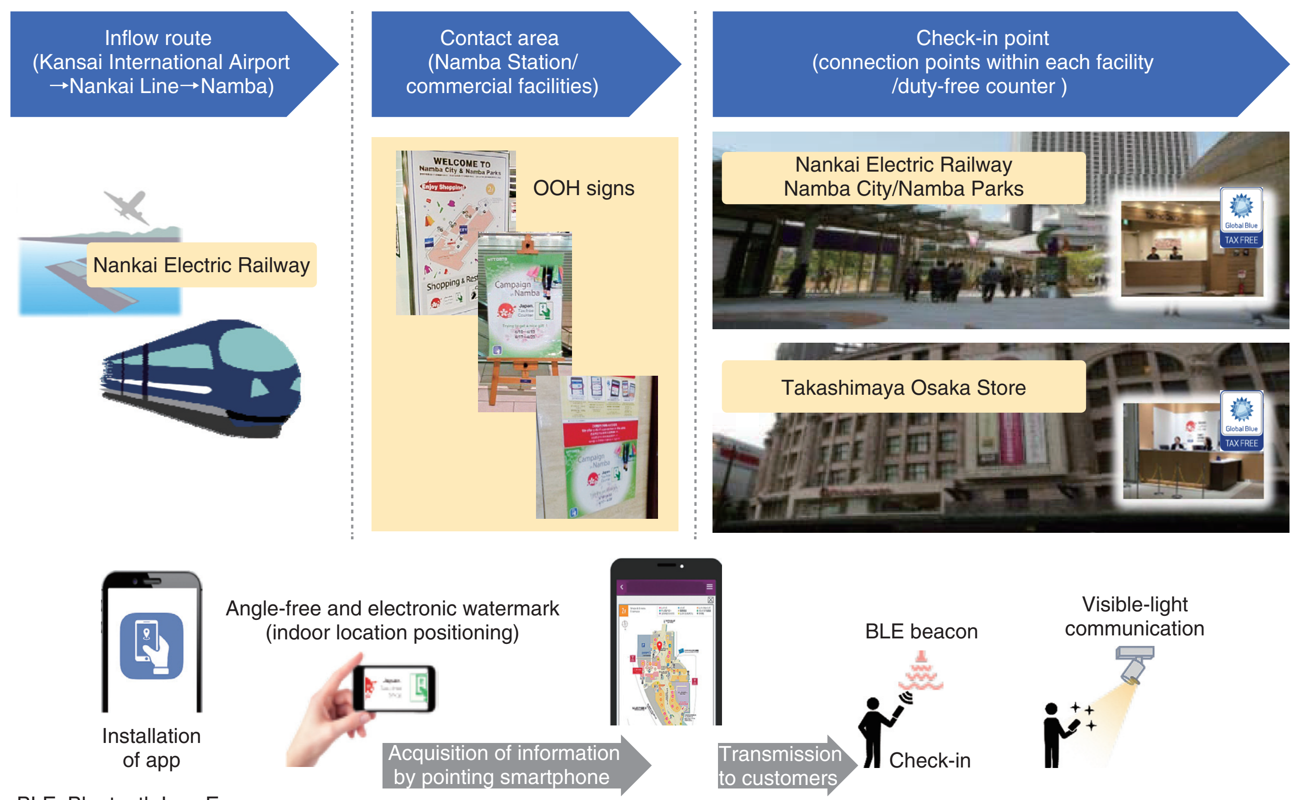
4.2 Technical points

A universal object-recognition platform developed by NTT is utilized for reading OOH signs (**Fig. 4**). In conjunction with an application programming interface, the universal object-recognition platform jointly controls various recognition tools, and it can be called up from various client apps. Its key features are summarized as follows.

- It is possible to widen the coverage of recognition targets (i.e., the number of targets can be increased).
- It is possible to increase the recognition rate compared to when each individual recognition tool is used individually.
- Multiple recognition targets can be processed in parallel simultaneously, so recognition results can be acquired instantaneously, achieving fast recognition speed.

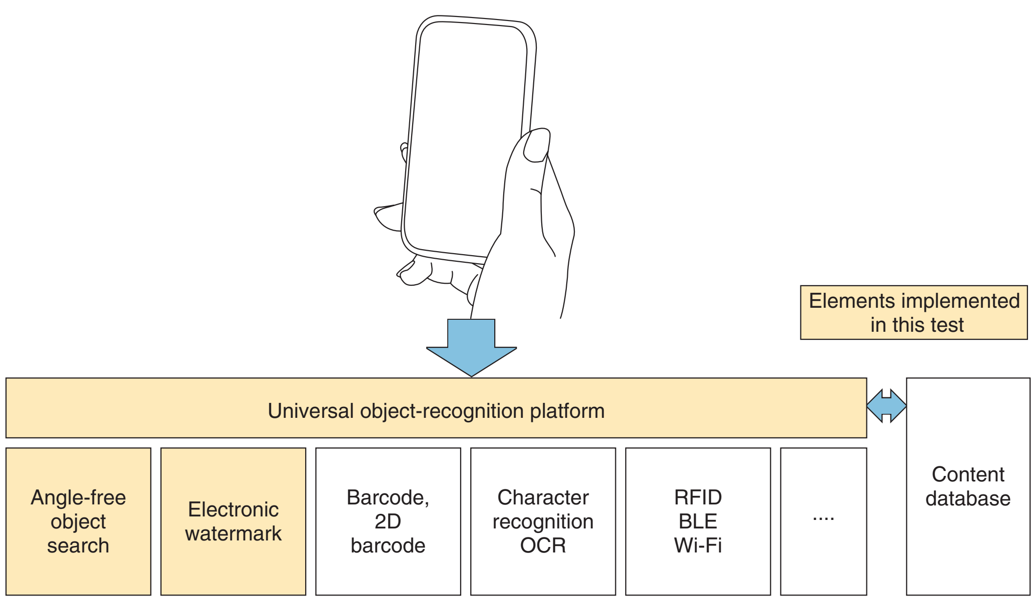
In the demonstration tests, electronic-watermarking technology and angle-free object search technology were applied to make it possible to recognize real logos, posters, and other images, to link to online content, and to acquire helpful information via a simple, instinctive operation.

OOH signs (**Fig. 5**) were prepared for the demonstration tests and set up in 12 locations around Namba Station and nearby shopping facilities in Osaka City,



BLE: Bluetooth Low Energy

Fig. 3. Image of demonstration tests performed in the Namba area.



OCR: optical character recognition
RFID: radio frequency identification

Fig. 4. Universal object-recognition platform.

Installed poster

Attachment of stickers to existing signboards

Fig. 5. OOH signs used in demonstration tests.

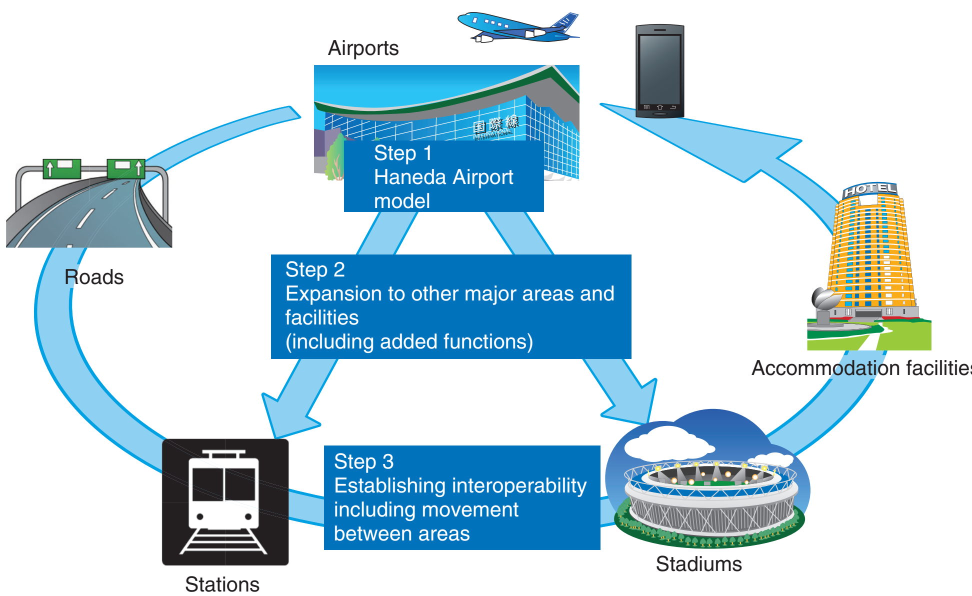


Fig. 6. Three steps involved in expanding hospitality services.

Japan. This service can be introduced by attaching a translucent sticker to existing promotional media such as posters and wall advertising; accordingly, it is possible to start operations without damaging existing designs. Among foreign visitors to Japan who had downloaded the app for events, about 60% acquired information from OOH signs, and it was confirmed that about 20% of them actually visited the place they received guidance to.

4.3 Future development

The NTT Group is planning to carry out new technical development and demonstration tests aiming toward 2020. It is also focusing on commercializing and introducing point-and-search UI using universal object-recognition technology while calling for new business partners to collaborate in experimental trials.

5. Goals targeting 2020

Goals have been set to commercialize services for providing transit guidance and information to foreign visitors to Japan. Three steps are involved in achieving these goals (**Fig. 6**). The first step consisted of conducting demonstration tests at airports, as described earlier. The second step involved carrying out demonstration tests at train stations and their surrounding facilities. For visitors in the future, however, it is unrealistic to require all tourists to master each app and the UI/UX design for different sites.

In the third and future step, through co-innovation involving various stakeholders, we will establish interoperability, including movement between areas, and provide hospitality services with a sense of uniformity in order to achieve total information support covering sequential travel actions—from arrival at the airport to returning to the airport.

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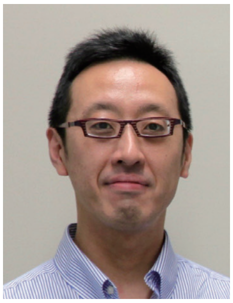

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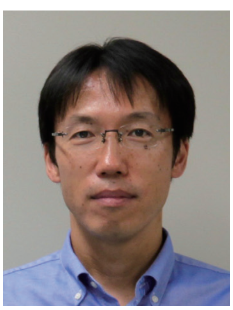

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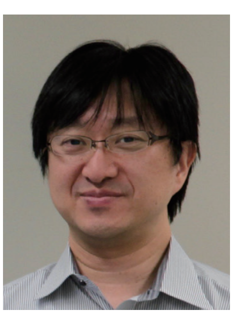

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