Deployment of Eye-Catching, Visually Appealing Flight Information Systems

KANAI Takeshi, AKAMATSU Manabu, HADA Yukitake, OKAMOTO Masashi, TARUKI Kazuya, HIRABARA Maho

Abstract

As the world becomes ever more interconnected, emerging markets and urbanization are driving continuous growth in air traffic. With demand for air transportation soaring, airports are no longer mere facilities where passengers embark or disembark from aircraft. Instead, they now offer a wide range of amenities designed to appeal to passengers in transit, including entertainment services, bars, restaurants, and mini shopping malls. Given these trends, it is more important than ever to equip airports with display systems that can effectively deliver a variety of multimedia information to passengers in a visually appealing, eye-catching format. For many years, NEC has been developing information display systems that focus on flight information systems at airports. In this paper, we will examine those systems and discuss NEC's commitment to continued development in this field.

Keywords

FIS, universal design, thin client, field sequential, digital signage, large display panel

1. Introduction

A flight information system (FIS) is a system that provides primarily flight information via video and audio systems installed throughout the airport where they can easily reach passengers, staff, and visitors. Using visual means such as large display panels and display monitors as well as audio means such as automated public announcement, these systems also provide a variety of other pertinent airport and flight-related information such as access traffic information, weather reports, advertisements, etc.

Demand for air transportation increases every year, and the number of air travelers in Japan is expected to increase from 278.1 million in 2012 to 333.9 million in 2027. Additionally, the rise of low-cost carriers (LCCs) and increased use of small-to-medium aircraft has resulted in a rapid rise in the number of flights that take off and land at airports.

Against this background, intensification of competition between airports and commercialization of airport facilities are underway, resulting in what could be called "information congestion" at airports, making it difficult to effectively deliver the appropriate information at the appropriate time and place. Today, flight information systems need not only to be more widely distributed throughout the airport facilities, they must also go beyond the provision merely of flight information, displaying a variety of other multimedia information, as well. With all of these developments, FIS is becoming more important every year.

Since its first full-fledged system introduction at Narita Airport Terminal 2 in 1992, NEC has installed state-of-the-art FIS systems at sixteen Japanese airports including Shin-Chitose, Haneda International, Fukuoka, Sendai, and Niigata and one overseas airport (Iloilo International Airport, Philippines).

A system that was originally intended only to provide text information using LED and CRT monitors is now transforming into a multimedia display system centering on LCD monitors.

In this paper we will review the various component technologies that NEC has developed and refined based on its extensive experience in FIS system delivery and show how these have made it possible for NEC to develop leading-edge contemporary FIS systems for use in modern airports, as well as underlining the company's commitment to the ongoing development of the FIS.

2. Features Required for FIS

The following features are required for FIS.

(1) Highly reliable central server

It goes without saying that flight information is crucial to the operation of an airport. If the system is brought down by a server crash, the impact on passengers and airport staff could be extremely serious. Consequently, the central server at the core of the FIS system must be highly reliable, with the ability to handle high data loads without experiencing downs or crashes.

(2) Display panel design with high visibility

A high-visibility design is required for FIS system, one that fully takes into consideration the principles of Universal Design, ensuring barrier-free access to all information regardless of age, sex, or physical ability. This will allow everyone to understand the provided information.

(3) Expandability and flexibility of display design

In order to effectively guide passengers, display content and display timing need to be optimized according to the construction of the passenger terminal building; thus, the display panels need to be flexible enough and expandable enough to enable the display content to be changed as required depending on the installation location.

(4) Easy maintenance design to enable rapid recovery in the event of a failure

At a large airport, hundreds of different display panels are typically installed at various locations throughout the facility. In order to ensure reliable information delivery, these displays must be properly and efficiently maintained. Ease of maintenance is also required in the event of failure so that the displays can be restored to operation as quickly as possible in order to minimize passenger inconvenience.

(5) Secondary use as symbols or landmarks

The large display panels incorporated in the FIS also serve as symbols or landmarks, as well as providing information. Recently, as FIS systems have become more integrated with digital signage, they are being used to help enhance the mood of travelers and deliver advertising.

(6) Construction of systems without affecting airport operation

When updating an FIS system, it is necessary to perform construction work and alterations efficiently and safely for extended periods of time during the night after the airport is closed.

3. NEC's Commitment

NEC's commitment to the requirements described in Chapter 2 is introduced below.

3.1 Technology to Improve the Reliability of the Central Server

(1) Quad configuration employed for the central server

To optimize reliability, the central server normally features a redundant configuration (duplication) using two

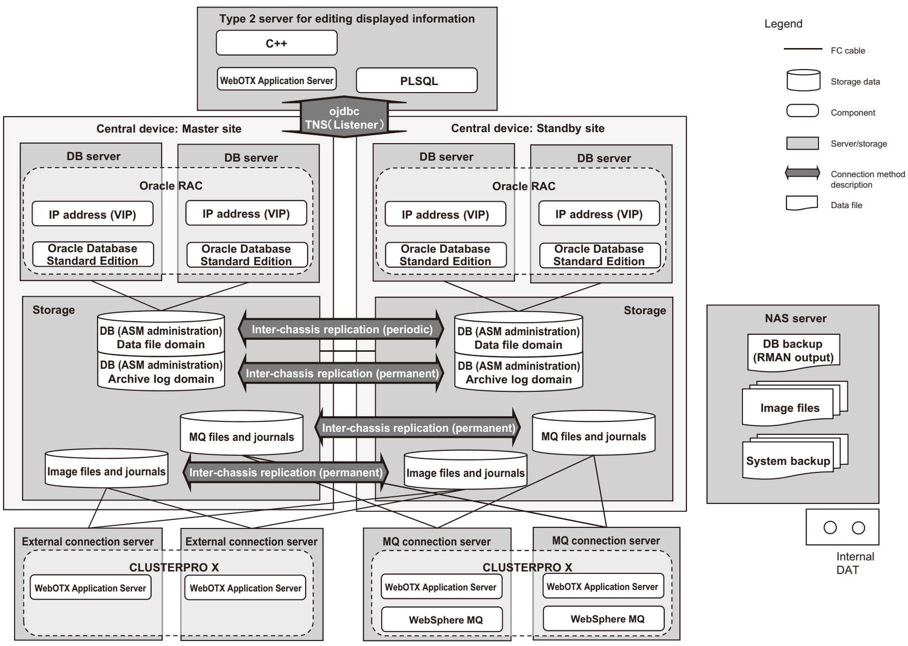

Fig. 1 Schematic diagram of quad configuration central server.

Oracle RAC databases. Although this is generally sufficient, the center server employs a quad configuration for airports that demand even higher levels of reliability, with a duplex system configuring incorporating two active and two standby systems (**Fig. 1**). This significantly reduces the chances of any interruption in operation by switching to the standby system even if any failure occurs in the shared disk (iStorage).

(2) Local backup function

The local backup function serves to keep operation inside the local network by directly sending commands from an input/output terminal without passing through the central server. This ensures continued operation even if the central server is down and the shared network is not usable.

A conceptual diagram of its operation is shown in **Fig. 2**. Under normal conditions, the input/output terminals used for the local display are connected to the central server, and the latest flight information is stored in the terminal. When a failure occurs in the central server or shared network, the input/output terminal used for the local display is switched to connect to the local network, and the system operation can be continued by sending commands to display information directly from the input/output terminal.

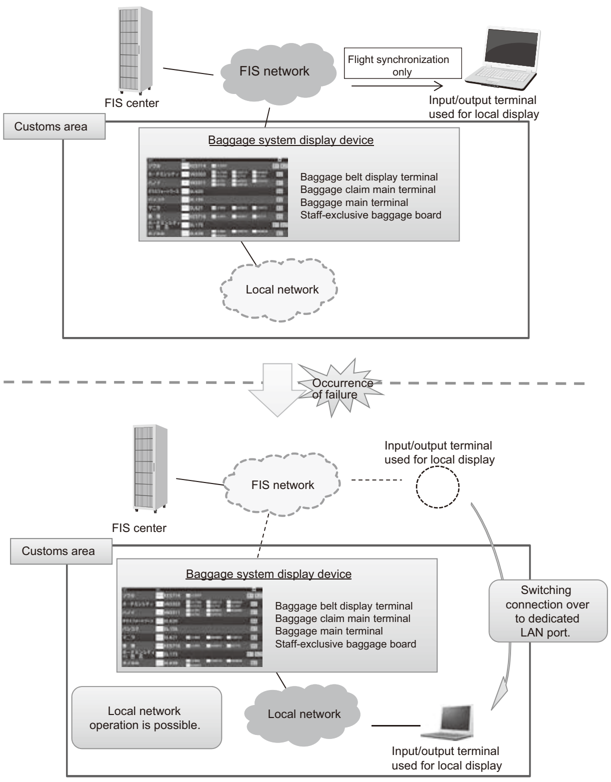

Fig. 2 Conceptual diagram local backup function.

3.2 Measures to Improve Visibility

(1) Large display panels

The number of dots per character on a large display panel is usually 16 x 16 pixels or 24 x 24 pixels. Because large displays don't have as many pixels as conventional displays, the visual capabilities of large display panels are limited. NEC is developing unique designs for a large display panel in order to achieve optimized expressive capabilities even with limited number of dots, which also take into consideration the panel installation conditions and also Universal Design standards (**Fig. 3** and **Fig. 4**).

(2) Display monitors

Meeting the standards of Universal Design is essential for FIS systems as they are used by a wide range of people, such as the elderly, disabled, children, and foreigners. Supported by NEC Management Partner with expertise in user-centered design (UCD), NEC is developing more attractive and easier-to-understand displays.

Not only have we made efforts to develop display configurations that provide information in an attractive and intuitive way that is accessible to anyone, but we have also

Fig. 3 Design example (16 x 16 pixels per character).

Fig. 4 Installation example.

adopted the UD (Universal Design) font which features excellent visibility with appropriate type sizes and color contrast in consideration of elderly and disabled. Moreover, in accordance with the principles of Color Universal Design, which emphasizes important information for people with various types of vision, colors have also been selected and arranged based on how they are perceived by different types of color vision.

Fig. 5 shows how the display looks according to the type of color vision.

Operators enter data on the display terminal screens while confirming the display image, and such operation is allowed also on the operation terminal screens. By enabling data entry using intuitive mouse-based operation while confirming the displayed images, this system improves usability for airport and airline staff.

Fig. 5 Comparison of how screen appears depending on color vision.

3.3 Expandability and Flexibility of Display Design

Display designs (layouts, display timings, etc.) for display panels are defined in XML files, facilitating horizontal or vertical display depending on installation situations, and maximizing design flexibility.

The display editing tool shown in **Fig. 6** allows the display design to be edited via a GUI (Graphical User Interface) and output to XML files, allowing the system to be easily adapted to meet the specific requirements of different airports.

3.4 Easy Maintenance Design

(1) Easy maintenance made possible by thin-client system

Windows-based control PCs are used for display control of the display monitors. Because a few hundred control PCs are used at large airports, software (including the OS) startup and operation is based on the thin-client method (**Fig. 7**). Thanks to the integrated management of the software on the central server, this makes it unnecessary to install software on the display side, as well as en-

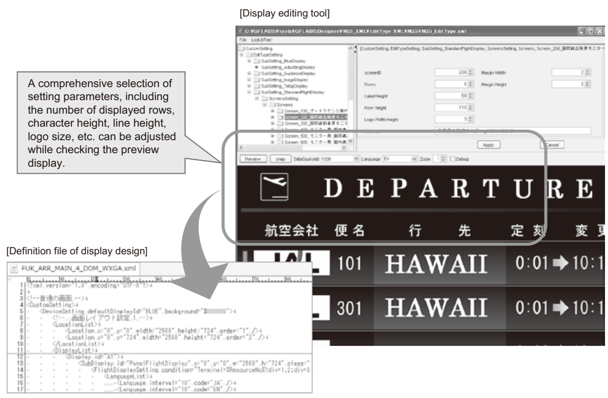

Fig. 6 Display editing tool.

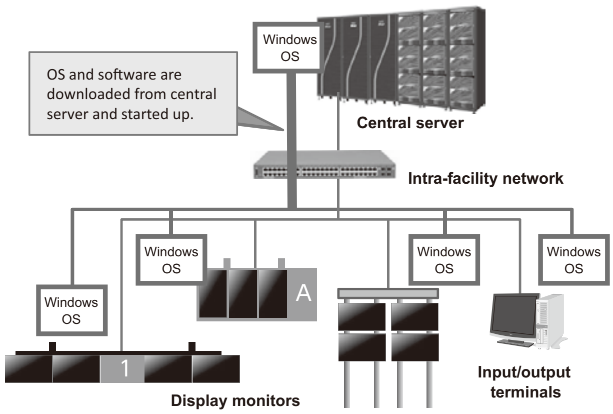

Fig. 7 Configuration example using thin-client system.

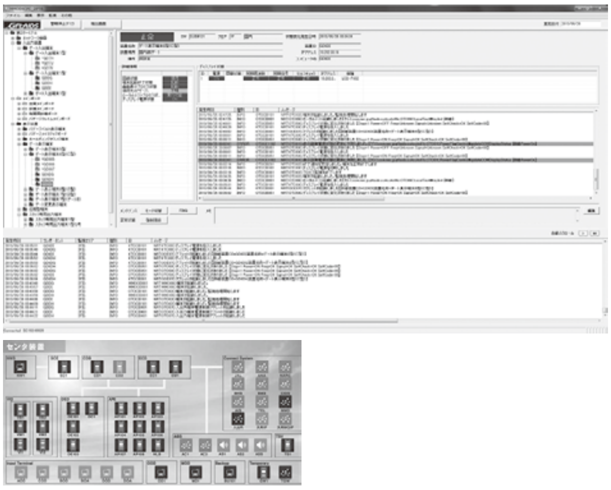

Fig. 8 System monitoring display examples.

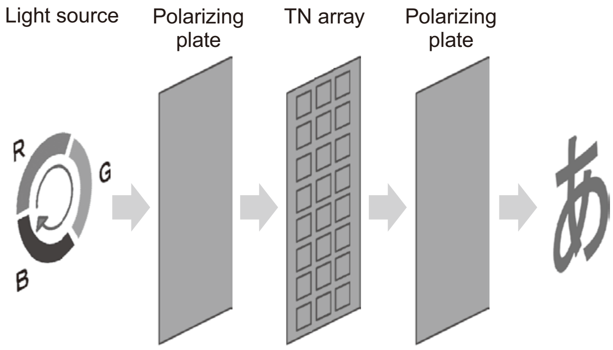

Fig. 9 Principles of field sequential system.

Photo Large display panel using field sequential system.

abling much faster failure recovery than is possible with conventional fat-client systems, thereby assuring easier and more efficient maintenance.

(2) Detailed device monitoring

Hundreds of installed display monitors are all operated automatically, while the status of each device is managed and monitored in the central operation room (**Fig. 8**).

In addition to status (alive/dead) monitoring of the control PCs for the display monitors and SNMP (Simple Network Management Protocol) monitoring, the status of the browsers that operate the control PCs is also monitored. Whenever an abnormality is detected, the system is restarted to recover it automatically.

Device power on/off status is also monitored with distinction between normal and abnormal termination. The operation status (start-up, termination, daily rotation, etc.) is also displayed on the monitoring device, enabling operators to immediately verify the status of the entire system with this monitoring device alone.

The temperature and brightness of the displays are also monitored. In particular, the status of various LED display parameters such as the status of each display line, fan, and power supply is monitored in detail. All device status data is displayed to the administrators using representations such as trees and maps.

3.5 Display Panels Suitable for Use as “Landmarks” at Airports

(1) Large display panels using the field sequential system

The field sequential system is a driving method used in LCD panels. Taking advantage of the after-image effects of the human eye, it conveys colors by appropriately controlling the illumination time of respective backlight colors (red, green, and blue) (**Fig. 9**). Since it does not require color filters to convey colors, it achieves sharp, easy-to-see, and stable displays with high brightness and a wide field of view (**Photo**).

(2) Integration with digital signage

While conventional FIS systems specialize in the display of flight information, NEC’s FIS incorporates a CMS (content management system) function, enabling it to switch between a variety of different content such as railroad transportation information, road traffic information, news, and advertisements.

A schematic diagram of the integrated management of the display schedule of flight information and other content is shown in **Fig. 10**. Display effects can be enhanced by letting the FIS display panel be shared with the digital signage and switching the content with the flight information.

For example, the left side of the display shows flight departure information, while the right side shows content related to those flights. In this way, the communication power of the content can be enhanced.

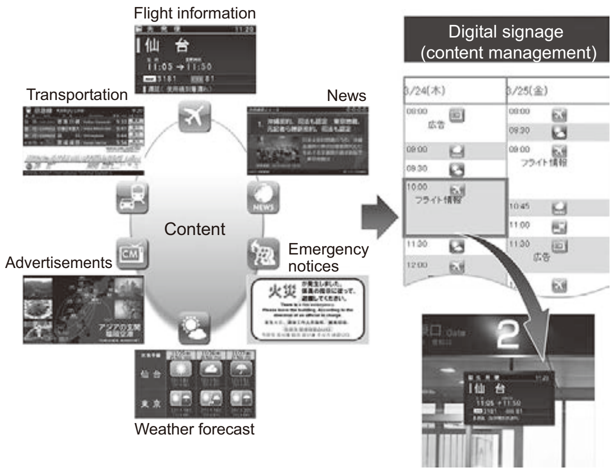

Fig. 10 Schematic diagram of integrated management of display schedule of content.

3.5 System Updates at a Large Airport

In a system update at a large airport executed in cooperation with NEC Networks & System Integration, we spent out about six months updating and refurbishing the system, carrying out all work after hours. The project was successfully completed without any problems and was highly evaluated by the client, winning official commendation.

4. Conclusion

In this paper, we have reviewed the various component technologies that support NEC's FIS system, while emphasizing and our ongoing commitment.

Spurred by the Japanese government's promotion of the open skies policy and the establishment of the Law for Airport Management Utilizing Private-Sector Capabilities, the current airport market is in a process of transition from the era of government-led airport construction to an era of increased airport efficiency driven by the private sector. With the increase in airport traffic that can be expected with the forthcoming Tokyo Olympics in 2020, versatile and visually attractive flight information display systems will be more important than ever.

In view of these developments, our goal is to advance our cloud computing technology to optimize our FIS cloud systems by utilizing our cloud computing technology, to achieve high expandability using our SDN (software-defined networking) technology, to enhance our digital signage functions such as video walls, and to create additional value through system linkage with airport security and video systems as well as by incorporating a waiting time prediction system for passengers. In the simplest terms, our goal is to develop information display systems that will be easy to use and very attractive to passengers.

We are also now focusing on proposals overseas with a view to moving into global markets, particularly in Asia.

* Oracle is a registered trademark of Oracle Corporation and/or its affiliates in the U.S. and other countries.
* Windows is a registered trademark of Microsoft Corporation in the U.S. and other countries.
* All other company and product names and logos that appear in this paper are trademarks or registered trademarks of their respective companies.

Authors' Profiles

KANAI Takeshi
General Manager
5th Air Transportation Systems Department
Transportation and City Infrastructure Division

AKAMATSU Manabu
General Manager
4th Air Transportation Systems Department
Transportation and City Infrastructure Division

HADA Yukitake
Manager
5th Air Transportation Systems Department
Transportation and City Infrastructure Division

OKAMOTO Masashi
Manager
4th Air Transportation Systems Department
Transportation and City Infrastructure Division

TARUKI Kazuya
4th Air Transportation Systems Department
Transportation and City Infrastructure Division

HIRABARA Maho
4th Air Transportation Systems Department
Transportation and City Infrastructure Division

Information about the NEC Technical Journal

Thank you for reading the paper.
If you are interested in the NEC Technical Journal, you can also read other papers on our website.

Link to NEC Technical Journal website

Japanese | English

Vol.9 No.1 Special Issue on Solutions for Society - Creating a Safer and More Secure Society

Vol.9 No.1
January, 2015

Special Issue TOP

NEC Information