SynX™-Supervision: A Software Platform Making Social Infrastructure Intelligent and Remote Operation Ready

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In large system products such as transportation systems, production lines and defense systems, ancillary facilities such as surveillance camera systems and communication systems are installed, because it is necessary to monitor the system operating state, along with autonomous control over the machines incorporated therein, to make a comprehensive judgment about the operating conditions and orchestrate all the team members taking part in the operation. SynX-Supervision uses the latest software technologies to realize the functional integration of such ancillary facilities and autonomous control systems of machines. It is getting applied extensively as a platform that enables advanced cooperation between humans and machines in various fields and facilitates smartification of social infrastructures.

1. Introduction

The Covid-19 pandemic that started at the end of 2019 has acutely reminded us of the importance of social infrastructures in everyday life. On the one hand, this sheds light on the people working therein and came to arouse a challenge.

Even in the fields with a certain level of successful automation such as production, logistics and transportation, “human monitoring and response” are still indispensable for safe and high-quality operation. Under the current situation of limited human resources, however, there is a recognized risk of failing to accurately grasp the operating conditions of machine systems or establish adequate cooperation between the central monitoring room and the actual site. From a perspective of a business continuity plan (BCP), it is considered necessary to reduce the dependence on manpower in terms of both quality and quantity. In order to make our society more resilient, it can be said that the time has come for us to think again about enhancing the intelligence of machines from a system point of view and digitalization of their operations.

Looking at this situation from a systems engineering perspective, it is not enough to automate only its core equipment in the manufacturing industry, for example, and it is necessary to realize a world in which the logistics in the upper and lower streams and the energy and utility facilities that support them are also linked organically. In response to this social demand and the analysis, Mitsubishi Heavy Industries, Ltd, (MHI) announced "ΣSynX" in 2021 as a standard platform for synchronizing and coordinating various machine systems, and has started to consolidate digital technologies for realizing optimal operation by making machine systems more intelligent[(1)].

As one of the first applications of ΣSynX in the field of logistics equipment, we developed “SynX-Vehicle,” a machine embodying a new concept of Automated Guided Forklift (AGF); the demonstration testing of a technological package to realize intelligent warehouse logistics has thus started[(2)]. The application of this package is not limited to logistics, but can be relevant to other

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various fields owing to the control architecture having been reconsidered in a unified manner based on our extensive knowledge of mobile bodies/robots.

"SynX-Supervision" is a software package as one component in ΣSynX and is a collection of aggregated technologies that connect humans and machine systems. By combining these technologies provided by ΣSynX, for example, it becomes possible to coordinate the activities of a group of autonomous robots for loading/unloading with human involvement therein. Regarding the ΣSynX portfolio, we will increase and improve the SynX series components that can be connected with one another, so that we will be able to offer solutions whose value can be enhanced cumulatively, as represented by the symbol "Σ" for the true digitalization of customers.

2. Problems with conventional systems and the concept of SynX-Supervision

2.1 Conventional monitoring/control systems and their problems

The "human monitoring and response" described in the preceding section are a necessity for not only the whole portfolio of MHI products, but also the applications in other fields including finance, retailing, buildings, restricted lands and stadiums. Their use in places such as roads, urban areas and crowded streets can also help ensure public safety. Because their market needs are wide-ranging and universal, the existing solutions are also rich in variety, as exemplified by surveillance camera systems, public address systems and switching equipment for voice telecommunication. When designing and installing an entire production or transportation system, we often chose one that fitted the requirements of these existing solutions and incorporated it into the system on a functional unit basis (**Figure 1** a). However, in the fields in which intelligent machines are the main players in the system, the following problems have surfaced.

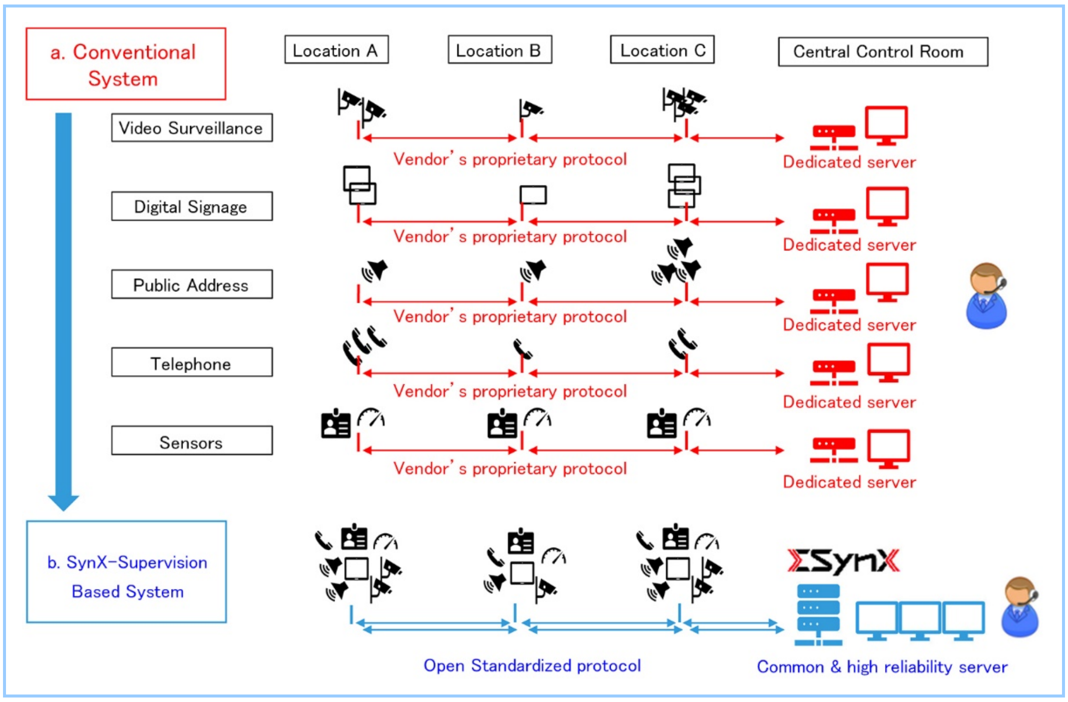

Figure 1 Configuration of the conventional system and that of SynX-Supervision
SynX-Supervision integrates different types of functions and allows them to run on a common computing platform.

(1) Necessary information cannot be obtained efficiently

It is difficult to keep attention when required to indiscriminately monitor numerous camera images displayed all over a screen. When a machine operates autonomously, it is preferable for the machine itself to point out a trend to which attention should be paid and cooperate with the operator in monitoring how it will develop over time. The reliability and efficiency of machine alerts can also be enhanced, if the operator is notified not by words and numerical data only, but by those accompanied by a live streaming image. In this way, the operator can instantly check the alarm back to the situation visually, and then decide what to do.

On the other hand, too much dependence on the machine for notification may cause the operator to overlook an event that is unnoticed by the machine. Therefore, information should be provided in a balanced manner from two perspectives: indication of a problem identified by the machine and its intended action, and understanding of the comprehensive and holistic situation without machine interpretation. However, it is almost impossible to build an easily usable system by combining the existing solutions that were developed independently of machines.

(2) Communication between people is slow and uncertain

Because individual systems operate independently, an alert raised by the control system or an abnormality detected in a camera image may be followed by time-wasting processes such as finding a nearby intercom or the telephone number of a responsible staff member, before communication is established. The staff member should also be experienced in this regard. Explaining the situation verbally or giving instructions to the staff member who does not directly see the screen or camera image of the control system often causes misunderstandings.

(3) Comprehensive analysis is difficult

In the event of an accident, investigating what really happened from multiple angles takes a lot of time and effort, because data extraction and display arrangement need to be manually performed owing to various types of data such as numerical data of the control system, camera images and voice communication records being stored in separate systems. If the relevant data from the neighboring areas at the time of an accident can be shown on the screen immediately, the following analysis and judgment can help contain the incident before it causes extensive damage. However, it is impossible with the current systems.

(4) Incomplete Remote support

If the situation necessitates support from an expert, it is not possible for him/her to remotely select and check the control system/visual data via the terminal as freely as in the central monitoring room. Even the use of a web meeting system requires the expert outside to ask the staff on-site to switch the image to a specific camera, which creates extra work for the staff on-site rather than helping with the situation.

(5) Maintainability and life cycle cost

In the conventional system, the server (central computer) for data aggregation and management and the workstation (terminal) for display and manipulation are individually set up by installing software dedicated to each unit of functions such as video monitoring and public address. For a system that is required to be restored quickly after the occurrence of a failure, such dedicated articles with proper settings need to be ready in advance for emergency use. This increases the number of spares and their management cost.

When it comes to long-term use, system maintenance and upgrading are likely to become impractical, because compatible products for such specialized hardware will be unavailable. For each middleware of the operating system, a security upgrade is also required at different times. This ramps up management work.

2.2 Development concept of SynX-Supervision

The main battlefield for intelligent machine systems has been set inside the "machine system" (shown in the middle of **Figure 2**), which is the control system closely associated with the machine. However, SynX-Supervision considers it as the "inner control loop" and aims to achieve more advanced overall recognition and judgment including human responses as the "outer control loop." SynX-Supervision performs sensing of various matters that are encompassed within the target area of manipulation (environment) such as the machine system, raw materials, products, users/staff, and even unknown threats/events. The obtained information is comprehensively provided to the operation supervisors (or artificial intelligence (AI) that works in part as their substitute) to judge the situation. Moreover, the function to enable human responses (i.e., manipulation of target values or environment) via audio terminals, public address speakers or signages has been incorporated.

This architecture takes a basis on the "OODA loop" model proposed by John Boyd[(3)].

The root cause of the problems with the conventional systems described in the preceding section is the structure with siloed stacks of disparate data such as "numerical value", "image" and "audio". In SynX-Supervision, therefore, no such architecture is employed. Instead, it focuses on the steps of "Observe (monitoring)", "Orient (situating in the context)", "Decide (decision making)" and "Act (taking action)". Our accumulated expertise and know-how in various fields such as sensing and data analysis are applied to each of these steps. In this way, the use of disparate data in an integrated manner can be facilitated to support people who take part in the operation.

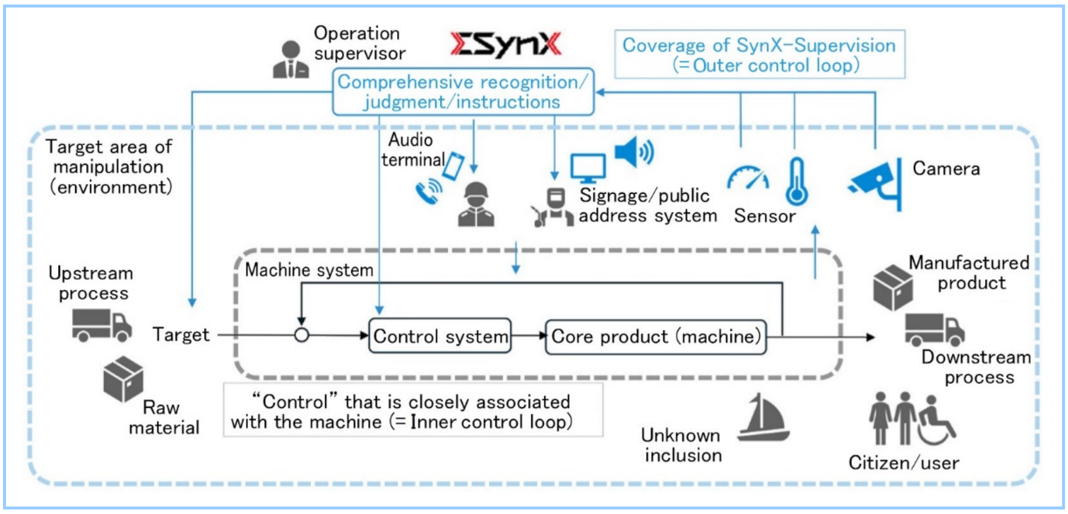

Figure 2 Coverage of SynX-Supervision
SynX-Supervision makes it possible to support/advance comprehensive recognition, judgment and instructions including the human response.

3. Functions and features of SynX-Supervision

3.1 Functions of SynX-Supervision

(1) Support function of "Observe" (monitoring)

An IP (Internet Protocol) surveillance camera with the industry standard Open Network Video Interface Forum (ONVIF) is detected on the network; live streaming monitoring is made possible with minimum latency.

There are two display options: "Workstation" for manipulation by the operator and "Video wall" for showing an image on a large screen. Using these two in a combined manner, the situation can be assessed from two different perspectives: the "intention" of the machine system, and the objective and comprehensive evaluation independent of machine interpretation.

(2) Support function of "Orient" (adapting to the situation)

For example, an image can be shown by automatically switching cameras or enlarged on the screen based on the information received from a production system through the "interoperable interface with external systems," which will be described later. Therefore, a material in the process can be shown tracked along the flow of the production line, thereby making it possible to reduce the workload of the operator. Furthermore, important parameters such as material temperature can be superimposed over the object on the screen, or allow relevant guidelines to be displayed dynamically for making it easy to check on material misalignment. This means that how the situation is understood and controlled by the machine system is naturally shared with the operator.

Camera images are automatically stored in the computer storage device under set conditions. A time-synchronized replay of multiple selected images can be of use to accurately understand and analyze accidents and other events. Since audio data from the communication system and numerical data/event information from the control system are chronologically stored in the common storage device, these different types of data can be used in a combined manner for interpretation and analysis.

A necessary part of the data can be cut off and sent to other analysis/recognition software (or equipment). Conversely, it is also possible to extract and display an image to which attention should be paid, depending on the processed results.

(3) Support function of "Decide" (decision making)

Concerning event information that the system received, it is possible for the user to add and improve by defining and developing the logic that can lead to the next action. Decision making may be supported via the workflow in which the system formulates and proposes response options, and humans select and confirm them.

For example, when the button of an emergency telephone is pushed or an abnormal condition is detected in an image from the relevant camera, the on-the-spot image can be automatically shown on the screen, so that the operator can talk while visually checking the situation. Conversely, if a dangerous item is detected in an image, the system can automatically list the nearby staff's contact information depending on the type of item and ask the operator to decide (**Figure 3**).

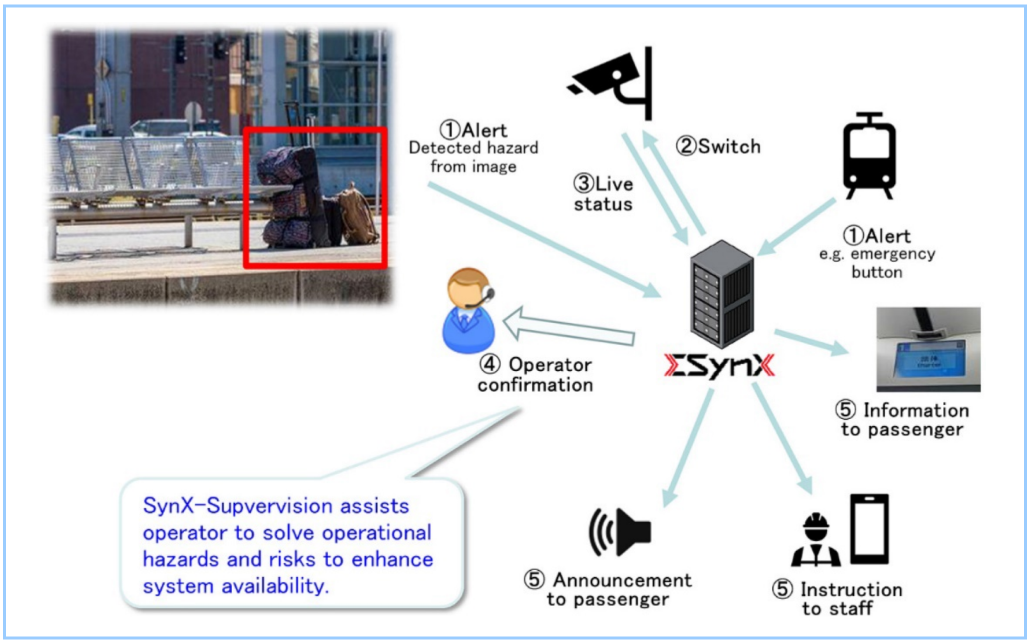

Figure 3 Automation of action enabled by the integration of various types of functions (an example)
The system availability is enhanced by helping the operation supervisor quickly avoid danger/risk.

(4) Support function of "Act" (taking action)

By connecting IP phone terminals, intercoms, and ceiling speakers with each other using Session Initiation Protocol (SIP), it becomes possible to make a live announcement not only from the operator's room, but also via any arbitrary phone terminals (depending on the settings). The transmission scenarios of audio messages are classified as BGM (background music) all the time, scheduled timetable basis, based on the trigger signal from the machine system, or manually by the operator. Their priority levels can be set arbitrarily (generally speaking, the priority increases in the order of mention). As a frequent use case at the production site, a group call can also be initiated and controlled by the trigger signal from the machine system.

Digital signage (screen noticeboard) has also been incorporated; necessary information can be displayed simultaneously with a voice message, based on the trigger signal generated by the machine system or the operator. As the digital signage terminal is controlled by the web standard HTML5, any terminals with a modern browser can be basically used regardless of their models. It is also usable for giving instructions to remote staff via portable terminals such as tablets.

3.2 Technological features to realize functional integration

(1) Interoperable interface with external systems

As described so far, in SynX-Supervision, the flexibility and versatility of an interface that is interoperable with the machine system or the other ancillary subsystems such as the fire alarm system are important. In the configuration of SynX-Supervision, differences among various communication protocols cultivated in each industry or business field are absorbed by the Messaging Hub through which necessary trigger signals and data are always captured (**Figure 4**). In this way, the signal converting component whose development is required as per the external system to be connected is separated from the standard/common functions of SynX-Supervision, thereby improving the efficiency of development and debugging. As the Messaging Hub can store all the data exchanged therein in a chronological database, these data can be used to test with a simulated external system at the stage of development or perform a post-analysis of an event in the past.

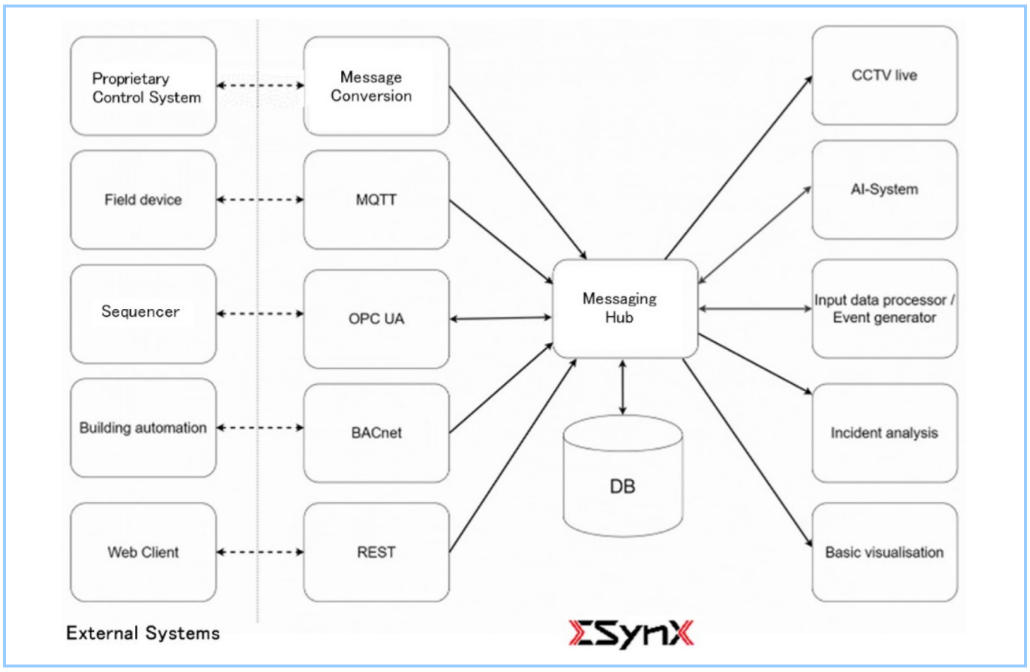

Figure 4　External systems and their connections
The Messaging Hub was set up to absorb the differences among various communication protocols cultivated in each industry or business field.

(2)　Uniform management of users and their authentication

While incorporating multiple functions/subsystems, SynX-Supervision adopts the concept of so-called single sign-on, implementing the uniform management of users and their authentication.

In this way, once a user logs in, she/he is authorized to access terminals such as cameras, stored data, contents of the screen, and such in any of the subsystems, depending on the preset role of the user. **Figure 5** gives a simplified example in which only the manager can change the contents of the screen or see recorded evidence. Traditionally, industrial systems rely on the physical security of the central monitoring room and often do not require the user to log in to the system. However, for the sake of privacy and labor rights, strict management is becoming legally necessary in terms of access authentication to the data handled in camera or voice communication systems. SynX-Supervision offers a uniform solution to this issue.

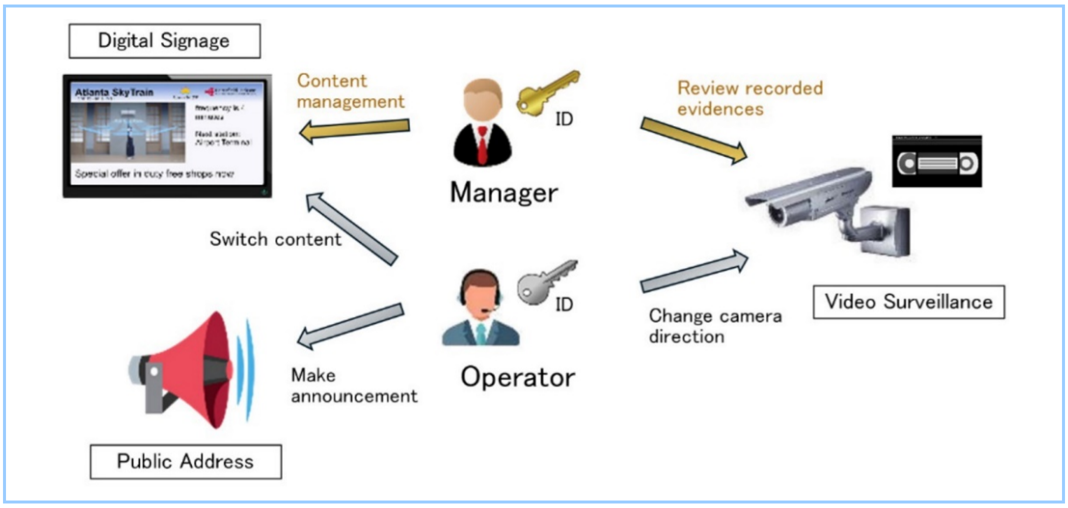

Figure 5　Uniform management of user authentication
With a single sign-on, the user is authenticated for access to multiple subsystems, according to his/her role.

(3) Improved maintainability with the use of web applications

SynX-Supervision functions as a web server. Images are displayed via a web browser for the workstation (including video monitoring), video wall and digital signage.

The early web browsers showed static images and necessitated reloading of the screen when information was updated. However, a dynamic page update method called Ajax was introduced around 2005. Later in 2014, it was standardized as HTML5, which resulted in the widespread use of "web applications" by consumers and office workers. These web applications were as usable as installed applications.

Having adopted this technology in the field of industrial systems, SynX-Supervision realizes usability comparable to installed Human-Machine Interface (HMI) software even on the web browser, as exemplified by real-time information display and quick response to the operation of a mouse.

The use of web applications eliminates the need for pre-installing software dedicated to SynX-Supervision in the workstation and signage terminals. Terminals with a so-called modern browser can be used immediately, once they are connected to the network and the user logs in. This considerably improves the maintainability. For example, if one terminal in the central monitoring room broke down, another can replace it. Even in the case of no spares available, quick restoration is possible if a commercial off-the-shelf terminal is procured.

As the HTTP communication of a web browser is originally intended for wide area networks, it is easy to remotely monitor and operate while complying with the information security requirements of each use. In SynX-Supervision, the communication is encrypted. Installing hardware-specific identification and corresponding certificate can restrict the terminals that can be used.

While such use of a web application as HMI software in industrial systems brings a huge advantage, long-term stability of the running application and real-time features (i.e., minimizing of latency) have been of concern. In developing SynX-Supervision, we addressed these issues mainly by performing long-term continuous operation testing while observing/analyzing the consumption of resources such as memories, and by employing our originally developed video player software with minimum latency. We have achieved about a year of 24-hour operation in an actual production facility.

(4) Securing reliability and scalability with virtualization and redundancy

SynX-Supervision software is containerized on a small functional unit basis. Because of the capability of managing/supervising the functions (microservices) running on the containers, the load can be distributed over computers or the network if the system is large. The software can be updated by the unit of microservice, thereby making it possible to reduce downtime.

Moreover, the virtualization of a computer environment in which these containers run on the hypervisor can provide redundancy to withstand failures of some of the computers and enables incremental addition of hardware resources. As described before, SynX-Supervision is intended to implement the functions conventionally running on different hardware units on a uniform hardware platform. It is therefore less wasteful than individually creating redundancy or managing/adding resources in multiple units of functionally dedicated hardware.

4. Application examples and the outcomes

(1) Iron and steel making plants

Sometimes in iron and steel making plants, production lines several hundred meters in length are controlled collectively. Therefore, it is crucial that any problem that occurred at some point on the production lines be promptly detected and taken care of, thereby preventing declines in yield rates or disruption of whole production lines. The measures traditionally taken for this purpose include production monitoring by setting up multiple monitoring rooms with direct sight to the critical zones of the production line such as the inlet/outlet of rolling stand and coil winders, while establishing communication/cooperation among the monitoring rooms. However, these measures necessitate the involvement of many operators as well as special attention to ensure that cooperation among these distant monitoring rooms is successful. In recent years, therefore, there has been a strong need for a centralized monitoring/control room that enables the production line to be operated while checking on the information from the control system and images from numerous surveillance cameras installed along the production line. In some cases, these surveillance cameras were procured/installed by the customers themselves, separately from the machines/control systems delivered by MHI Group.

SynX-Supervision has been provided to multiple customers in the iron and steel making industry through Primetals Technologies Limited, MHI Group's iron and steel making machinery systems manufacturer. The utilization of SynX-Supervision, which cooperates closely with the control system of iron and steel making machines, makes it possible to operate the production line effectively. Given in **Figure 6** is an example in which images from many surveillance cameras arranged along the rolling line are displayed in the centralized monitoring/control room. A small screen is fixedly assigned to each camera, while a relatively large screen is used to display an image to which attention is especially required under given production conditions. Our strength lies in the ability to always show pertinent images by making use of our expertise/know-how about machine systems, by connecting SynX-Supervision with the in-house machine control and production management technologies. It is also possible to superimpose on an image the information from the machine control and production management systems in the form of words, numbers or figures, therefore enabling a smaller number of staff members to understand the overall operating conditions quickly and properly. The setting for switching images and superimposition can be set/changed/adjusted by the user via the graphical user interface (GUI). This system has been used by the customer for about a year of 24-hour production line operation.

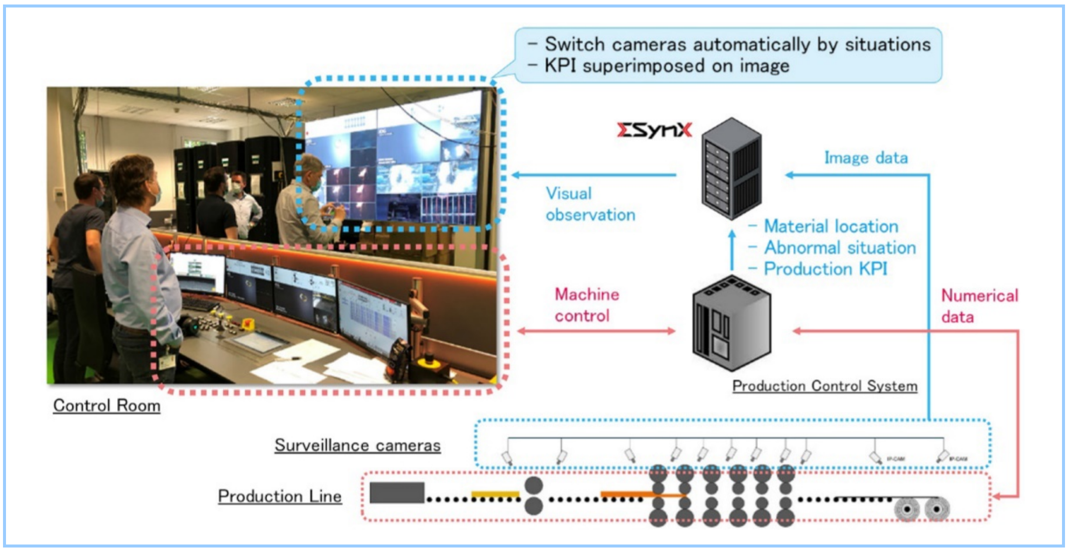

Figure 6 Practical application example of video monitoring of the rolling line
Centralized video monitoring is realized by, for example, automatically switching the images in cooperation with the control system of the production line and superimposing numerical data on an image.

Figure 7 shows an example in which the public address and voice telecommunication systems were incorporated in addition to video monitoring. It was introduced to a production line of a steel product for food packaging. As in the case of the preceding example, it is possible to automatically make a public address to the operator at the monitoring/control room and the staff working around the production line, depending on the information from the machine control and production management systems. This can make sure that the tasks manually conducted regularly such as changing waste containers for chip collection are performed. In cooperation with customers, we are testing a new function to detect abnormalities such as chips jammed in the machine based on camera image analysis and alert the operator/staff accordingly. The expertise and know-how accumulated through designing and operating machine systems are indispensable in making this type of image recognition effective. Our system features are image recognition software (which was developed by Primetals Technologies Limited using such know-how), real-time video streaming by SynX-Supervision, and notification of the results of processed data to the operator by SynX-Supervision. Using SynX-Supervision which is visual information handling software as a platform, many years of MHI group's know-how specializing in this field is gradually and smoothly dispensed as an added value to customers. In this example, being equipped with integrated data recording, the system can stream recorded images and other multiple data in a synchronized manner, which makes it easy to reproduce and analyze how a particular event occurred.

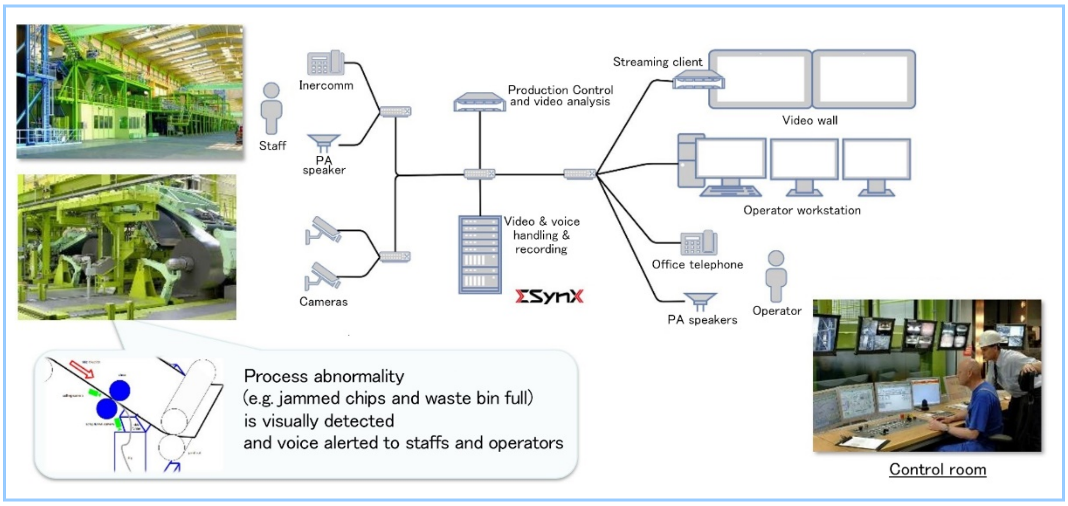

Figure 7 Practical application example of the system into which video monitoring and voice telecommunication are incorporated

In addition to the trigger signal from the production system, the staff is automatically voice-alerted when an abnormal condition is detected in an image.

Pictures : curtesy of thyssenKrupp Rasselstein GmbH

(2) Transportation systems

Of the transportation systems, Automated People Mover (APM) is our specialty and is often dealt as a turnkey product which means that the contract collectively includes design, procurement and installation of the components such as vehicles, tracks, traffic signal systems, electric facilities, fire protection equipment, video surveillance systems, passenger information systems (digital signage), and public address systems. Commissioning of the operation/management of transportation systems is increasing in our group.

As in the case of the field of iron and steel making machines, there is substantial room for improvement in operation quality and efficiency. That is where intelligent machine systems can be used as incorporated functions in the system, which is enabled by making use of our product expertise and management know-how. Overall reduction of downtime and life cycle cost through effective preparation for the failure of components can benefit both customers and our company.

Figure 8 summarizes the application of SynX-Supervision to a transportation system. When compared to the practical example of the iron and steel making field (Figure 7), the first difference of note is the addition of the passenger information system. This is a type of digital signage and can be exemplified by digital noticeboards at a station to show train departure/arrival and destinations, weather forecasts, news and advertisements. Information to be displayed at a station is switched based on the information such as train location data from Automatic Train Supervision (ATS) which takes the role in scheduling the train operation as a part of railway signaling systems. As the information reception and response behavior of the passenger information system have a lot in common with the public address system, these two systems are integrated on the same hardware/software platform in SynX-Supervision. This system simplification improves the flexibility in fine-tuning timing and updating contents, thereby contributing to better passenger services. The integrated system of voice telecommunication and video monitoring minimizes the restriction by allowing nearby staff to integrally recognize combined information of the operation status of each system, alert, video, etc., when an emergency button or phone in a station or train is used for example.

The connection/cooperation between the machine system and SynX-Supervision also includes providing alerts at the time of emergency brake activation in addition to routine guidance such as train operation and door opening/closing. This is because the connection is made not only to ATS on the ground side, but also to the onboard systems of Vehicle Control System and Automatic Train Operation (ATO). In the transportation system, therefore, SynX-Supervision has a layered structure of the ground side and the onboard side (with multiple layers). As SynX-Supervision has been designed and implemented in such a way as to become compatible with a wide range of general-purpose computers, most of the software running on the ground side and the onboard side is the same.

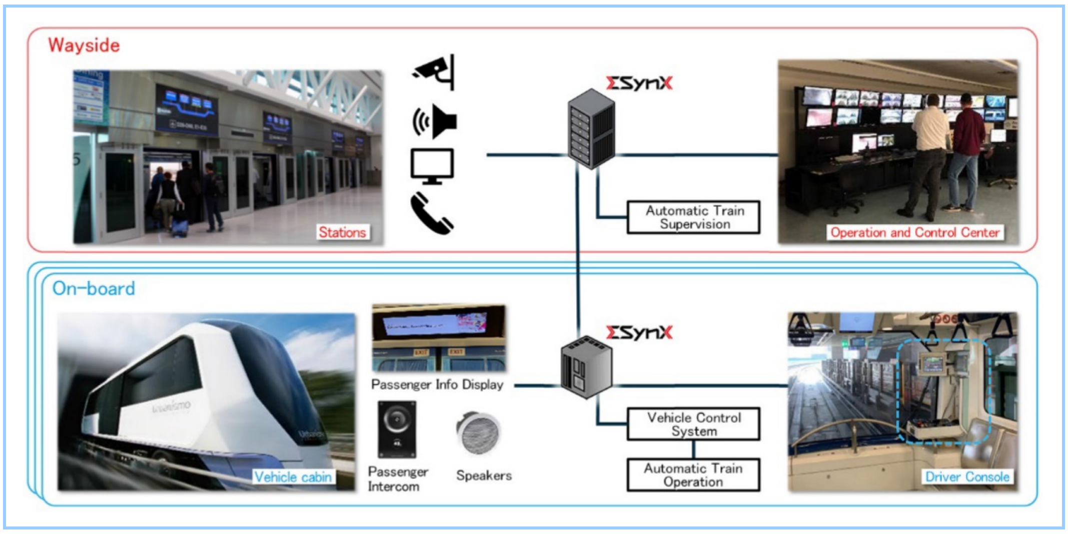

Figure 8　Application to a transportation system
Information is obtained from the machine system on both the ground side and the onboard side, and is provided to passengers on time. A proper understanding of operating conditions by the operator is also realized.

(3)　Marine vessels

Whether a ship is commercial or naval, there is always a strong need to secure safety while reducing the workforce necessary for navigation or other assigned activities. Therefore, a recent trend is to install surveillance cameras inside/outside the ship, thereby enabling smaller crews to accurately grasp the overall situation. Naval ships, which play a pivotal role in maintaining maritime security, are also required to serve other purposes such as disaster support; there is an increasing need for better security management among the crews including untrained persons onboard, for example, in the case of protecting and accommodating citizens. It is important to achieve long-term maintenance of their capabilities by phasing in advanced technologies such as AI for upgrading.

In response to such needs, we conducted a trial demonstration of a system for more advanced and intelligent functions for mainly naval ship video monitoring using SynX-Supervision. This application is different from those of the aforementioned iron and steel making machines or transportation systems. That is, in these systems, the critical areas should always be shown on a screen for monitoring. In naval ships, however, it is unrealistic to keep numerous images on a screen all the time. Typically, it is necessary to bring an image of a specific zone on a screen for checking, depending on which areas are manned or the activation status of the fire alarm system. Therefore, we enabled the demonstration system to detect the presence of humans in images collected by SynX-Supervision using AI, bringing the image of interest over the naval ship's cross-section view. Multiple recorded videos can also be displayed side by side. With a touchscreen, an event that needs investigating can be scrutinized by freely forwarding/rewinding the videos (**Figure 9**).

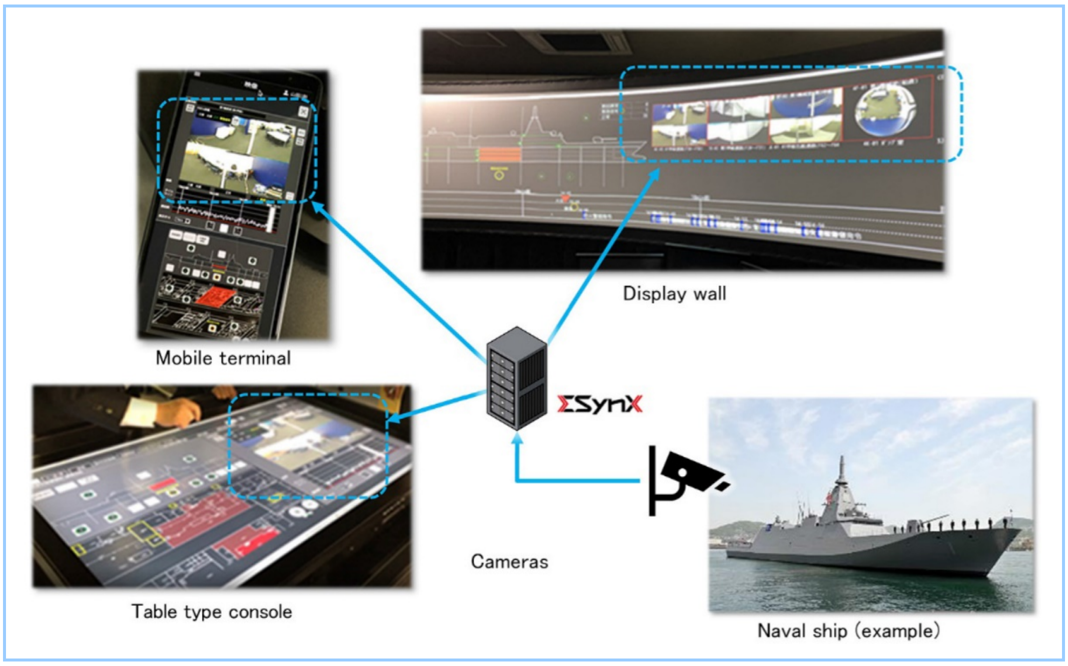

Figure 9 Demonstration system to apply to naval ships
Visual data are brought and displayed on the screen of the ship's control system, aiming to realize an accurate understanding of the situation and reduction in the workload of crews.
Source: the Japan Maritime Self-Defense Force website

5. Value-added benefits

5.1 Value-added benefits provided by SynX-Supervision

As indicated through the application examples in the preceding section, SynX-Supervision can offer customers the following unique value-added benefits.

(1) Improvement of operation quality

An accurate understanding of a situation and adequate cooperation among the operation staff are the key to improving the operation quality in any field. SynX-Supervision's contribution in this regard includes a timely display of information in cooperation with the machine system, and automated systems for communication and instructions. Recently, car driving assisted by devices such as cameras is getting common, and is believed to have reduced the accident rate. Likewise, for large machine systems, better cooperation between humans and machines can also be studied and pursued.

(2) Securing of BCP and response to new work styles and societal demands

The use of a web application as HMI helps secure BCP by lifting the restrictions on the terminals for use and the places from which operation can be supervised. SynX-Supervision serves as the platform for operational continuity under remote cooperation, even if pandemics or other disasters prevent many operators from actually coming to the site for work.

Especially when specialized skills and knowledge are required, it is getting difficult to secure a sufficient number of such staff and deploy them to the plants where the machines are installed. There is a strong need to loosen the restrictions imposed on the age and place of residence and expand the work opportunity. We have already started a trial in which SynX-Supervision is used for construction progress management and gives instructions by connecting our office with the site where the machines are installed.

On the other hand, issues on privacy have been pointed out regarding the use of visual and voice data at a workplace or public space. SynX-Supervision helps customers to meet regulations such as EU General Data Protection Regulation (GDPR) and establish an operational system in line with societal demands by managing users and their authentication uniformly.

(3) Minimizing life cycle cost

The integration and generalization of computer resources contribute to reducing the costs, because, for example, even the expansion of memory capacity or processing power still retains high flexibility when it comes to selecting vendors. Furthermore, a smaller footprint for equipment and scaled-down power supply/wiring systems can also lower the design/installation costs as a ripple effect.

The use of web applications enables a wide range of general-purpose products to be used with the HMI workstations installed at the central monitoring/control room. As there is no need to pre-install software dedicated to each of many installed workstations, cost reductions can be expected from sharing/minimizing spare equipment and quick procurement of them.

The life of such information equipment, including obsolescence, is shorter in general than the machines. Therefore, when a facility is in operation over a long period, the frequency of updates is relatively high, which often ramps up the life cycle cost. As a system vendor, we consider it very meaningful that we can offer responsible solutions to customers from a standpoint of securing their long-term benefits.

(4) Securing prospects and future development

SynX-Supervision, which can transmit, store, manage and extract different types of data uniformly, serves as the foundation for future development by enabling customers to maintain the latest system capability and operation quality through incorporating new technologies such as AI. As various requirements for decarbonization around machine systems are under discussion, their regulations/rules are expected to change constantly. For example, if it becomes necessary to collect evidence or be audited using images with the loading/unloading records of fuel or raw materials and their usage, there would be no problem with adding/providing a function for such purposes with SynX-Supervision, which has plastic properties.

6. Conclusion

SynX-Supervision is a software developed as a platform to realize the revolution of value added through making our machine system products intelligent. Focusing on “human recognition, judgment and instructions” that are required across multiple product fields, we have applied the latest software technologies therein to create a foundation enabling gradual/continuous introduction of the technologies that are expected to develop in the future, such as AI. Thus, we will improve operation quality for customers and secure the value of our products that they use over a long period.

Having been in operation for a year, this software has a proven record of quality and serviceability, increasing its functions and applicable fields in an accelerated manner. Looking forward, we will further advance the platform by connecting to/combining other software solutions and mechanical products we accumulated in-house, and help realize a thriving, secure, safe and comfortable society in which humans and machines work together harmoniously.

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