

Development of DX Solution AccelVision

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[Summary]

Declining productivity due to labor shortages caused by falling birth rates and an aging population has become a serious problem in industrial sectors, especially manufacturing. The AccelVision industrial DX solution developed to address these challenges aims to improve production efficiency by advancing labor-saving measures through two-way communications, external system integration, and flexible adaptation to existing equipment. Furthermore, integration with video management systems visualizes events to provide intuitive understanding and support fast and accurate responses. Additionally, collaboration with partner companies is expanding solutions tailored to customers' requirements, in addition to safety management and network monitoring. This article introduces the features of AccelVision, and development of Estinargy, the edge platform device playing a key role in the solution.

1 Introduction

Recent falling birth rates and an aging population have led to serious productivity issues due to labor shortages in various industries. Industrial digital transformation (DX) using digital technology to transform business operations has become a focus of attention to solve these challenges. DX aims to improve production efficiency by saving labor through automation of data collection and analysis, replacing traditional manual processes. However, DX implementation remains slow with causative factors including the difficulty of introduction into existing facilities with mixed equipment types and the lack of resources and appropriate tools for quickly analyzing vast amounts of data.

We have developed the AccelVision industrial DX solution to increase productivity by saving labor through reduced time losses at situation assessment and on-site instructions when resolving problems, as well as cutting data analysis workloads, particularly in manufacturing and other industries. As described in section 2, AccelVision addresses these challenges by enhancing two-way communications and facilitating rapid response to production equipment troubles as well as efficient data collection and analysis. Additionally, it helps build flexible systems that can adapt to existing facilities, reducing implementation barriers by offering optimal proposals tailored to customers' environments. Furthermore, we aim to provide sustainable support for DX promotion by offering solutions that leverage our long experience in network bandwidth control technology and expertise across

product development, maintenance, and general support.

The AccelVision design adopts a structure combining partner components to complement core key components, enabling easy implementation and versatile expandability (Figure 1). Furthermore, using the Estinargy edge platform device described later configured with packaged software offers optimal solutions tailored to each customer's unique challenges (Figure 2).

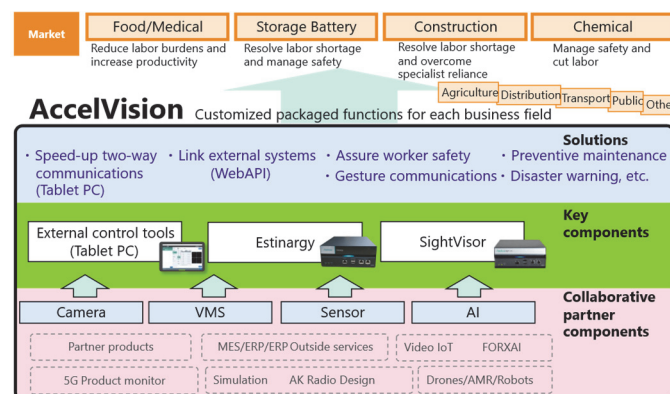


Figure 1 AccelVision configuration

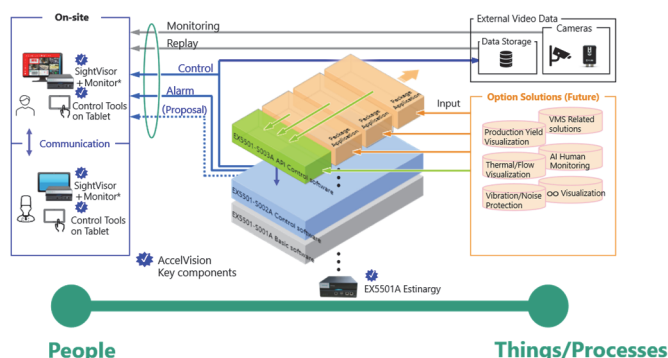


Figure 2 Estinargy configuration

2 AccelVision Features

2.1 Faster Two-Way Communications

Supervisors in production management offices on factory production lines plan, monitor, and adjust production for efficient production and controlled delivery times, and costs. However, when a line problem occurs, supervisors go directly to the site to understand the situation and provide advice, which slows response and line recovery times.

By using AccelVision to share on-site video and production status between supervisors and line operators, instructions and completion notifications can be controlled remotely. This two-way communication improves operation efficiency and cuts line downtime (Figure 3).

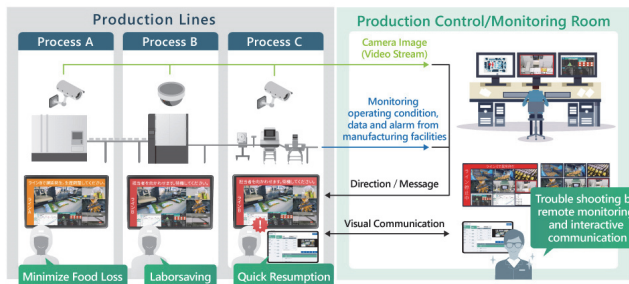


Figure 3 Two-way communications configuration

2.2 Faster Troubleshooting Response to Production Line Equipment Problems

When line equipment has a problem, contact control (DI/DO) is used commonly to notify external systems (such as SCADA) monitoring control and collecting data, as well as to display warnings alerts to workers. However, such equipment does not help understand the failure details, and there are issues with visually confirming events that have occurred already.

AccelVision uses a distributed remote monitoring system to remotely monitor and control equipment such as emergency power supplies and power distribution equipment. It can receive contact signals, add details such as problem descriptions and occurrence times, and display warning information, and then transmit this information to external systems through a Web API. Not only does it control warning displays similar to existing systems, but it also integrates with a Video Management System (VMS) to monitor video from before and after an event occurs. Visualizing events helps more intuitive understanding and enables quick and accurate responses (Figure 4).

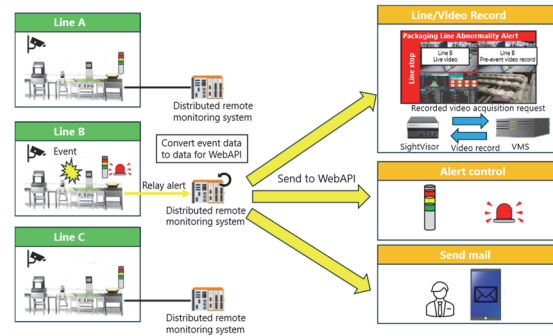


Figure 4 External system integration

2.3 Efficient Data Collection and Analysis

Brief “micro-stops” occur routinely on production lines and are often not recorded by the system because they are deemed unlikely to lead to serious issues. Additionally, when the amount of information about the problem is extensive, background searches are time-consuming and labor-intensive, and it’s difficult to understand the situation details from the trouble description alone.

AccelVision collect all information from both simple problems like micro-stops to major issues and this information can be grouped by production line, equipment, or importance level for reviewing.

Furthermore, AccelVision maps events, allow quick location identification, and because it can replay video from before and after the event to confirm details at the time, quick and accurate cause analysis is possible (Figure 5).

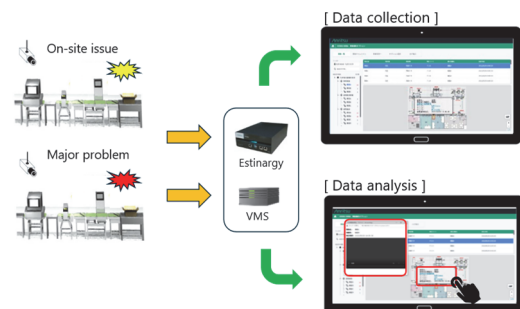


Figure 5 Data collection and analysis

3 Estinergy Development

3.1 Objectives

Implementing the features described in sections 2.1, 2.2, and 2.3 requires a relay function to receive notifications from external devices and perform corresponding controls. Additionally, continuous business improvement requires centralized management of event notifications with links to video data that administrators can easily check and analyze at any time.

We developed the ‘Estinargy’ edge platform device forming the core of AccelVision to implement the required functions (Table 1).

Estinargy is an all-in-one hardware device that collaborates with line equipment and external devices, centralizes management of event data, and links with recorded video. It plays a key role in supporting efficient management of event data combined with on-site video to enable a rapid response.



Figure 6 Estinargy Unit

3.2 Software Package Management and Expandability

To respond flexibly to individual customer’s challenges, we adopted a package management system for software delivery that separates object structures for each function. This supports provision of software combinations with the necessary functions matching customer needs while functionality can be expanded easily by adding features via the WebUI (Table 2).

3.3 Flexible API Provisioning

Achieving integration with external systems requires an API that is both easy to use and versatile. Estinargy is based on REST API, which is commonly used for data transfer between different applications.

The REST API is a form of Web API, which is a simple and scalable architecture based on the HTTP protocol. Resource operations use HTTP technologies (GET, POST, PUT, DELETE).

Since data from external devices varies widely, it is necessary to standardize data formats and consider reserve fields to minimize data types. Estinargy facilitates integration by limiting HTTP methods to POST and restricting data formats to one JSON (JavaScript Object Notation) type. JSON is a lightweight data exchange format mainly used by web applications. It offers excellent extensibility and readability, enabling a versatile data format that includes event, video, and device control information, as well as reserve areas for future expansion.

By disclosing the data format to partner companies and system integrators (SI), we’ve created a system that can receive arbitrary data from other makers’ line equipment and

sensors. This supports flexible and extensible collaboration combining AccelVision with other companies’ systems, expanding the range of solution offerings.

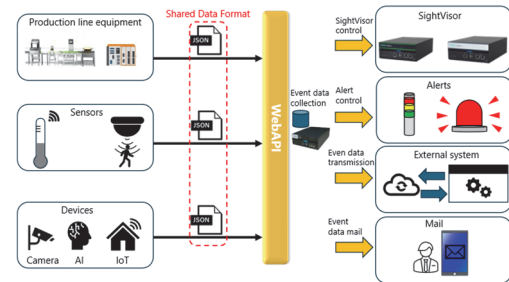


Figure 7 Integration using Web API

3.4 WebUI Provision using Blazor

Package software consists of a web application (front-end) providing a Web user interface (WebUI) and applications that operate inside the device (backend) for data processing and other functions.

Development of the Estinargy WebUI implemented the front-end using Blazor, an open-source web framework for developing web applications using C#, HTML, and CSS based on .NET, which is described later.

Traditional web application development implements the client side primarily in JavaScript and the server side in other languages (PHP, Java, etc.), which presents challenges in terms of learning costs and development efficiency.

In contrast, Blazor allows unified implementation of both client-side and server-side processing to a certain extent in C#. Furthermore, developers can build rich and interactive WebUIs efficiently by using the extensive libraries and tools available through .NET. This enables development of web applications with advanced functions while maintaining code consistency across different technology stacks.

3.5 UI Ingenuity

Event data collected from external devices is aggregated, allowing past occurrences to be viewed via the WebUI. However, simply displaying information means users must search vast amounts of data to find necessary information, which requires considerable effort. Therefore, the following three enhancements were implemented to improve usability.

(1) Hierarchical Event Data

Grouped display is achieved by organizing event data hierarchically (Figure 8), enabling quick identification of the event line to verify the target among vast amounts of data efficiently. This hierarchical organization classifies

information and allows for high-relevance events to be understood at a glance, resulting in significantly improved operability and visibility.

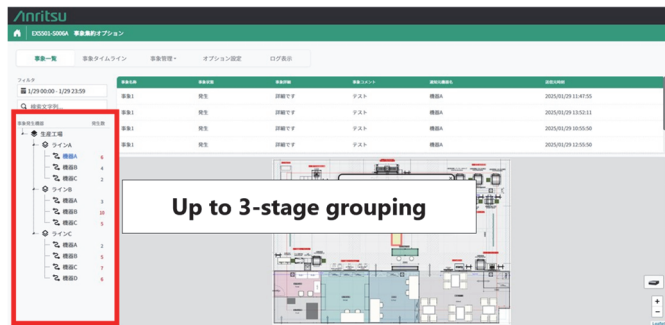


Figure 8 Hierarchical event display

(2) Event Occurrence Location Map

Event locations are plotted on a pre-prepared map.

Additionally, detailed data are checked easily via popup displays (Figure 9). This approach significantly reduces the effort required to identify event locations, enabling quick data comprehension.



Figure 9 Event map location display

(3) Event Timeline Display

Event data is displayed on a timeline (Figure 10), allowing users to see the sequence and interrelationships at a glance. This makes it easier to organize information along a time axis even during multiple events, enabling efficient tracing of occurrence situations.

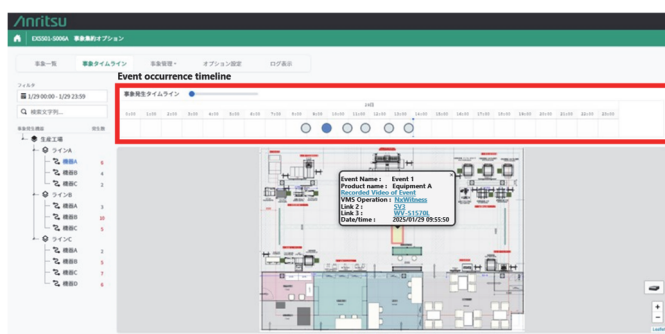


Figure 10 Event data timeline display

3.6 Inter-service Communication using gRPC

Internal, efficient, and fast data transfer between the frontend and backend uses gRPC, an open-source Remote Procedure Call (RPC) that can process multiple requests simultaneously by using HTTP/2.0.

Furthermore, gRPC is ideal for inter-microservice communication, making it very effective for Estinargy, which consists of multiple software packages. Additionally, it offers high scalability, allowing flexible adaptation to future migration to cloud servers depending on the provided functions.

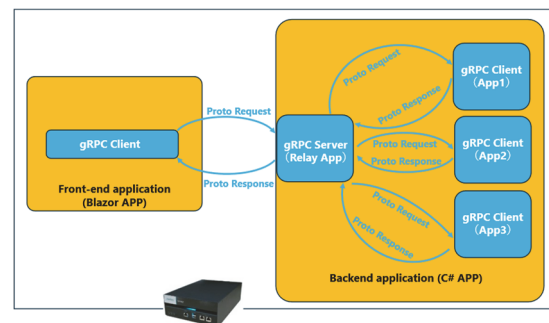


Figure 11 Internal communications architecture using gRPC

3.7 .NET Based Multiplatform Support

Estinargy uses .NET as its application platform. .NET serves as a development environment for multi-platform applications that support various operating systems (OS). It was selected for this development after considering the goal of deployment across a wide range of OS and hardware environments, and taking into account the availability of LTS (Long-Term-Support).

4 Video Technology

4.1 VMS Integration

As described in section 2.2, Video Management System (VMS) integration enables replay of recorded video in a web browser from a specified time range before event occurrence, making it possible to analyze events visually with captured video.

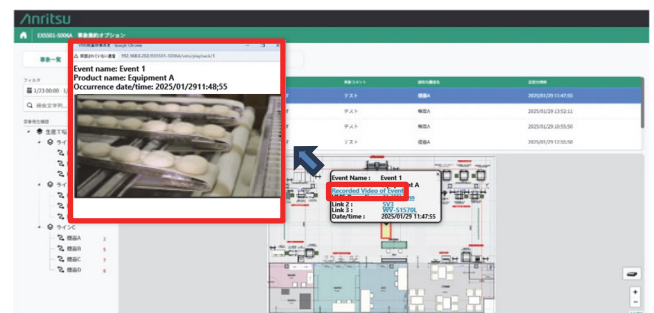


Figure 12 Replaying video record of event

4.2 SightVisor Integration

SightVisor is a multi-decoder that can display video or web content on up to 9 split screens. SightVisor and switching display control at an event displays relevant camera footage and event information automatically. Additionally, live video and recorded video can be played simultaneously by retrieving recorded footage from the VMS. This allows users to seamlessly recognize alerts, assess the current situation, and identify and analyze the cause to efficiently understand and respond to incidents.



Figure 13 Replaying video record of event

4.3 Multiple/Consolidated Video Recording using HDMI Encoder

Multiple camera videos and Web screens can be consolidated as one video record by using a commercial HDMI encoder to encode the video output from SightVisor and record the redistributed video with VMS.

Using this method, multiple locations can be consolidated into one video to cut search times for target videos, allowing quick confirmation of the video data relevance.

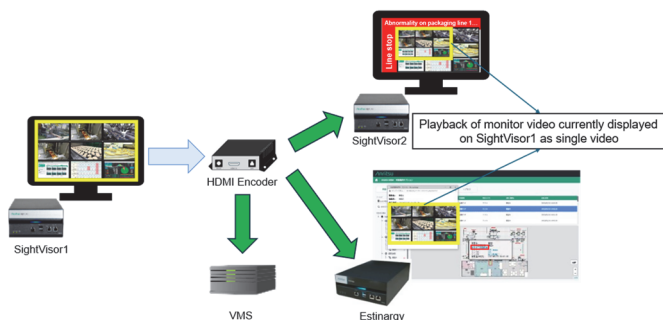


Figure 14 Consolidating multiple video records using HDMI encoder

5 Collaboration with Partners

5.1 On-Site Innovative uSIGMA® Collaboration Solution

Manufacturing and logistics processes involving people and objects (assembly, inventory management, etc.) are not well visualized (easily visible), which is a bottleneck for DX and business management/improvement.

To meet this challenge, Adsol Nissin Co., Ltd. offers the uSIGMA® solution supporting workplace transformation by visualizing, analyzing, and using location and movement data for people and inventory, etc., in factories and warehouses to reduce unnecessary work and improve and transform field operations. By linking with AccelVision to further strengthen the uSIGMA® visualization and analysis capabilities, video can be used in operations management and work analysis so managers can intuitively understand ‘what people were doing’ and ‘where objects are located.’

Specifically, it is possible to play live or recorded video from a specified time to trace the movements of people and objects by requesting camera data from Estinargy to analyze using uSIGMA®.

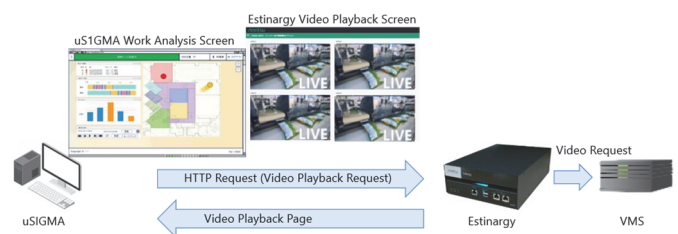


Figure 15 uSIGMA-AccelVision Integration

5.2 Collaboration with Factory and Building OT/IoT Security Services

In today's era when companies, local governments, and various industries are promoting DX, Internet-connected terminals are not limited to IT equipment but are increasing in number to include control devices in factories and buildings, raising concerns about cyberattack risks.

Against this background, NTT Advanced Technology Corporation (NTT-AT) is developing an ‘OT/IoT Security Services for Factories and Buildings’ solution that visualizes communications within internal networks and monitors devices connected to control networks and their communication status. Adding video to this proposed NTT-AT solution facilitates fast and accurate situation assessment at an event. Integration with AccelVision, creates a unified monitoring solution for both cyber (network) and physical (video) aspects to reduce on-site personnel workloads.

Specifically, when NTT-AT's proprietary software (INI: Internal Network Inspector), which automatically analyzes communication logs collected by the Fortinet ‘Fortigate’ network security appliance sold by NTT-AT, detects unauthorized terminals or connections to unusual destinations, it

notifies Estinargy via the WebAPI. Upon receiving a notification, administrators can efficiently confirm the situation visually by recording the event and playing the footage at the event occurrence at sites such as data centers to quickly identify signs of cyberattacks and strengthen responses.

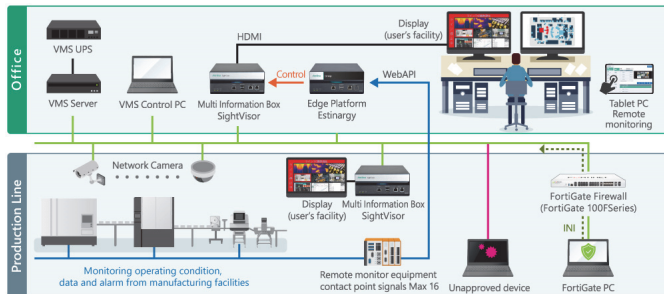


Figure 16 Integrated cyber-physical solution

5.3 Collaboration with ADDSAFE Workplace Safety Support Package

Japanese manufacturing industries, which account for 20% of all industries in the country, suffer the greatest number of workplace related accidents. Furthermore, recent advances in manufacturing automation and product diversification has an increased demand for rapid responses, leading to increased burden on workers and higher risks of occupational accidents. In this context, Konica Minolta Corporation uses its 'ADDSAFE' advanced image processing and AI technology to recognize people and objects from camera footage as a solution to detect abnormal events, such as falls and unauthorized entry in real-time using AI video analysis.

By integration with AccelVision, ADDSAFE detects falls and unauthorized entry and notifies Estinargy, enabling immediate notification to relevant parties and allowing rapid response using two-way communications for better on-site safety management.

Future long-term collection of case and analysis data may help prevent incidents before they occur.

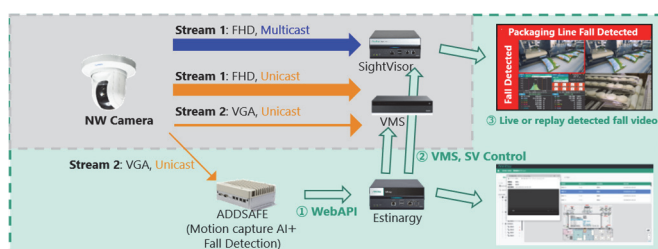


Figure 17 ADDSAFE-AccelVision integration

6 Anritsu Application Examples

6.1 Tohoku Anritsu No. 2 Factory

Tohoku Anritsu, the key factory manufacturing Anritsu's products, has implemented a 'Temperature and Process Monitoring' solution as part of DX initiatives to visualize work processes. This solution uses AccelVision to collect events that occur during the work process and visualize the situation using video.

For example, when an abnormality occurs in a collaborative robot, the event is notified to Estinargy, and the situation at the abnormality is recorded and visualized as video, facilitating analysis of the work process to support decisions about work improvement and optimization.

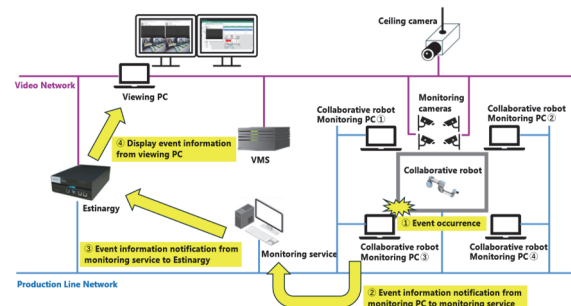


Figure 18 Temperature process monitoring-AccelVision integration

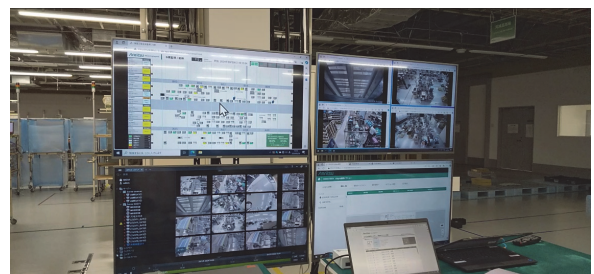


Figure 19 AccelVision at Tohoku Anritsu No. 2 Factory

6.2 Anritsu 5G Laboratory

The Anritsu 5G Lab started operation in April 2021 as a site for technical verification support, introduction of use cases utilizing Local 5G, and collaborative innovation.

AccelVision uses the Anritsu 5G Lab as a site for collaborating with partner companies as described in section 5, and is exploring use cases, verifying feasibility, and conducting demonstrations with invited customers.

AccelVision is also on permanent show, allowing visitors to experience Anritsu's industrial DX solutions. The laboratory is developing products with higher customer value by collecting feedback from customers who have actually experienced AccelVision, thoroughly investigating necessary functions,

and implementing a cycle of additions.

For example, intrusion detection is being demonstrated using ADDSAFE. Figure 21 shows the display when the intrusion detection is notified to AccelVision, allowing visitors to experience how they can detect entry into dangerous areas in real-time, confirm the situation through video, and respond quickly.



Figure 20 ADDSAFE Intrusion detection



Figure 21 ADDSAFE - AccelVision collaboration demonstration

7 Conclusions

We have developed AccelVision, a solution to promote industrial DX primarily in manufacturing industry, as well as Estinargy, an edge platform device forming the AccelVision core. AccelVision enables visual analysis using video data through two-way communication and coordination with external systems, making it possible to improve production efficiency by advancing labor-saving measures.

Furthermore, by collaborating with partner companies, we will continue to expand solutions tailored to customers' needs, not only for on-site safety management and network monitoring, but also to accelerate DX across various industries.

Its effectiveness has been confirmed through demonstrations at Tohoku Anritsu's No. 2 Factory and the Anritsu 5G Lab, and further development is expected through future technological innovation.

8 References

- 1) Blazor
<https://dotnet.microsoft.com/ja-jp/apps/aspnet/web-apps/blazor>
- 2) gRPC
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- 3) Development of SightVisor Information Browsing Device using H.264
- 4) Development of Unified Network Controller PureFlow WSX
- 5) Role of Anritsu 5G LAB in Resolving Industrial Digital Transformation (DX) Challenges

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Table 1 Specifications

Item		EX5501A
Main interfaces	LAN interface	1000 BASE-T×2
	Video output	Digital video (HDMI×2connectors) *However, uses only one HDMI in normal mode
	Audio output	Analog (2 ch) 3-pole stereo mini jack×1
	Output impedance	Approx. 150Ω
Home	Software list	Installed software list for added functions/WebUI link component names
Server operational data	System data	CPU usage, memory usage free disk space
	Network data	LAN1 and LAN2 MAC address, IP addresses
Maintenance	System data	Equipment name/serial number/installed software/license details/system data
	System settings	Software updates/license/date and time auto settings/software log/database initialization/equipment internal log initialization/equipment restart/equipment shutdown
	Network settings	LAN1 and LAN2 IP address settings/Static routing setting/Ping
	Backup/restore	Database backup/restore
Control	Remote control	Power-on/off using infrared remote controller
	Settings	WEB browser

Table 2 Option Software List

Model	Name	Remarks
EX5501-S001A	Basic software	Standard install in edge platform device
EX5501-S002A	SightVisor Integrated management software	Web application supporting SightVisor control functions
EX5501-S003A	WebAPI Option	Software to receive SightVisor control and external device data in REST format as HTTP Request
EX5501-S004A	Data integration option	Software to display camera icons on maps or floor plans based on camera position data, enabling visual selection of cameras
EX5501-S005A	Camera PTZ option	Software providing conversion and relay functionality from JBEE (Japan Building Electrical and Electronics Engineers Association) commands to ONVIF format control, to control ONVIF format cameras that cannot be directly controlled from SightVisor
EX5501-S006A	Event aggregation option	Software to store and view event information notified from external devices, and to play video footage linked to event information
EX5501-S007A	Event aggregation option for partners	Software to store and view event information notified from external devices, control video related to event information (including playback, fast-forward, rewind, etc.), externally transfer event information, and forward email