Transit System Smart Card Solutions and Future Prospects

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Abstract

More than 100 million transit system smart cards have been issued in Japan to date and their usage rate in the Tokyo Metropolitan Area has surpassed 90 percent. Transit system smart cards have been established as a new type of social infrastructure that supports many different needs and lifestyles. At NEC, since the introduction of Suica, we have been leveraging our ICT technology to advance smart card development, while deploying our systems nationwide and building new value into this rapidly progressing technology. More progress is anticipated as we head towards 2020 and demand is expected to increase rapidly as newly emerging economies invest in modern public transportation infrastructure. By taking advantage of what we have already learned, we hope to promote and support the expansion of transit system smart card technology both in Japan and overseas, thereby helping to build the social infrastructure that provides the foundation for greater public wealth and comfort.

Keywords

transit system smart card, regional revitalization, overseas deployment, public transportation, social solution

1. Introduction

The number of transit system smart cards issued in Japan has already topped 100 million, creating a social infrastructure that has permeated the everyday lives of everyone who uses public transportation systems such as railways and buses. They also serve as stored-value cards. Transit system smart cards introduced for use in major cities and railways have now achieved mutually accepted nationwide usage in 2013 - making it possible to ride almost all railways and buses in major cities across Japan using just one card, thereby significantly improving convenience. This trend towards smart card use is also beginning to pick up in smaller towns and cities throughout Japan, as well as overseas.

The Ministry of Land, Infrastructure, Transport and Tourism announced that nationwide mutually accepted smart cards will be usable in all prefectures by FY 2020. Full details on the project are contained in the "Basic Plan on Transport Policy" set forth by the Cabinet in February 2015. This has spurred prefectures to move rapidly toward adoption of smart cards.

In the meantime, the government is actively promoting the export of Japan's world-leading railway engineering technology to overseas markets. Thanks to the rapid popularization of automobiles that has accompanied economic development, many newly emerging economies in Asia suffer from significant traffic congestion and air pollution. To combat these problems and reduce environmental stress, many countries have tied development loans to related projects. Funding from international development financial organizations such as the World Bank and Asian Development Bank has also been targeted at the completion of MRT (Mass Rapid Transit) and BRT (Bus Rapid Transit) systems. In synchronize with the completion of these public transportation systems, the introduction of transit system smart cards is also moving forward.

2. Our Commitment to Transit System Smart Cards So Far

From the launch of Suica in 2001 through 2014, NEC participated in several construction projects and was involved in the development and deployment of 9 transit system smart card brands. NEC's contribution centers on the development of backbone systems ranging from center servers and station servers. The center server manages the life cycle of the smart card from its issuance to scrapping, while the station server handles storage and distribution of data between devices. The overview is shown in **Fig. 1**.

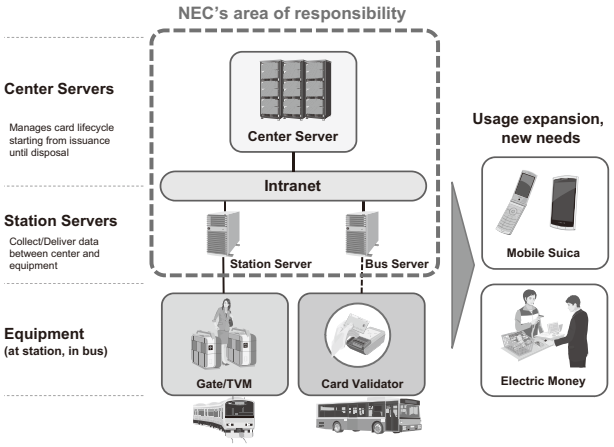

Fig. 1 Conceptual illustration of overall transit system smart card system.

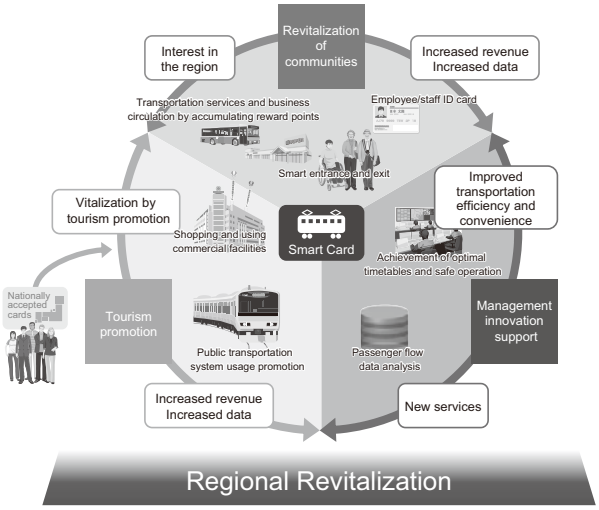

Fig. 2 Smart card that contributes to regional revitalization.

As the evolution of smart cards continues, NEC is actively involved in developing new solutions to meet diversifying needs and applications for transit system smart cards.

Representative examples are stored-value cards that can be used for payment at station kiosks and convenience stores as well as Mobile Suica, which allows mobile phones and smartphones incorporating the FeliCa chip to be used as mobile passenger tickets and stored-value cards. As Mobile Suica can be reloaded anywhere, it is playing a major role in helping to expand usage.

3. Commitment to New Markets

3.1 Commitment to Local Communities in Japan

Throughout Japan, many communities are suffering from the combined effects of an aging population and a declining birthrate. Trying to find ways to revitalize the economy under such circumstances has become a vital issue. Similarly, public transportation systems now find themselves forced to find ways to curb or offset declining ridership, as well as to encourage visitors from outside of the community to use local public transport systems, rather than relying on rental cars and taxis.

To address these problems, NEC is promoting the introduction of smart card systems that allow visitors to use their nationally accepted cards to ride local transit, while offering more convenience for local residents. The convenience of smart cards can be further increased by not restricting their usage to transportation applications, and linking them to stored-value cards and other services. Moreover, NEC believes that smart cards can contribute to the revitalization of local economies, thereby playing a major role in the rebuilding of local regions by facilitating the redesign of public transportation systems and the creation of new services through the analysis of smart card usage data (**Fig. 2**).

To contribute to local economic revitalization, NEC designed a smart card system for the regional promotion of Kumamoto Prefecture, called the Kumamon no IC CARD.

Kumamoto's economy has been particularly hard hit by the combination of aging population and declining birthrate, which has led to declining revenues not only for local transportation companies operating trains and buses, but also for commercial businesses such as retail establishments. Finding ways of overcoming these problems and revitalizing the economy has become a major focus of local leaders. Meanwhile, a separate but related issue was the obsolescence of the magnetic cards used as passenger tickets by transportation companies. The introduction of the smart card was seen as a way of solving these problems.

Accepted by buses and trains operated by the five transportation companies in Kumamoto Prefecture, the Kumamon no IC CARD can also be used as stored-value cards at authorized shops. While functioning as a commuter pass, the Kumamon no IC CARD also features promotional functions such as reward card and coupon card, making it popular with an increasing number of users.

Moreover, as one of the prefecture's goals is to attract more tourists, we are building a system that will make it possible to use nationally accepted cards in Kumamoto Prefecture. This is something that NEC's strength with extensive experience in building system becomes advantage to accomplish such project.

As we have seen, to help create an autonomous and sustainable society, NEC is building systems to facilitate the introduction of smart cards that cater to the unique characteristics of each region, while maintaining universal usability.

3.2 Commitment to Overseas Deployment

In its 2015 mid-term management plan, NEC announced that, as part of its growth strategy, the company would contribute to

the construction of new national infrastructure to help strengthen the foundations of Japan's society and economy, while at the same time promoting overseas deployment. In line with this strategy, NEC is working to strengthen its ICT businesses in the transportation sector. To promote its ICT technology in emerging countries in Asia, NEC is focusing on the theme of meeting the advanced needs that accompany urbanization.

While Japan's transportation infrastructure has already reached maturation, emerging countries are following in Japan's footsteps, and are just now entering the phase of rapid economic growth (**Fig. 3**). However, these newly emerging economies are growing much faster than Japan did. Whereas the Japanese railways started with paper passenger tickets, their counterparts in Asia's emerging countries are going straight to contactless smart cards. We are confident that we can leverage our experience in Japan's transportation infrastructure to make a meaningful contribution to the growth and modernization of Asia's emerging countries.

With a view to reducing cost and improving convenience while preventing losses caused by fare evasion, public transportation systems under development in emerging countries are expected to adopt an automatic fare collection system (AFCS) that uses contactless smart cards - a system already widely used in Japan's mass transit systems.

NEC has been involved in the development of transit system smart cards in Japan for many years. During that time, we have achieved many successes and acquired extensive know-how. We believe that NEC's AFCS can meet the needs of public transportation systems in emerging countries in Asia.

As an example, the joint venture of NEC and Katahira & Engineers International received an order as a technical cooperation project, from the Japan International Cooperation Agency and Pakistan for an integrating transport ticketing system in Dhaka City in October 2014.

In conjunction with the Dhaka Transport Coordination Authority and local software development firms, we are developing an AFCS that will issue smart cards, manage its IDs, and handle payments, creating an environment in which common contactless smart cards can be used across Dhaka's public transportation systems, including the city's existing buses as well as planned MRT and BRT systems. At the same time, we will be applying the know-how and technology we have gained in Japan to the design of contactless smart card, AFCS.

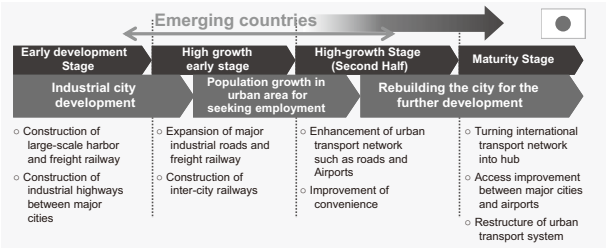

Fig. 3 Growth stages of countries and needs for transport infrastructure.

Facilitated by international development financial organizations, AFCS are being realized in Vietnam and India. We are aggressively participating the tender to solve challenges Asia's emerging countries are facing.

This will help us promote and disseminate our technology throughout Asia, helping to strengthen our social solution businesses in Asia - the objective set forth in NEC's 2015 mid-to-long-term management plan. In so doing, we expect to successfully achieve the proportional target of overseas sales.

4. Future Development

As we have seen, NEC has achieved significant success in the development of transit system smart card solutions both in Japan and overseas. As part of its 2015 mid-term management plan, NEC is putting an emphasis on solutions for society, as well as on expansion in Asia and the promotion of locally oriented businesses. We believe that the transit system smart card solutions are exactly the way to support the advancement of social infrastructure.

We are confident that these solutions will provide an effective means of ameliorating various social issues both in Japan and overseas. In Japan, we will support the revitalization of society and economy, with a special focus on 2020, while striving to help improve the public transport system infrastructure to aid in regional revitalization. Overseas, we will focus on emerging countries - particularly in Asia - that are achieving remarkable growth, by enhancing our sensitivity to local needs and accelerating our businesses. The following are three areas where we are actively working towards the future.

(1) Expanding transit system smart cards usage in Japan

The elimination of areas where transit system smart cards cannot be used is stated as one of the goals of the "Basic Plan on Transport Policy" announced by the Japanese Cabinet in February 2015. Taking advantage of our experience in designing smart card systems in regional cities in Japan, as well as in building national card systems, NEC will continue to help introduce systems in regions where transit system smart cards have not yet been introduced and/or where compatibility with nationally accepted cards does not exist yet. We are planning to strengthen our efforts to expand the convenience of transit system infrastructure by making it possible to use transit system smart cards anywhere in Japan.

To achieve this, we are planning the construction of a service that offers a one-side usage environment for nationally accepted cards in public transportation smart card systems introduced independently by local regions. Not only will this expand the range of services available with local transit system smart cards, but it will also expand

the areas where the nationally accepted cards can be used.

(2) Towards 2020

We will improve the convenience of transit system smart cards to support the regional revitalization discussed in 3-1 above and to meet the needs of foreign tourists, whose numbers are expected to increase as 2020 approaches. In addition to conventional payment functions such as using public transportation systems and as stored-value cards, we also diversify its service and increase the number of places where transit system smart cards can be used, such as digital tickets and as entrance and exit of buildings.

To accomplish this goal, we are trying to achieve a system that can adapt to any situation that might be encountered in daily life by adopting account-based system rather card-based system. Account-based system can accept multiple media, such as wearable media and even biometrics. We will conduct research to help determine which media is best suited to different applications and that is more closely in synchronize with how people live their lives.

(3) Emerging countries in Asia

In Asia's emerging countries, construction of public transportation systems such as MRT and BRT is now underway. The leading-edge technological prowess in transit system smart cards that NEC has already established in Japan will be deployed in Asia's emerging countries. We are confident that this technology is the key to solving a number of local issues.

In the future, it is possible that an internationally accepted public transportation smart card system will be established throughout Asia, including Japan. This means that transit system smart cards used in Japan on a daily basis will be able to be also used overseas, adding even more convenience.

To achieve this goal, various issues have to be dealt with first. These include the compatibility of cards, assurance of security, and foreign exchange. We are confident that these issues can be solved, and will work hard to help facilitate the successful achievement of an international smart card system that supports economic vitalization, efficiency improvement, and fairness on a global level.

NEC is committed to helping build public transportation infrastructure with high added value on a global level by utilizing our extensive ICT assets such as big data analysis technology, image recognition technology, and authentication technology, in addition to the accomplishments in transit system smart card design and system operation that we have already achieved. We will continue to strive to build a brighter future, while working in concert with people around the world.

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