Digital twin-based future subway innovation

Lines 1~4 and Vehicle Depots Enhanced Integrated Monitoring System

2022.09

서울교통공사

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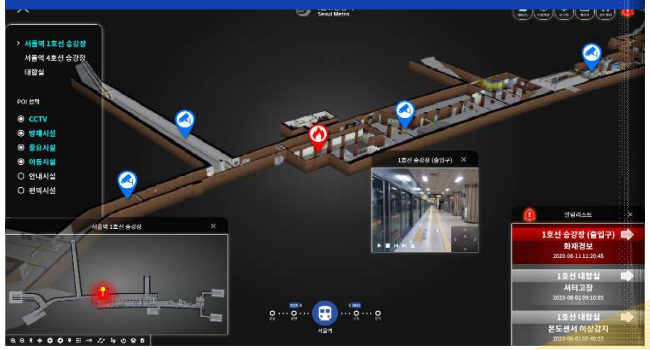
Business Overview

Objective	Lines 1/2/3/4/8 and Vehicle Depots Enhanced Integrated Monitoring System
Time Period	2020.10.22 ~ 2022.09.30 (1, 2, 3, 4, 8 Lines, each separate order)
Segment	120 stations and 4 vehicle depots for Lines 1~4
Scope	❶ 3D-based Integrated Management System ❷ Intelligent Integrated Monitoring System ❸ Integrated Infrastructure Environment
Sponsor	Seoul Metro (Ministry of Information and Communication)
Governance	Samsung SDS Consortium SAMSUNG SDS • Overall Business Mgmt. • Provide 3D-based Platform + • Delivery of Intelligent CCTV + • Communication Wiring/Track Construction • Install Various Equipment

What is Smart Station?

Smart Station is a control center **that enables integrated management and efficient operation of the station facilities** through 3D-based digital twin and Intelligent monitoring system

3D-based Digital Twin



Station Control Center

Intelligent CCTV-based Monitoring

Integration Management of Various Facilities within the Subway Station

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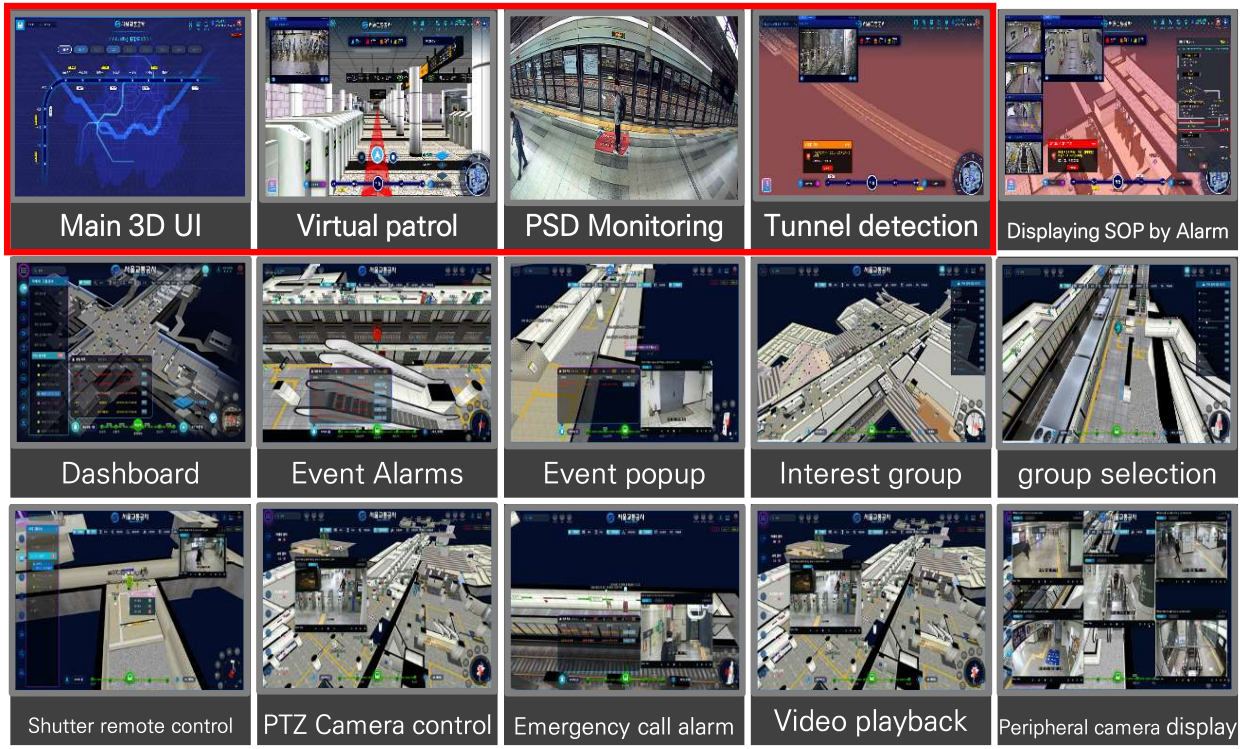
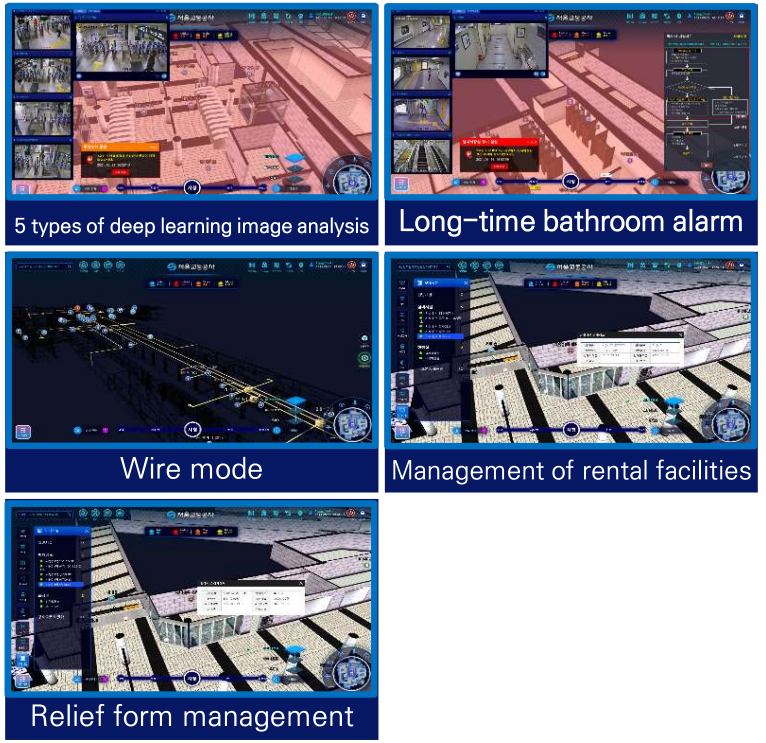
Key Features

New Technology Enhancement



New



Establishment of Intelligent Integrated Monitoring System Based on Digital Twin

Implementation of Intelligent Integrated Monitoring System + 3D-based Integrated Management System + Establishing an integrated infrastructure environment

Subway map UI screen

New

Lines 1 & 4 Subway Map

Main Issue

- Complex menu layout decreases user readability and convenience

Issue Solved

- Intuitive menu layout increases user readability and convenience

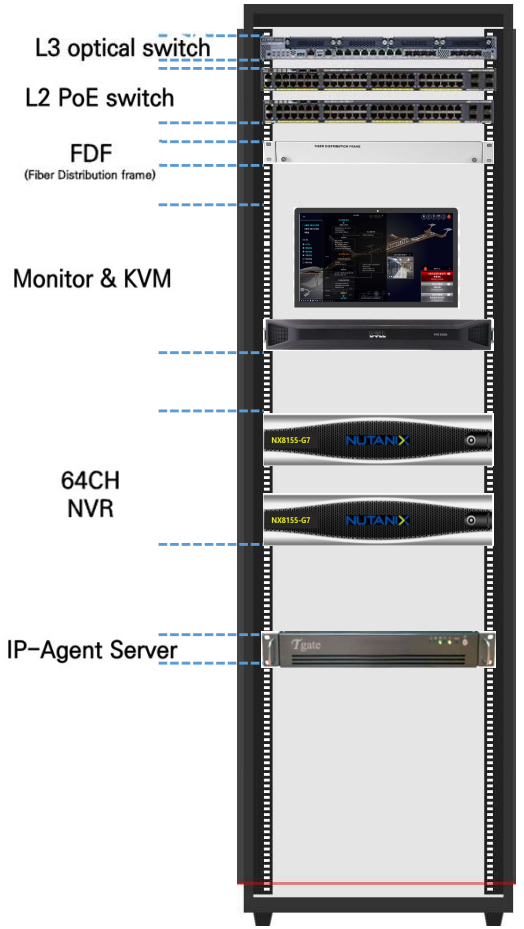
Station operation improvement by optimizing equipment operation

14 Lines existing operations (example)

Space required for operating 81 CCTVs, Sadang Station

Secure space efficiency by minimizing the top surface example

Space required for operating 100 CCTVs for this project

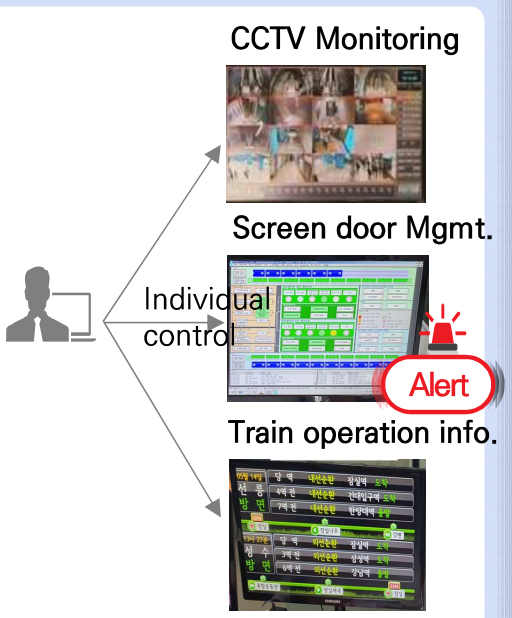


- ✓Minimize necessary equipment to secure equipment top surface space (60% more vs. before)
- ✓Extra free space can be used for other purposes
- ✓Power usage reduction effect

* Rack size specification: H2,030 X D1,000 X W600

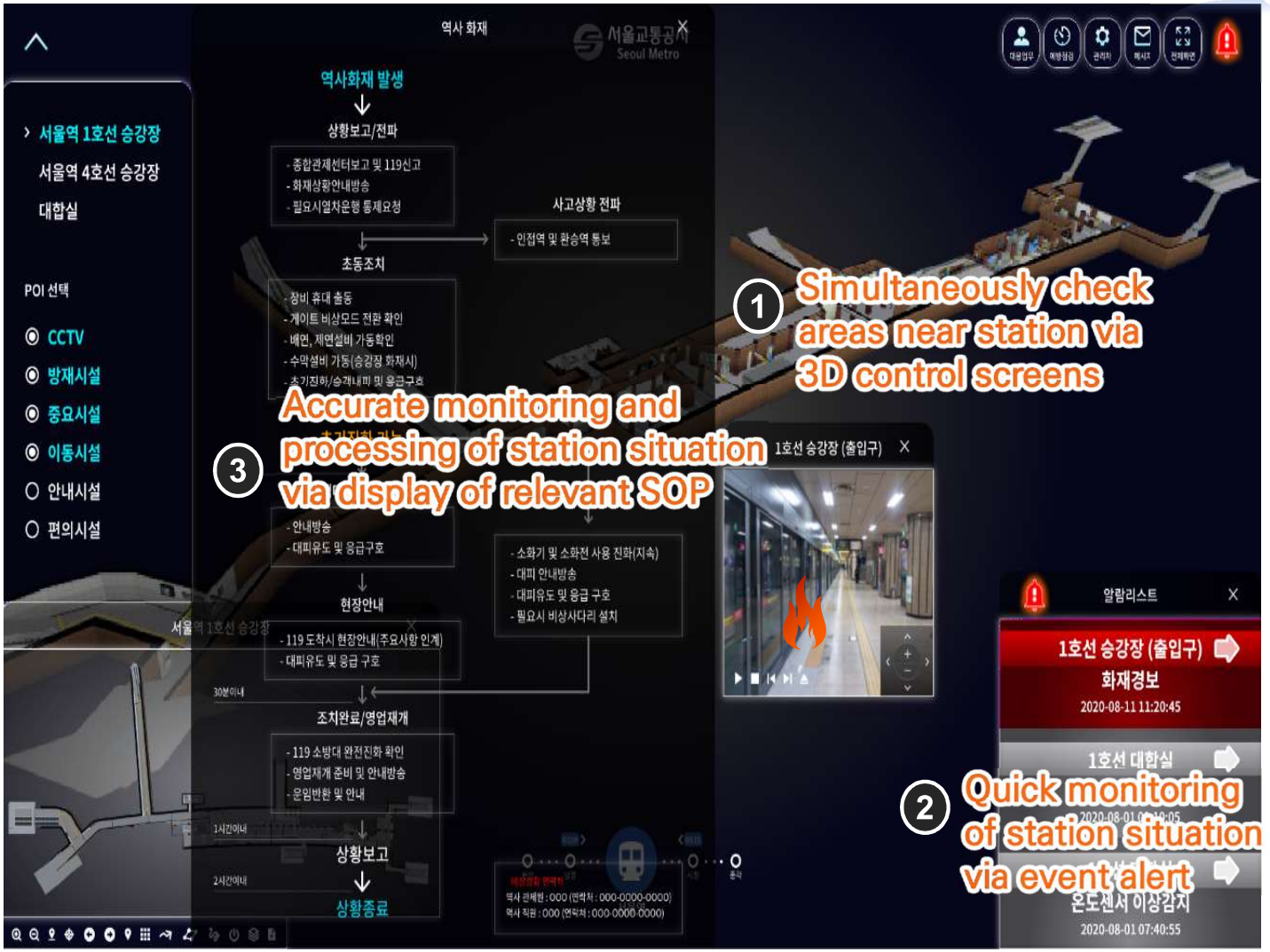
3D-based integrated monitoring system – quick control

14 Lines existing operations (example)



- Replace individual control with integrated monitoring system
- Improvement of various outdated facilities

Quick response through Single View in case of emergency example



Intelligent CCTV – deliver intelligent monitoring system

14 Lines existing operations (example)

example

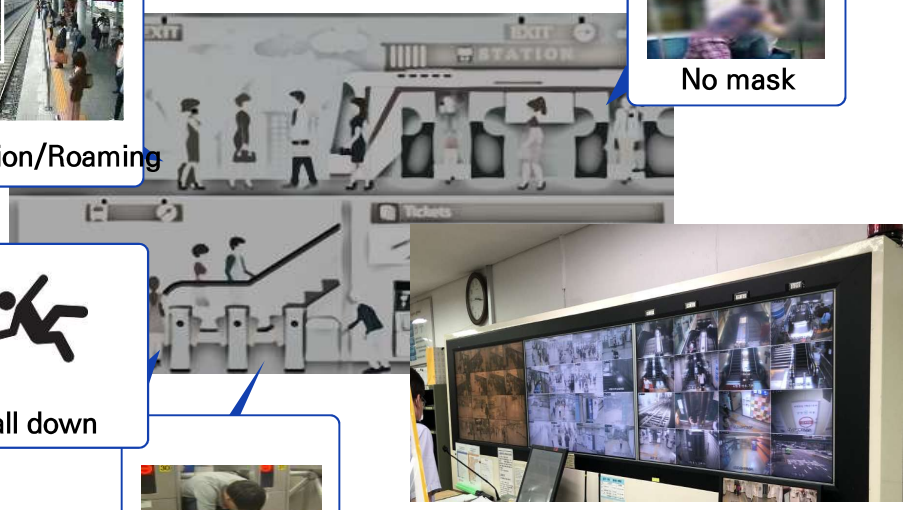
Outdated equipment and blind spots
Illegal riding and various safety accidents

Analog CCTV

400,000 pixels
1,993 units

Intrusion/Roaming

No mask



Fall down

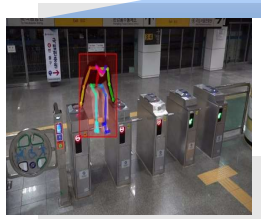
Illegal riding

- Decreased control efficiency due to outdated CCTV
- Difficult to check immediately when various situations occur

Intelligent CCTV and AI deep learning technology for
Zero safety accident blind spots

Intelligent IP CCTV

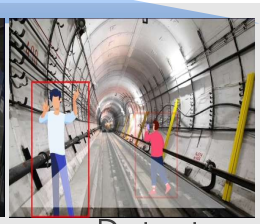
+ 2million pixels
Intelligent CCTV
3,468 units



Detect
Illegal riding

Detect
No mask

Detect
fall down



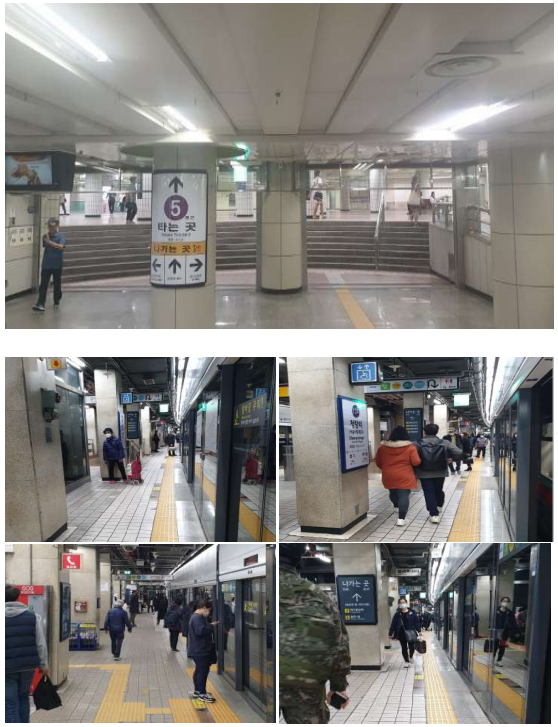
Detect
restricted access
area (tunnel)

AI (deep learning)-based
integrated monitoring

Prevent Illegal riding + Prevent infectious diseases + Prevent safety accidents + Preemptive accident prevention

Intelligent CCTV – introduce fisheye camera (panorama video)

14 Lines existing operations (example)



- Difficult to understand intuitive situation due to blind spots
- Difficult to understand situation inside due to Side cameras on the screen door

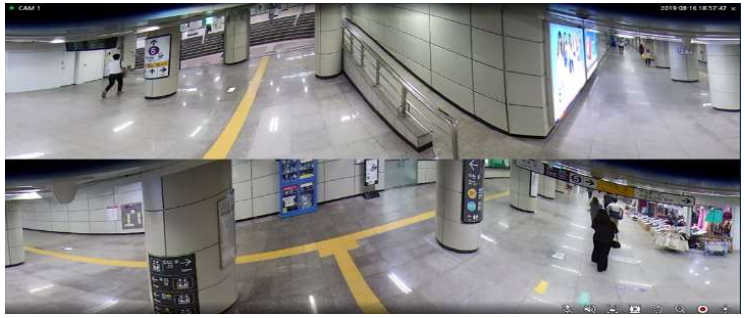
Visibility of intuitive situation and ability to respond via videos with no blind spots

example

Visibility of Intuitive situation

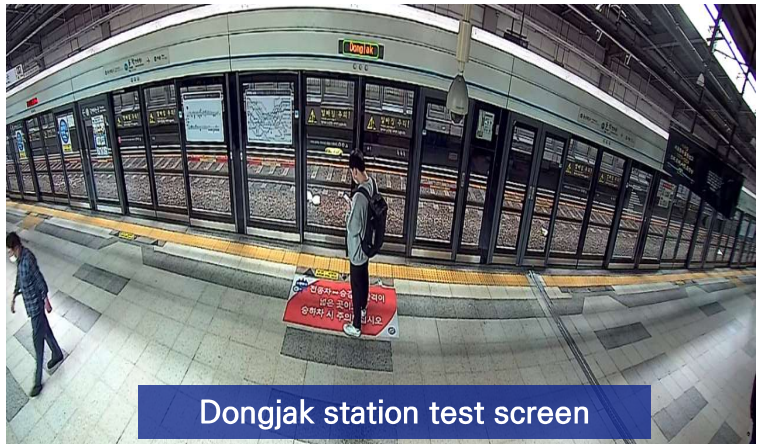
- Video with no blind spots using fisheye camera

Visibility of subway waiting room



- Intuitive understanding of situation by providing sequential videos of screen doors organized in the order of the carriages

Visibility inside/outside the platform



PSD Monitoring (PSD* : Platform Screen Door)

Existing

Side View only

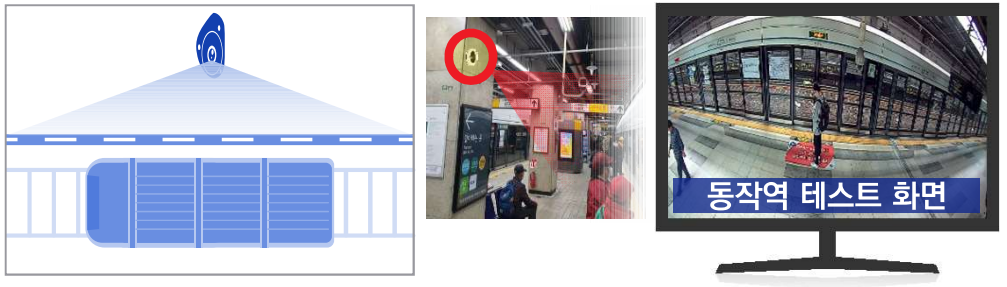
PSD iTV Screen (Housing Camera)

Main Issue

- Difficult to see inside due to side cameras
- Crew hard to make intuitive decisions

New

Entire View



PSD iTV Screen (Housing + Fisheye camera)

Issue Solved

- Install camera in front for internal/external view
- Crew can make intuitive decisions

PSD failure integration – increase safety of passengers through real-time data

14 Lines existing operations (example)

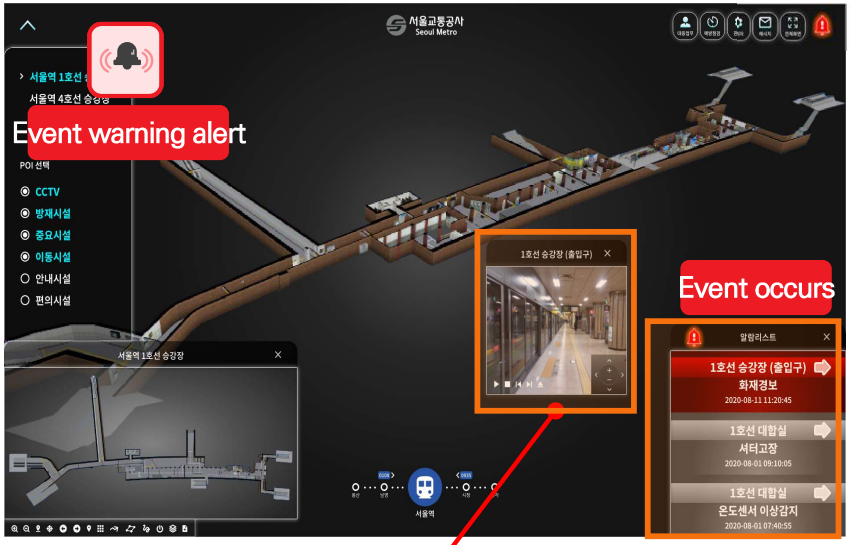
Only PSD status and failure can be checked

PSD Quick response via event in case of failure

example

Warning Alert when abnormal status is detected

Display the video of the failure point and check the platform status



PSD Failure Status Detection

PSD status and failure check through Event. In case of failure, the 3D Map automatically moves to the point of occurrence

PSD Failure occur

✓ Increase passenger safety by improving user monitoring at the station

Tunnel Safety Monitoring

General monitoring

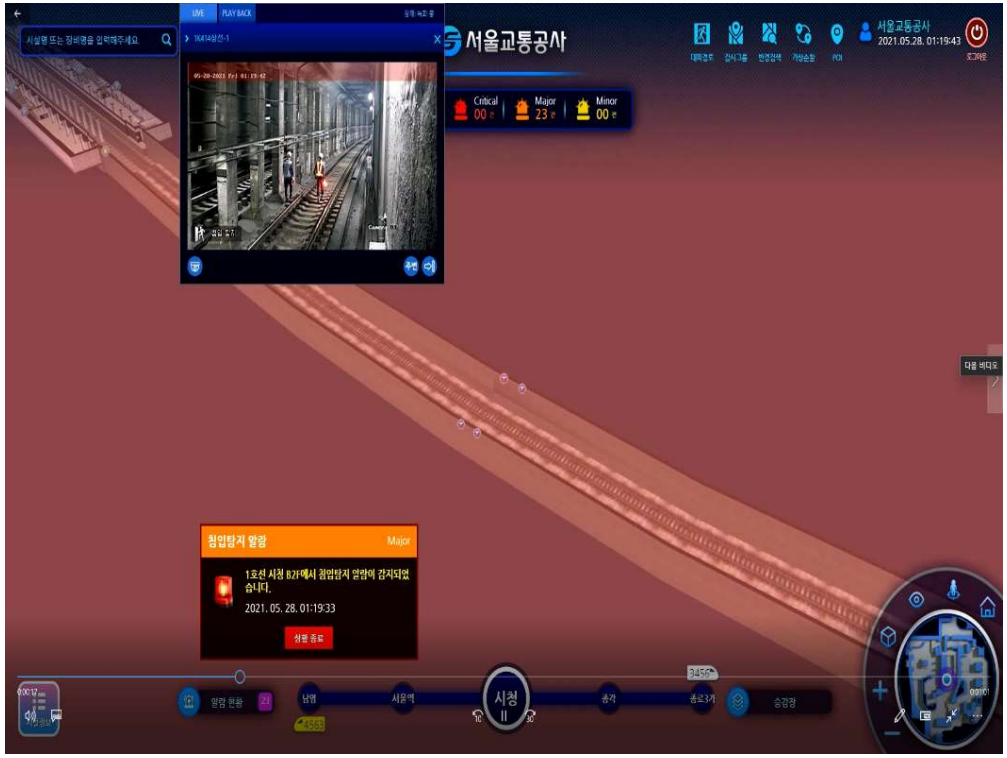
Existing

Main issue

- The administrator monitors the tunnel at all times

Intelligent monitoring

New



An issue Solution

- Automatic monitoring of movement in tunnel and alarm

Illegal ride monitoring

Illegal ride detection

3D Integrated Platform Alarm Detection

The main feature

- Detects illegal rides and displays alarms on 3D control screens

ITV Standardization – increase train operation safety and convenience in maintenance

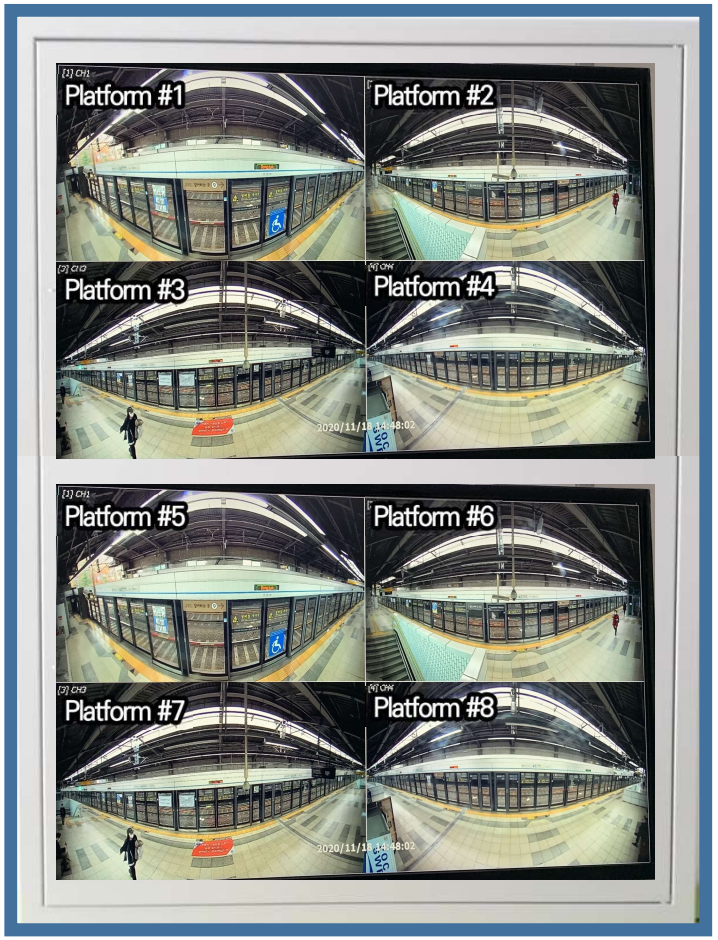
1 4 New application of line (example)

Strengthening maintenance efficiency through standardized ITV supply

example

Unstandardised ITV environment

Ununified monitor size and enclosure size



✓ Easy maintenance through standardization to cover the enclosure

✓Securing visibility by standardizing monitor size

Toilet long-term occupancy monitoring

Detection of occupancy through double sensor

Built-in 4 PIR[1] sensors and 1 heat sensor in IC

Infrared detection of the human body

\+

Heat-sensing

- Detection of occupancy by infrared measurement (PIR)
- Detection of occupancy status by thermal measurement

Sense accuracy Enhancement

Toilet occupancy status and motion detection and warning alarms

Warning alarm when abnormal status is detected

Motion/ Waiting Status Detection in the Toilet

The main feature

- Detects long-term occupants such as falling in the bathroom and displays alarms on the 3D control screen

Virtual Patrol

The first person mode

Further Improve

Further improvement

- Improve realism from a first-person perspective
- Realistic patrol route

Rental facility and aid supplies Management

Management of commercial rental facilities in the station

상가번호	시청(1)역 151-107호	임대용도	의류
계약면적	22㎡ (6.66평)	월임대료	2,613,800원
임대시작일	2020. 09. 18.	임대종료일	2025. 10. 18.
임대인		전화번호	

The main feature

- Main information management such as lessor/lease period/store number, etc.

The management of relief supplies in the station

방재시설 상세정보

· 공간 정보

시설명	구호물품 보관함1-1	위치명	하선 1-1 지점 벽면

· 물품 정보

No	물품	제조일자	유효일자	수량
1	화재용 대피 마스크	2016. 04.	2021. 04.	12 개
2	생수 2L	2020. 05.	2021. 05.	2 개
3	면수건	2020. 12.	2024. 12.	100 개
4	화재용손수건	2020. 12.	2024. 12.	35 개

The main feature

- Management of major information, such as the quantity and expiration date of relief supplies

Fire fighting/Fire I/F Integration – increase station safety

1 4 New application of line (example)

- Monitoring fire locations that do not match the PLC-based real environment
- Integrated management of individual managed monitoring systems is required

Rapid response through event in case of fire

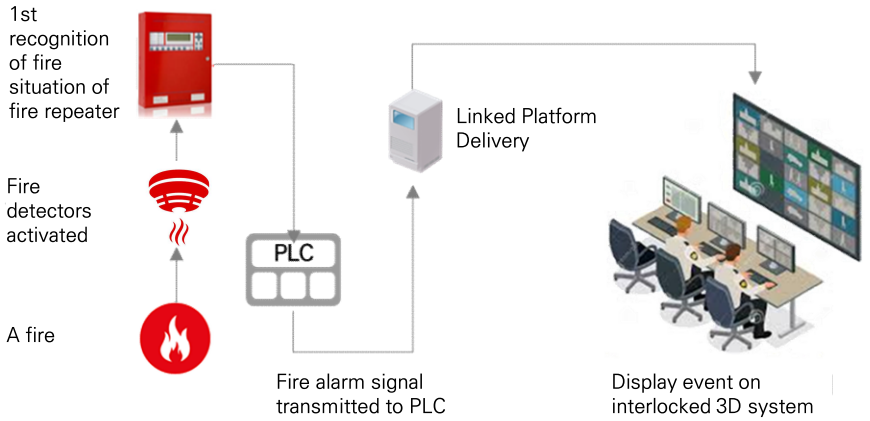
example

Warning alarm when abnormal status is detected

▸▸ Display video of the fire occurrence point and check the situation

Fire Sensor Status Detection

▸▸ Automatically move 3D Map to the point of fire through Event Checking the location of occurrence



Shutter I/F integration – increase convenience through remote control

1 4 New application of line (example)

Move directly to the shutter position and control directly in the field

Increase employee work efficiency by providing automatic control function

example

Remote area Automatic/ simultaneous control And sound source transmission

- When clicking the shutter control icon, the control UI and the camera image are interlocked and displayed
- Up/Down Button function provided
- STOP button function provided

Within Station Shutter manual control

✓Automatic/simultaneous control on 3D-based integrated control platform

✓Warning light and speaker voice guidance (installation site)

IOT sensor trial application – guaranteed IoT service scalability

1 4 New application of line (example)

1) Communication room

IoT New Sensor Installation 2) Machine room

NB-IoT

- A total of 200 stations will be installed for 10 stations on Line 1 and 26 stations on Line 4
- Real-time measurement of temperature/humidity and fine dust in machine room and communication room

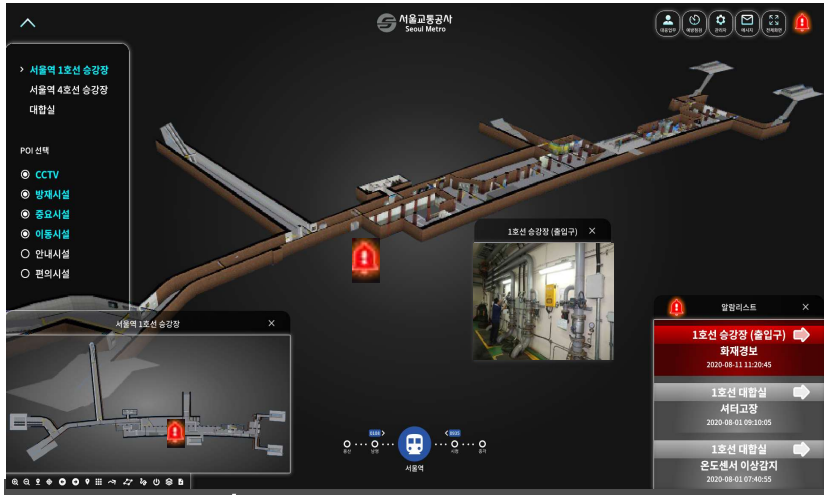
Providing monitoring functions through real-time measurement of IoT sensors

example

Warning alarm when abnormal status is detected

- Occurs an event that exceeds the temperature/humidity threshold
- Display peripheral camera image pop-up
- Responsive work progress

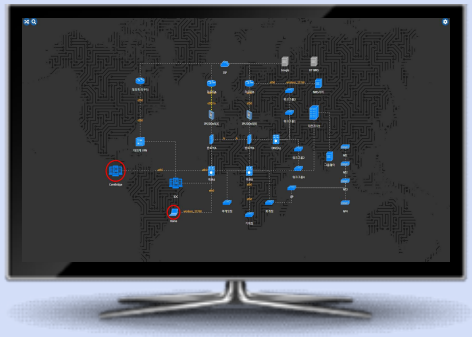
Detection of temperature/humidity and fine dust conditions of facilities in the station, such as machine rooms



Temperature/humidity and fine dust concentration in real-time communication machine room Confirmation service provided

FMS – integrated control of construction equipment for this business

1 4 New application of line (example)

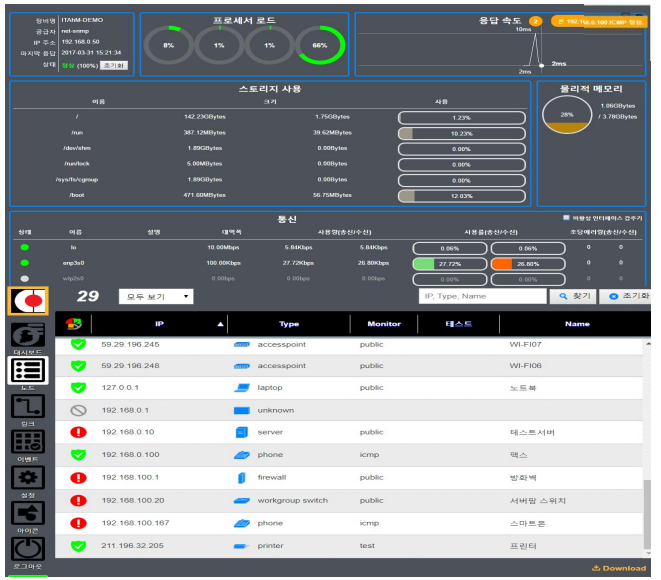


- Suseo Vehicle Base
- Zi-Chuk vehicle base
- Comprehensive control(1 line) Communication control center(1 line)
- Comprehensive control(4 line) Communication control center(4 line)

- Convenient screen UI provided
- Providing real-time monitoring
- Equipment history management

Check if there is any abnormality in each device by monitoring system operation status

example



Integrated equipment management system (FMS)

- ✓ Integrated monitoring for each device
- ✓ Real-time display of device operation status
- ✓ Immediate response in case of failure

Devices


Server


CCTV


IoT Sensor

IP / MPLS

Networks


Fire Wall


L4 Switch


L3 Switch


L2 Switch

3D Wire Mode

CCTV POI tracking area

Providing wire mode according to CCTV location by station

The main feature

- Increase maintenance efficiency by identifying the location of CCTV piping / wiring through wire mode

감사합니다

1~4호선 및 차량기지 노후 통합 모니터링 시스템 개량 사업 소개