NTT Group Activities in Transportation × ICT

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Abstract

The NTT Group is promoting collaboration with partners in fields where information and communication technology will be further exploited. The Feature Articles in this issue introduce our collaborations with members of the transportation industry and the technologies being applied in these collaborations.

Keywords: transportation, seamless, diversity

1. Introduction

In January 2016, CES (Consumer Electronics Show) 2016, the world's largest home appliance exhibition for consumers, was held in Las Vegas. This annual event is sponsored by the Consumer Electronics Association. Whereas CES's main focus had conventionally been on television and audio/visual appliances, in recent years the spotlight has been shifting to devices that are connected to networks such as wearable devices and sensors (i.e., Internet of Things (IoT)). While this trend is ongoing, CES 2016 also saw many mobility-related exhibits such as vehicle-related devices and drones. For example, one exhibit demonstrated how vehicles that had bumped against each other learned to avoid collisions and yield the right-of-way to each other. This seems to point to a future world in which a variety of moving objects become intelligent through being connected to a network and thereby learn to optimize their behavior.

In Japan, the population aging ratio (ratio of those aged 65 or older to the entire population) was under 10% in 1980, but by October 2014, it had soared to 26%, and it is expected to exceed 30% by 2025 [1]. In such a super-aging society, there is a pressing need to exploit information and communication technology (ICT) and software infrastructure in addition to strengthen the hardware infrastructure in order to support the formation of the *super-mega-region* and the development of compact cities and the related connectivity innovation [2].

The number of visitors to Japan from abroad has been increasing dramatically year by year, reaching 19.73 million in 2015 [3]. In response, the government raised its target for the annual number of international visitors by 2020 from 20 million to 40 million. Since such an explosive increase in overseas visitor numbers will give rise to congestion in transportation systems and tourist spots, there is an urgent need to reinforce the country's hardware and software environments in order to welcome these visitors.

As the environment surrounding transportation changes, new technologies have been developed, but various issues have also arisen.

2. NTT Group activities in transportation × ICT

The role of information and communication providers is changing. The NTT Group regards ICT as a catalyst for such change and seeks to enhance the value of various fields and industries. We have selected strategic target fields including transportation, agriculture, medical care, urban development, and tourism. In the transportation field, the group is pressing ahead with activities to further exploit ICT (transportation × ICT).

Among the group's transportation × ICT activities, this article focuses on achieving *diversity navigation* [4], which targets people in motion in light of the super-aging society and the increasing number of international visitors, and optimizes people's mobility by seamlessly connecting various means of
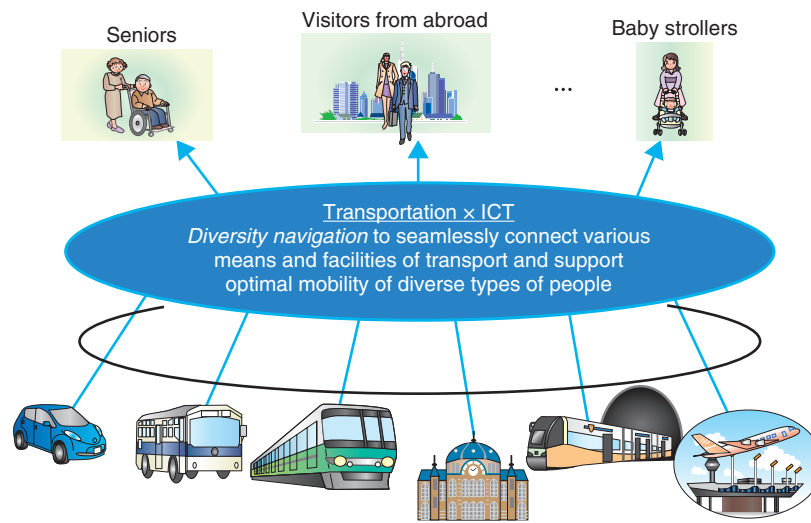
Fig. 1.   Direction of transportation × ICT.

transportation and mobility (**Fig. 1**).

3.   Seamless transportation

When people move from point A to point B, they use a combination of different means of transportation. They may walk, drive their own cars, take a bus, taxi, train, or airplane, or go sightseeing in a personal mobility vehicle or on a shared bicycle. Advances in the means of transportation are making it increasingly difficult to determine the best combination. This issue is particularly serious for seniors and visitors from abroad. Beyond the obvious language problems, it is difficult to determine where the required information can be found. The degree of detail and the means of information presentation vary from one transportation provider to another. There are no links between items of information that different providers offer. The manner of representing transportation facilities (e.g., train stations) on maps varies from facility to facility, and maps are not connected to one other. Taken together, these discrepancies constitute a substantial barrier to mobility. Consequently, we believe that it is extremely important to make the various means of transportation, information about facilities offered by transportation providers, and transportation services seamless through the power of ICT.

4.   Diversity navigation

It is not only seniors and international visitors who encounter mobility barriers. So, too, do pregnant women, small children, injured persons, people carrying heavy baggage, and those who are physically impaired (handicapped in respect of mobility, vision, hearing, etc.). The needs of these people are so diverse that it is not always possible to meet them solely with equipment, appliances, physical assistance, or hospitable behavior. It is necessary to use ICT to assist these people, in addition to making transportation seamless.

For example, when it comes to serving overseas visitors, it is difficult to have direction signs at stations provide information in over 100 languages, or for station employees to speak as many languages. It will be effective to provide multi-lingual support using ICT. We call the presentation of information adapted to diverse human needs and optimal mobility support diversity navigation, and we are developing relevant technologies and promoting the provision of relevant services.

5.   Applied technologies

What kinds of technologies are required to achieve seamless transportation and diversity navigation (**Fig. 2**)? First, seamless digital maps are needed in order to sort out various items of information needed for mobility. The more diverse and sophisticated the movements of people and objects become, the higher the degree of accuracy required of digital maps for use in navigation and control. Furthermore, in order to be able to provide navigation and control that are
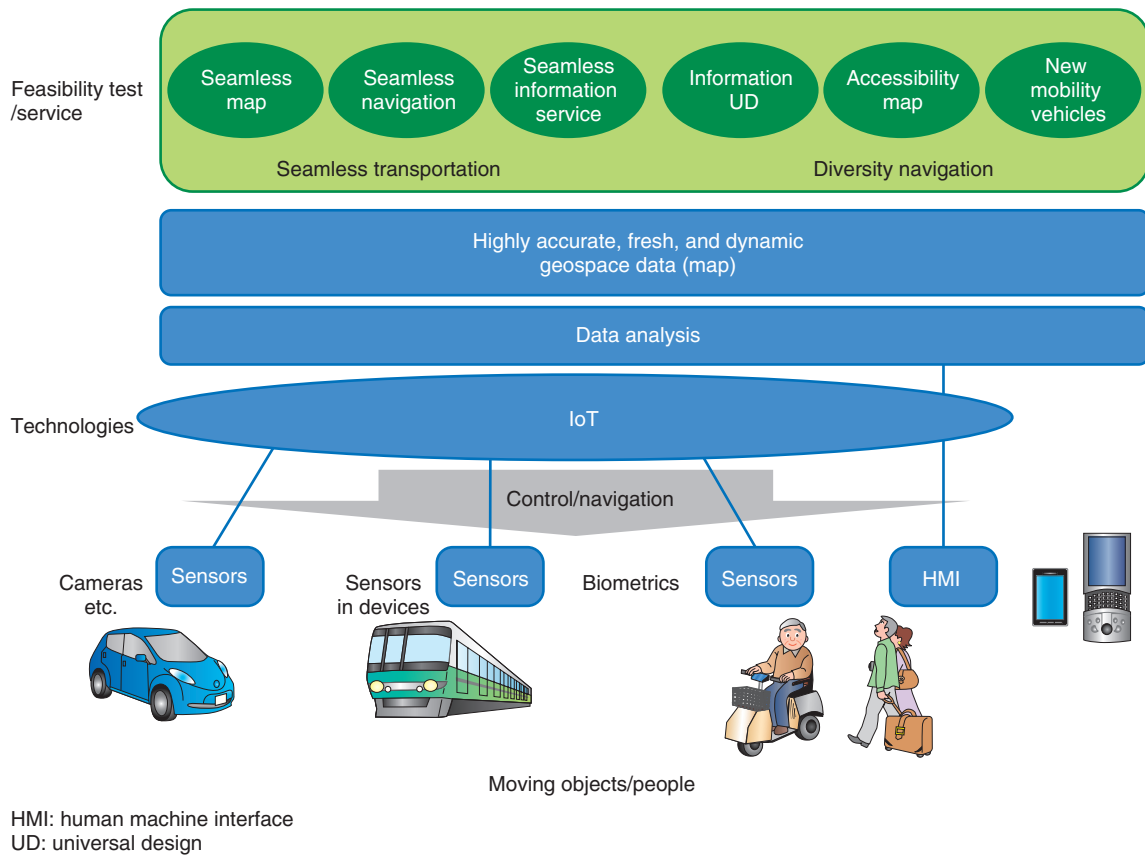
Fig. 2.   Technologies that support transportation × ICT and feasibility tests/services.

optimal for the moment, we need fresh (up-to-date), dynamically changing information for the relevant place. It would be more appropriate to call such information *geospace data* rather than a map.

Next, in order to be able to dynamically add information to geospace data, we need sensors that monitor people and their environments, a network for collecting sensor data (IoT), and data analysis technology that understands and predicts people's intentions, situations, and environment from the collected sensor data. Here, sensors include positioning mechanisms to pinpoint locations, which are important for mobility, in addition to those that monitor biometrics, cameras, and device sensors.

Then, in order to be able to provide information and navigation that are appropriate for the particular person or situation, the human machine interface (HMI) is important. To provide a better HMI, we are upgrading various technologies such as smartphones, digital signage, virtual reality, audio, and vibration technologies, and studying optimal combinations of these.

6.   Feasibility tests

In parallel with the above-mentioned technological development, the NTT Group is carrying out feasibility tests and providing new services in collaboration with partners in the transportation field. We are participating in the Seamless Indoor/Outdoor Navigation Feasibility Test near Tokyo Station [5] and developing advanced technologies in this area in order to achieve seamless transportation [6]. We are developing seamless information services to be provided on trains and at stations [7] and are conducting a joint experiment to upgrade the universal design of information at Haneda Airport [8]. We are also developing technologies for creating accessibility maps with citizen participation and have carried out experiments on these technologies [9]. We recently ran a feasibility test of a personal agent designed to achieve a new type of mobility [10].

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7. Toward mobility as a service

It is being projected that self-driving vehicles will become a reality in the 2020s. When vehicles and other objects that move about become extremely sophisticated, what will the whole transportation system be like? Some people suggest that vehicles will become more autonomous as they become self-driving, and that the sharing economy, represented by ride sharing, will penetrate society [11]. This trend would appear to indicate that transportation systems will soon become a seamless service. In such a world, all means of transportation will be connected seamlessly and will be controlled in a globally optimal manner. People will be able to use diverse means of transportation at will, whenever and to whatever extent they require. In October 2015, the Mobility as a Service Alliance initiative [12] was established in Europe. This is certainly aimed at that type of world.

In light of this trend, the NTT Group, building on the strength of having seamlessly connected and operated networks of world-wide telecommunications providers, will accelerate collaboration with transportation-related partners and thereby contribute to the development of the transportation field.

The Feature Articles in this issue introduce the technologies that support the NTT Group's activities on transportation × ICT, feasibility tests of transportation-related facilities centering on support for pedestrian mobility, and activities on transportation-related services that are being commercially provided.

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