Non-touch Solution Services Using Image Analysis System

Along with the rapid changes to the property sector brought about by factors such as advances in digital technology and the growing diversity of building users over recent years, the coronavirus pandemic has also prompted demand for non-contact methods for moving around inside buildings and using their facilities. Hitachi Building Systems Co., Ltd. utilizes the know-how and infrastructure it has built up through its maintenance business for elevators and escalators to deliver total solutions for buildings that include security camera and access control systems. This includes contracts covering around 200,000 security cameras and service agreements for approximately 3,000 access control systems based on the BIVALE cloud service for building management. This article describes Hitachi Building Systems' cloud services for building management that are organized around BIVALE together with its vision for a future in which such services will be provided to smart buildings.

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1. Introduction

Given the changing trends evident in developed societies in particular, which include shrinking workforces, globalization, and a shift in consumer needs from tangible to intangible goods, commercial property is one of a number of sectors where, rather than the straight-forward supply of products (surveillance cameras, access control systems, and so on), the requirement is for solutions that enhance operations and that are designed with users in mind.

Recognizing the demand for better security to prevent the unauthorized disclosure of personal information and the rising awareness of environmental and energy efficiency issues, not least being concerns about global warming, Hitachi Building Systems Co., Ltd. has long supplied solutions that are in tune with developments in wider society through its BIVALE*1 cloud service for building management launched in 2012[1].

*1 BIVALE is a new solution service that solves problems in building management and operations through integrated management of energy, security, and building management.

To help contain the coronavirus pandemic currently raging around the world, there is an urgent need for services that can enhance the safety and security of security camera systems dedicated to surveillance only and access control systems that involve physical contact with some means of identification. This has led Hitachi Building Systems to look at the adoption of more hygienic touchless mechanisms and resulted in the supply of solutions that make use of image analysis and work in tandem with existing services delivered through BIVALE[2].

2. Trends in Image Analysis Market

According to Fortune Business Insights Pvt. Ltd., the worldwide market for image analysis was worth around USD2.5 billion in 2018, a number that is forecast to reach 12 billion by 2026 with a compound average growth rate of 22%. The two main drivers of this market growth are expected to be investment in security generally and investment by government agencies in anti-terrorist and related measures. While simple applications of image analysis for

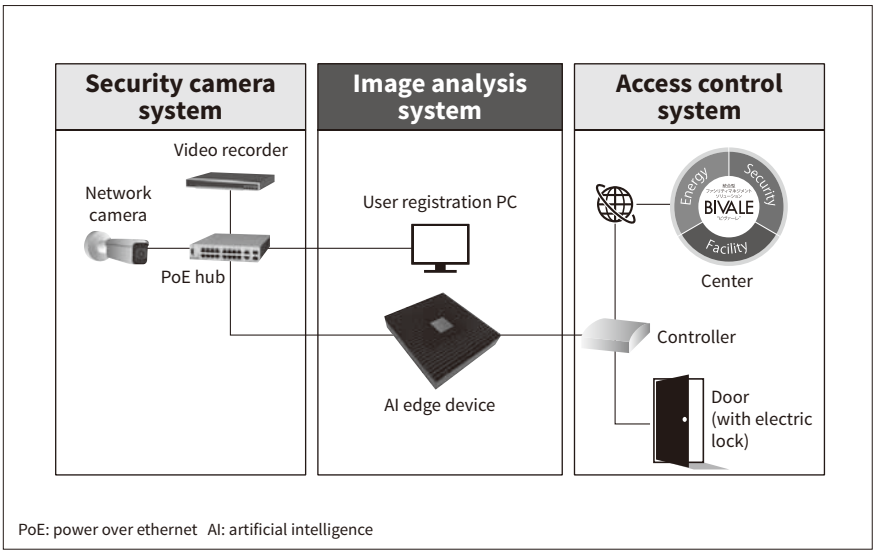


Figure 1 — System Block Diagram
The system can be implemented by adding AI edge devices to existing systems along with a personal computer for collecting user's facial recognition images.

activity detection made up a large proportion of the market in 2018, the expectations for the future include the ability to determine what a person or object of interest is doing in more detail along with technological progress and growth in the market for vehicle number plate recognition[3].

The key markets in the future will be in the Asia-Pacific region, with strong demand growth expected in China and India where the market was already worth around USD500 million as of 2018. It is also anticipated that small and medium-sized businesses will make greater use of cloud-based image analysis in the future as the associated technologies improve. Other areas where strong growth is expected include the use of image analysis in autonomous driving, industrial automation, and robotics.

3. Solution Services Based on Image Analysis

While many companies offer services that use image analysis both in Japan and elsewhere, the strength of Hitachi Building Systems lies in its status as a manufacturer of elevators and escalators and its ability to integrate its security camera and access control systems with these products.

By integrating its systems with image analysis services such as those that perform facial recognition or people flow analysis, Hitachi Building Systems is making its elevators, escalators, and access control systems more convenient and transforming their functions into services that take hygiene into account.

3. 1
Image Analysis System Configuration

While a number of image analysis services are already available on the market, most of these are cloud-based or use large on-premises systems and suffer from problems of slow response and high installation cost.

To overcome this, Hitachi Building Systems has come up with a system that combines a small and low-cost artificial intelligence (AI) edge devices with BIVALE and makes image analysis services easy to install. The service also allows for the continued use of existing assets through interconnection with existing security camera or access control systems as these are equipped with a local-area network (LAN) port or other communication interface (see **Figure 1**).

The management of personal information is an issue of concern with cloud-based image analysis services. The service addresses this issue by using a system configuration in which facial recognition data is kept on the AI edge devices and not held on the Internet.

3. 2
Non-touch Solution Services

Non-touch solution services based on image analysis can be broadly divided into solutions for facial recognition and people flow image analysis respectively. Hitachi Building Systems supplies services that are linked to building equipment such as doors or elevators.

The facial recognition solution is an access control system that uses facial recognition to augment conventional identity verification by smartcard (integrated circuit card), finger veins, or other form of identification. It is suited to door security and security gate applications. The use of facial recognition enables non-touch operation.

The people flow image analysis solution works by counting the number of people in the elevator hall or entrance lobby and can be used for things like controlling elevators based on the number of users or hailing them without having to touch a control panel.

(1) Facial recognition solution

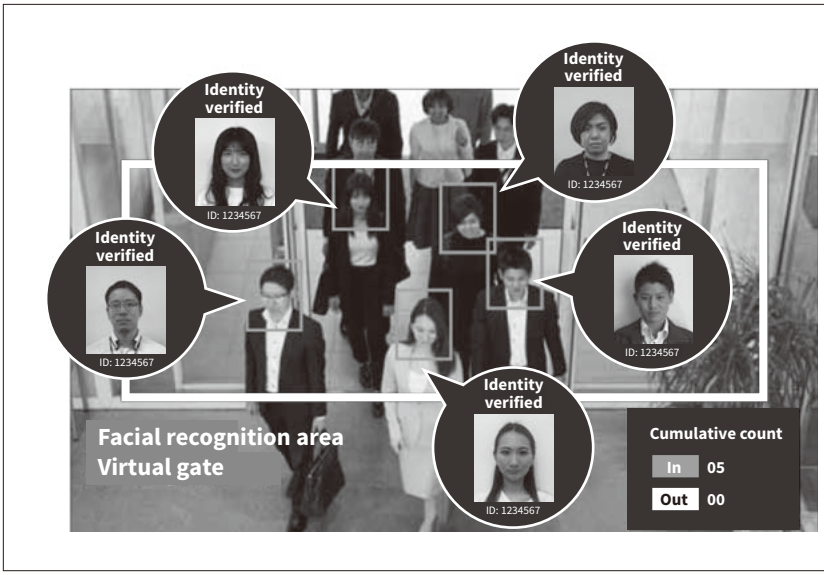
The facial recognition service enables hygienic, non-touch access control systems to be implemented that use it as a means of identification for entering through flapper

Figure 2 — Access Control Using Dedicated Facial Recognition Device

The system can be used to control access to server rooms and other high-security areas through the use of a dedicated facial recognition device able to verify whether an image is of an actual person to prevent impersonation using still or moving images.

Figure 3 — People Counting Using a Virtual Gate

Facial recognition can be performed for up to 10 people at a time by defining a virtual gate in the security camera's field of view.



gates located in shared areas of a building or opening the door to a private room. The ability to use existing network cameras means it can also be combined with security surveillance. Other applications include control of access to server rooms and other high-security areas through the use of dedicated facial recognition devices with dual lenses for photographic and infrared cameras to prevent impersonation using still or moving images (see **Figure 2**).

Delays in verifying identity at the entry to a building during the morning rush can be alleviated by establishing a virtual gate capable to identifying up to 10 people at a time in network camera frames. The solution provides speedy access management as it is able to verify identities without requiring everyone to individually swipe a smartcard or similar (see **Figure 3**).

One of the benefits of the facial recognition system is that it is able to use photograph data from a person's company identification or resume, meaning there is no need to collect biometric data during system installation, as would be required for identification by fingerprint or finger vein. This should reduce the amount of work involved in adopting the system. Even if the collection of facial recognition data is needed, this can be done in a hygienic non-touch way by taking people's photograph and does not required physical contact with the means of identification.

As a photograph taken by a smartphone or old-style mobile phone can provide the facial recognition data, visitors to a building who have pre-registered will be able to pass through the entrance without having to touch anything, thereby shortening the amount of time they spend in the lobby area.

(2) People flow image analysis solution

The ability of people flow analysis to count the number of people means it can provide up-to-date numbers on how many people are in a building, using virtual lines or virtual areas defined in the field of view of the network camera to distinguish when people are entering and leaving (see **Figure 4**).

The collation of foot traffic numbers for different parts of a large shopping complex commenced in April 2020 and the data is being put to use in marketing.

People flow analysis can also be used for security by defining virtual lines or areas and raising an alert if anyone is detected crossing the line or entering the area.

Whereas false alarms triggered by small animals or other non-human movements can occur when sensors are used

Figure 4 — Counting People Based on Numbers Crossing a Virtual Line

It is possible to provide an up-to-date count of how many people are in a facility or area by specifying a virtual line in the field of view of an Internet Protocol (IP) camera located at the entrance and counting the numbers of people coming in and out.

to detect intruders, image analysis should improve detection accuracy because it can be made to only detect people.

Another use is to control elevators based on the number of users. This can be done by counting the number of people who have crossed a virtual line at an entrance or entered a virtual area defined in an elevator hall (see **Figure 5**). It is also possible to press the elevator button automatically based on the number of people who cross a virtual line on the main floor.

Similarly, integration with dual security[*2, (4)], which is mainly used in residential buildings, makes it possible, once a person has been identified by facial recognition and allowed through the entrance, to hail an elevator and select their destination floor automatically. Performing these steps sequentially means the person is able to get all the way to their own floor without touching anything, making the process both convenient and hygienic with the attendant benefit of helping preventing the spread of infection.

*2 Authenticates at facility main entrances and elevator halls.

4. Future Services Based on Image Analysis

While a wide variety of image analysis techniques will likely be needed to cope with the sector's increasingly complex requirements, Hitachi Building Systems believes that the techniques suited to use in the smart buildings that it deals with can be divided into the following two categories.

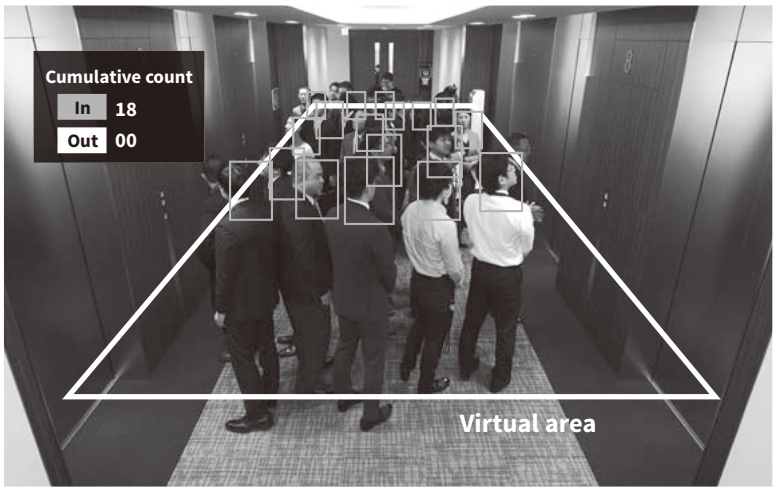
(1) Applications for facial recognition

Facial recognition is entering widespread use, being used for such purposes as unlocking people's mobile phones, passport control gates, office attendance and access control, and wide-area anti-terrorism systems.

Thermal cameras with a facial recognition capability can also be used for things like checking body temperature. More sophisticated forms of recognition have also become

Figure 5 — Counting People Using a Virtual Area

The number of people in a virtual area defined in an elevator hall can be counted by detecting their movements.



possible in recent years, including the estimation of health and emotional state as well as age and gender.

Future plans include looking into services such as the provision of analysis data on age and gender to customers in the retail sector or assessing the state of health of people entering buildings as part of the move to smart buildings.

(2) Activity detection

This is used for a variety of applications and involves performing a pixel-level comparison of a background image and area of interest in order to count people or areas or to identify abandoned items or loitering.

To encourage the shift to smart buildings, Hitachi plans to offer more sophisticated image analysis services incorporating techniques such as for detecting falls or other unusual activity in buildings, identifying suspicious activity, tracking people's movements, detecting wheelchairs or baby carriages, and functions such as searching for lost children. Hitachi also intends to look at integrating the use of people counting with AI-based air conditioning control so that it can be based on the number of people in each part of a facility.

5. Conclusions

This article has described the new initiatives and future plans of Hitachi Building Systems involving image analysis systems that use security cameras.

Providing new value for people, buildings, and society is part of the corporate mission of Hitachi Building Systems. In this period of major change for office and residential buildings, Hitachi Building Systems pays close attention to the needs of our time as it seeks to create safer and more comfortable environments. By utilizing newly developed digital technologies along with the infrastructural resources provided by management centers and field engineers and the expertise in building facilities it has acquired over time, the company aims to deliver new value, services, and smart building solutions to the people who use these buildings.

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