Large-scale Video Monitoring System

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Abstract

This paper introduces a case study of the construction of a large-scale video monitoring system for security purposes. The system coordinates a monitoring camera system, a video recording system, a video display system, an infrared sensor detection system and a fence-mounted sensor detection system.

We at NEC efficiently support the security business by coordinating large-scale intensive video monitoring systems and sensors and by fully utilizing the video recorders and display units developed by NEC System Technologies, Ltd.

Keywords

monitoring camera system, video recording device, infrared sensor
fence-mounted sensor, coordination of monitoring equipment

1. Introduction

In recent years, monitoring cameras have become a popular topic. Newspapers and TV news introduce monitoring cameras as security equipment in shopping areas and monitoring equipment to prevent bad manners on trains, as well as for crime prevention in public places.

In the case of conventional monitoring camera systems, monitoring cameras are set near the cash registers of financial companies, convenience stores, supermarkets and so on in order to monitor and record images, and in the case that a crime occurs, the captured images can be retrieved afterward to identify the criminal acts. However, the problem is that most of these are simple systems that are not linked up with security systems. The situation is almost the same even in the case of fancy jewelry stores employing costly infrared sensors.

The main feature of this system is the coordination of a video camera system, a video recording system, a large video display system, an infrared sensor detection system and a fence-mounted sensor detection system to constitute a large-scale video monitoring system for security purposes (**Fig. 1**).

2. Device Groups Constituting the System

(1) Device Group Constituting the Monitoring Camera System

About 700 IP cameras are connected via network equipment, and the captured information is intensively monitored at the monitoring center. Camera PTZ (pan, tilt and zoom) control can be carried out at monitoring terminals by a simple operation. The images captured by monitoring cameras are recorded all the time by a video recording system connected via network equipment (**Photo 1** , **Photo 2**).

(2) Device Group Constituting the Video Recording System

The images captured by the monitoring cameras are

Fig. 1 Explanatory drawing of the intrusion control information displayed on the screens of a large-scale monitor system.

Photo 1 Monitoring camera.

Photo 2 Video recording device.

Photo 3 Display unit.

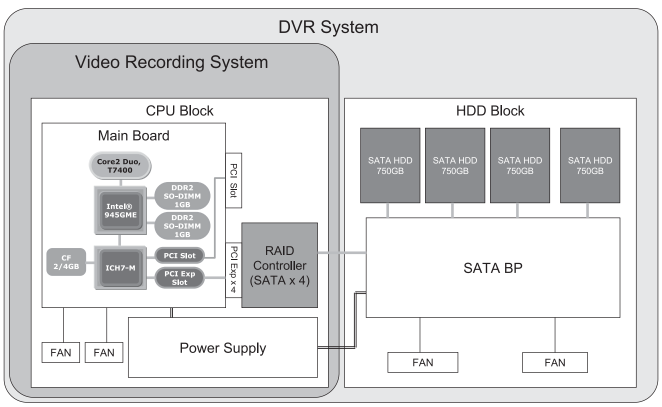

Fig. 2 Block diagram of the video recording system.

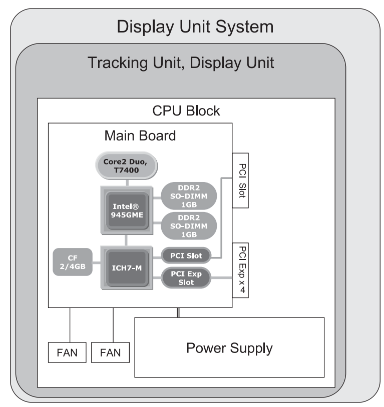

Fig. 3 Block diagram of the display unit system.

recorded using about 70 video recording devices. The recorded images can be retrieved and displayed at any time. The period of validity for recorded images can be configured from the main terminal. The system has a function to detect failures in video recording devices. If a failure occurs, an alternative recording device takes over the role of the failed recording device and starts recording (**Fig. 2**).

(3) Device Group Constituting the Large Video Display System

Monitored images are individually displayed on about 20 large liquid crystal display panels. Displayed images are sequentially switched in accordance with preset patrol patterns. In addition, the display system works in conjunction with the various sensor systems that are mentioned in the following. When an alarm signal is activated, live images around the sensors which detect abnormality are enlarged and displayed on the large LCD panels installed in the main monitoring center, which makes it possible to immediately identify the cause of alarm.

(4) Display Unit

Display units are installed in about 50 spots. Monitored images are individually displayed on the display units, and the images are sequentially switched in accordance with patrol patterns. These display units have a structure specially designed to display images for security purposes (**Photo 3** , **Fig. 3**).

(5) Video Monitoring System Server Group

A group of seven monitoring servers, eight distribution servers, three administrative servers, two database servers and two control servers constitutes a comprehensive monitoring system. The principal features of this large-scale video monitoring system include a live monitoring function for the whole system, realized by the monitoring servers, and an alarm system working in conjunction with sensor equipment, realized by the control servers.

(6) Operation Terminal

It is possible to manipulate the monitoring cameras of the video monitoring system via three operation terminals. In addition, it is also possible to manipulate the monitoring cameras to obtain monitored images from the camera via five terminals usually used for other security purposes.

The operation terminals employ a visual interface to realize easy operation. For example, it is possible to set the patterns of startup and shutdown time via a graphical user

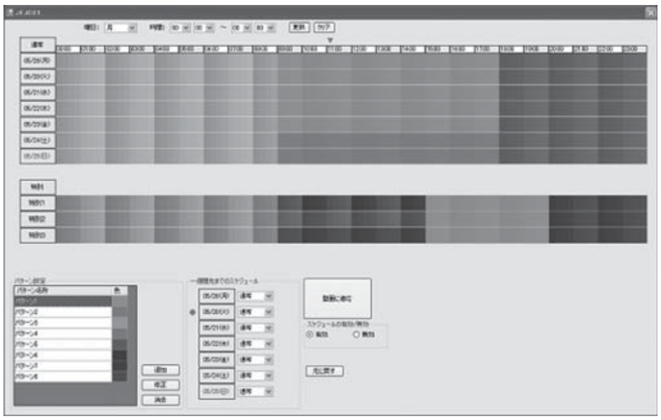

Fig. 4 Image of the patrol schedule setting screen.

interface (**Fig. 4**).

Moreover, by searching for abnormality occurrence among the alarm recording histories generated from each sensor (a description of these sensors will be given later), it is easily possible to replay the video images of the alarm occurrence out of video images recorded by the monitoring camera installed in the target area.

(7) Infrared Sensor

Combination sensors consisting of infrared sensors and microwave sensors are installed in the area surrounding a site in order to monitor about 60 areas. When an intruder is detected, the information is transmitted from the PLC panel to the video monitoring system.

An infrared sensor unit consists of a sensor and an infrared ray irradiator. An alarm is activated when the infrared ray emitted from the irradiator is blocked by an intruder (**Table**).

(8) Fence-mounted Sensor

Fence-mounted sensors are installed on the fences surrounding a site in order to monitor about 20 areas. When an abnormality in a fence is detected, the information is transmitted from the PLC panel to the video monitoring system.

The fence-mounted sensor system uses special wires laid on the fences, and an alarm is activated when a wire detects a vibration (**Fig. 5**).

(9) Voice Alarm Device

Voice alarm devices are installed in the monitoring center and manned guarding areas. An alarm device is activated by a signal from sensors, and the alarm to be activated is determined in accordance with the area in which monitoring cameras detect the abnormality.

Table Specifications for the combination sensor.

Product name	Combination sensor			
Model number	COM-IN-50HFL	COM-IN-50HFH	COM-IN-100AL	COM-IN-100AH
Detection method	Near-infrared beam interruption system (4 beams, simultaneous interruption) Microwave interruption system: Opposed type			Complex type
Infrared beam	Double modulation pulsed beam using LED (near-infrared diode)			
Microwave	24.11 GHz	24.19 GHz	24.11 GHz	24.19 GHz
Protection distance	1 to 50 m		5 to 100 m	
Max. arrival distance	Infrared sensor: 500 m (tenfold margin distance) Microwave: Approx. 100 m		Infrared sensor: 1,000 m (tenfold margin distance) Microwave: Approx. 200 m	
Detection response time	Infrared sensor: Approx. 0.05 to 0.7 s (variable with a potentiometer) Initial position: 0.05 sec. Microwave sensor: Approx. 0.04 to 0.3 s (variable with a potentiometer) Initial position: 0.04 sec.			
Supply voltage	10 to 30 V DC			
Power consumption	At protection: 165 mA or less ● Transmitter: 65 mA or less ● Receiver: 100 mA or less While beam alignment: 200 mA or less ● Transmitter: 65 mA or less ● Receiver: 135 mA or less		At protection: 165 mA or less ● Transmitter: 75 mA or less ● Receiver: 100 mA or less While beam alignment: 210 mA or less ● Transmitter: 75 mA or less ● Receiver: 135 mA or less	
Alarm output	Dry contact, swirchable between a/b contacts Contact capacity: 30 V AC/DC, 1 A or less (resistance load) Contact operation: Interruption time + off delay operation (approx. 2sec.)			
Environmental output	Dry contact, switchable between a/b contacts Contact capacity: 30 V AC/DC, 0.5 A or less (resistance load)			
Tamper signal	Dry contact, b contact (at alarm occurrence: close) Contact capacity: 30 V AC/DC, 1 A or less (resistance load)			
Alarm light	Red LED (receiver) At alarm occurrence: Lights			
Light detection sensitivity	Red LED (receiver) At light sensitivity attenuation: Light off			
Functions	Modulation frequency selection, tone indicator, environmental diagnosis, beam power selection, alarm memory indication, programmable AGC (auto gain circuit), auto gain lock function, monitor output, output selection switch (and/or)			
Angle adjustment area	Horizontal: +/- 90° Vertical: +/- 10°			
Ambient temperature	-25°C to +60°C			
Installation	Outdoor			
Wiring	Connection to terminals (M3 self-up terminal)			
Weight	Transmitter: 2,150 g Receiver: 2,300 g		Transmitter: 2,420 g Receiver: 2,570 g	
Appearance	PC resin (wine red)			

(10) Flashing Light Alarm Device

In addition to a voice alarm device, flashing light devices are employed as well. The flashing light alarm device is activated by a signal from the video monitoring system. It is a device to further enhance visibility and audibility by employing both a voice alarm and a flashing light alarm.

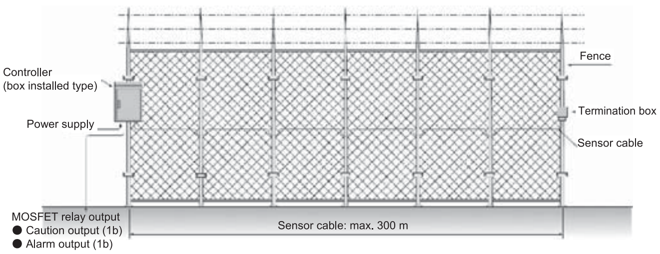

Fig. 5 Overview diagram of a fence-mounted sensor.

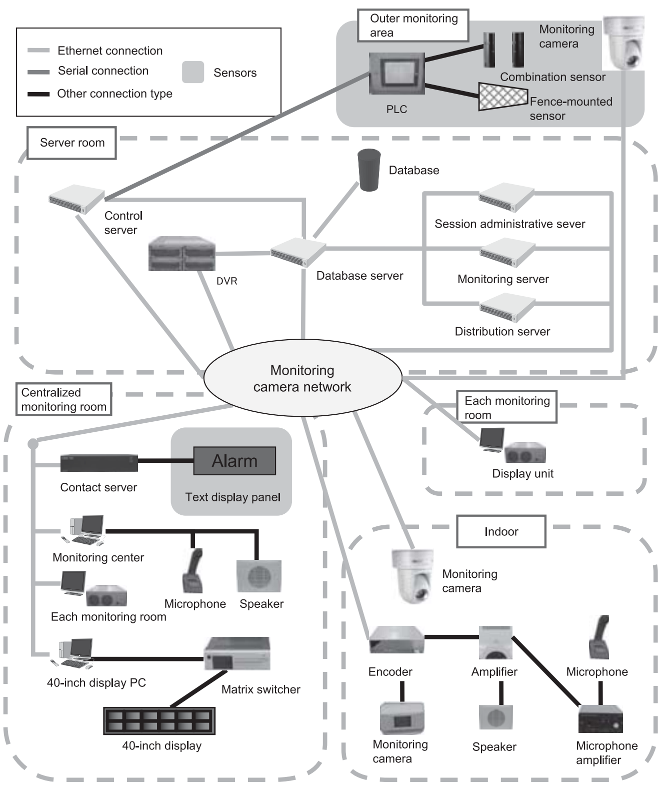

Fig. 6 The entire system outline.

(11)Outline of Entire Monitoring System

A comprehensive monitoring system will be constructed using this system with the best use of above mentioned devices. The entire system outline is shown in **Fig. 6** .

3. Conclusion

As mentioned above, a large-scale video monitoring system is required to provide a comprehensive solution by efficiently coordinating the function of various sensors, in addition to providing a video monitoring function using monitoring cameras.

For example, by using the large-scale video monitoring system introduced in this paper, it is possible to build a system in which an alarm signal is transmitted directly to the PHS cell phone of a security guard when an abnormality is detected. Thus NEC's system makes it possible to efficiently prevent an unauthorized intrusion, and the system is expected to become a comprehensive monitoring solution to ensure the safety and security of people.

In conclusion, we would like to express our deepest thanks to Sony Business Solutions Corporation for providing the API for controlling monitoring camera equipment, and Takenaka Engineering Co., Ltd. for providing information on the alarm signals of the outer warning sensors and making efforts to adjust equipment on-site for the realization of this system.

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