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Use cases of private 5G in the manufacturing site

Use cases of private 5G (1)

Logistics automation

Automated transport

Unattended and automated operation from carrying-out work by the automated guided vehicle through loading/unloading on/from in-plant trucks to running driverless in-plant trucks

Issue

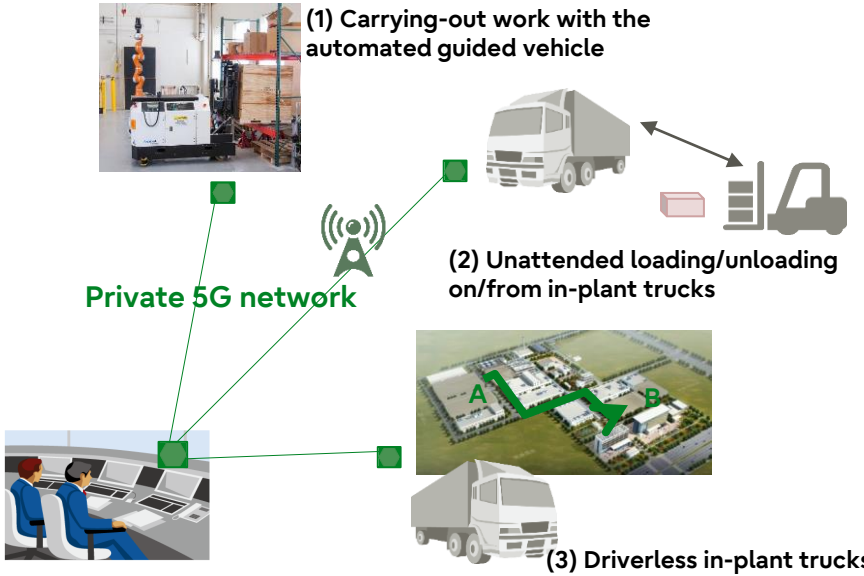
- ◆ Issue with labor shortage
- ☐ To increase the efficiency of transport operations in the plant
- ☐ To build a flexible logistics structure with no human operators in the plant according to 24-hour line operation and flexible production shift

Solution

- ☐ To perform automated or remote control
- ☐ To enable flexible support for line operation time including 24-hour line operation
- ☐ To display the position, speed and status of automated guided vehicles in real time through centralized remote monitoring and control for in-plant logistics by the equipment management section

Effect (Expectation)

- ☐ To eliminate labor shortages
- ☐ To achieve flexible line operation



Automated inspection/work support

Increasing the productivity and efficiency by means of automated inspection work and remote support for work

Issue

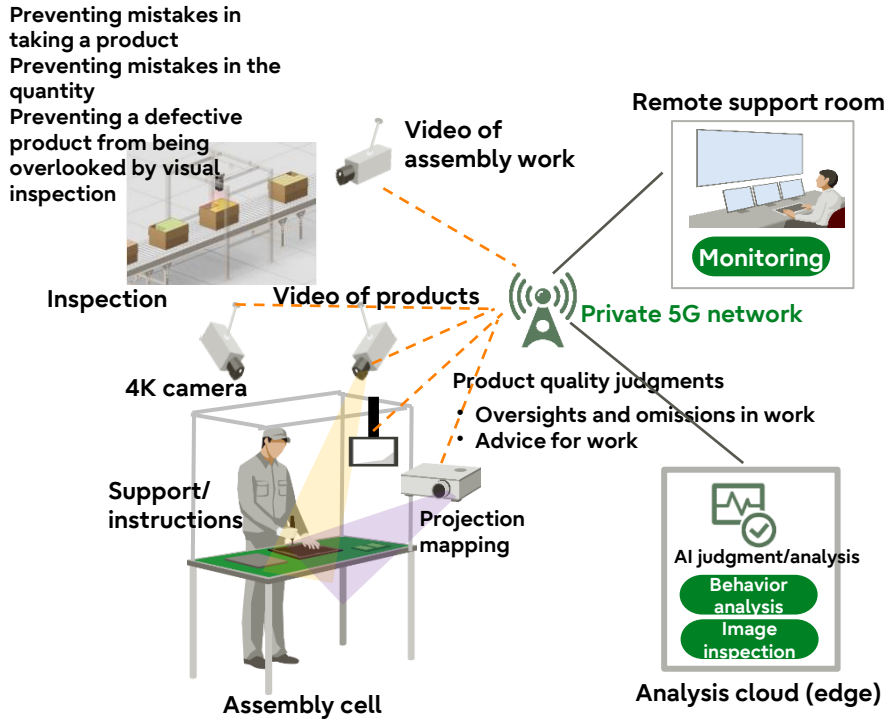
- ◆ Issue with productivity growth
- ☐ Release of defective products due to insufficient know-how of visual inspection by operators, and lowered efficiency of inspection work
- ☐ The know-how of skilled engineers is contributing to maintaining the productivity. However, the labor shortage imposes significant workloads on skilled engineers, taking time and incurring costs for the transfer of that know-how

Solution

- ☐ To perform automated visual inspection by analyzing high-resolution videos of products taken using 4K/8K camera with AI during product appearance inspection
- ☐ To prevent the release of defective products by AI judgment
- ☐ To provide operational supports for remote checking of the quality and making determinations/giving instructions by transferring high-resolution videos of operators' assembly works and products from the plant to headquarters

Effect (Expectation)

- ☐ To eliminate the shortage of skilled engineers
- ☐ To accelerate the transfer of know-how through remote support, leading to increased operating efficiency
- ☐ To resolve the issue with oversight of defective products in visual inspection, leading to increased productivity



Use cases of private 5G (3) Remote assistance solution
Remote support

Support for the work of on-site operators in dangerous areas using AR/MR

Issue

- ◆ Issue with operating efficiency
- ☐ Possible risk of accidents in dangerous work areas
- ☐ To provide appropriate support to on-site operators in order to efficiently complete their work in a short time

Solution

- ☐ To provide support for the work using HMD/AR
- ☐ To display appropriate work instructions on the devices such as HoloLens and tablets by remotely checking videos of the workplace

Effect (Expectation)

- ☐ To reduce mistakes
- ☐ To increase operating efficiency
- ☐ To reduce accidents

Providing information for support from remote locations

Supporter remotely checks the operation video in dangerous places. Input appropriate information; or Notify the operator of work support information through voice conversation.

Check looseness

Is there anything wrong?

It is okay to press the switch button.

Provide information for supporting the work to operators

Collect real-time information mainly including high-resolution images

Private 5G network

Work in dangerous places

Operator does his/her work based on support information displayed on his/her work terminal.

Input information for supporting the work such as details of the work and commands entered on the screen of the operator's device

Display an alarm on the operator's work terminal to notify the operator of possible danger.

Use cases of private 5G (4)
Automated picking operation

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Labor shortage in picking operation on production lines for improving the productivity

Issue

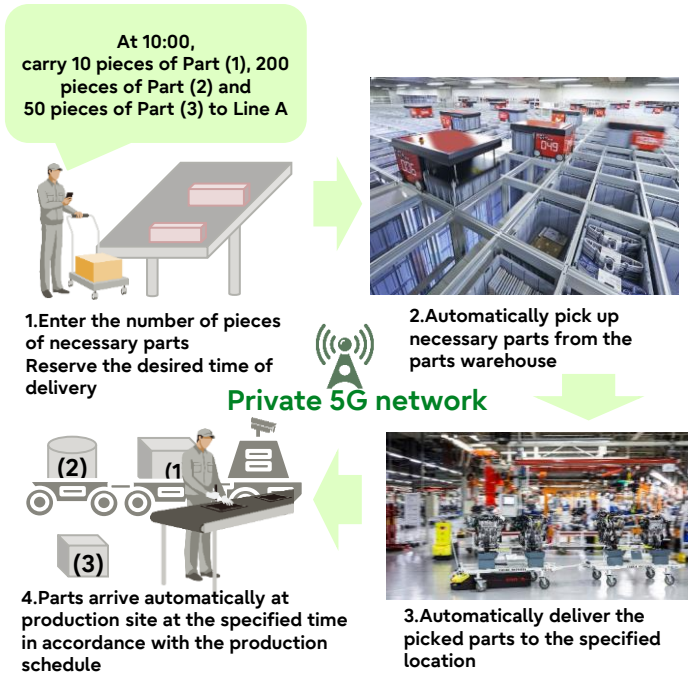
- ◆ Issue with labor shortage
- ☐ Picking operation on production lines imposes workloads on the operators
- ☐ Labor shortage is compensated by adjusting work shift schedules

Solution

- ☐ Automated AGV picking
- ☐ To perform automated picking operation by controlling AGV in real time on production lines, taking advantage of the low latency of private 5G

Effect (Expectation)

- ☐ To resolve the issue of labor shortage through automated picking operation
- ☐ To achieve flexible line operating time



Production management section

Grasp the part inventory and production statues in real time
Verify the part procurement and production plans in real time

Equipment management section

Centrally monitor and control in-plant logistics from remote location
Display the position, speed and status of AGVs in real time

Use cases of private 5G (5)
Changing the wired network to wireless network

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Flexible changes in production lines

Issue

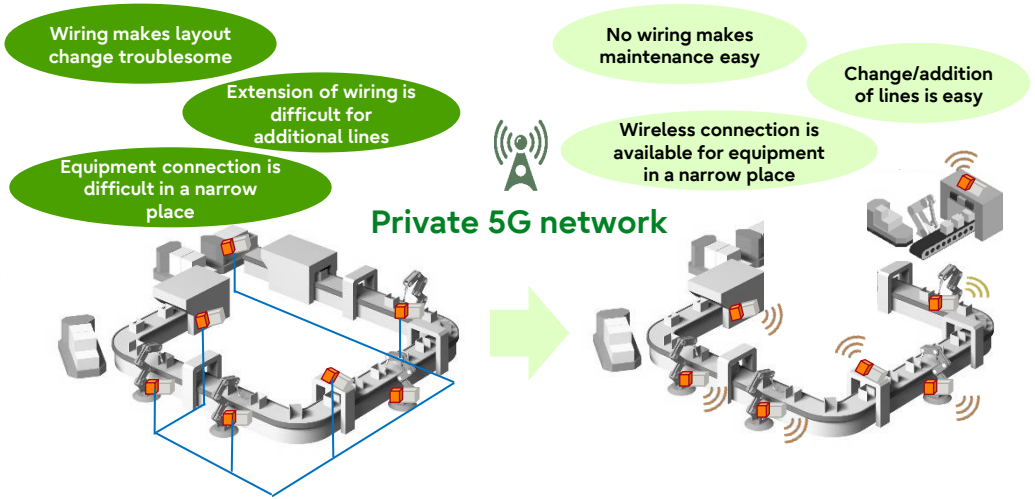
- ◆ Issue with productivity growth
- ☐ The production line layout cannot be changed flexibly for a customized production
- ☐ The production lines are controlled by the wired network Design change and rewiring are required for every change in production lines. Time consuming and costly
  - (1) Increase in cost Wiring work; purchase of wiring fittings
  - (2) Lack of flexibility Wiring design change is required for every change

Solution

- ☐ With private 5G implemented, the control network for production lines becomes wireless, which enables flexible changes in production lines
- ☐ Wireless production equipment enables to change production lines without restriction according to demand
- ☐ Edge/cloud-based PLC enables flexible design of robot control algorithms on multiple lines

Effect (Expectation)

- ☐ The production line layout can be changed flexibly for a customized production (Increase in productivity)



(1) Wireless network makes layout change more flexible than wiring network
(2) Implementing private 5G can reduce the number of APs, save maintenance effort and expand coverage.

Use cases of private 5G (6)
Operator behavior analysis/technology transfer

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Operator behavior analysis/technology transfer

Issue

- ◆ Issue with productivity growth and technology transfer
- ☐ Issues with shortage of successors of experts techniques and technology transfer are arising due to labor shortage
  - (1) Transfer of know-how takes effort and imposes significant workloads on skilled engineers
  - (2) It takes time to become familiar with the operating manual

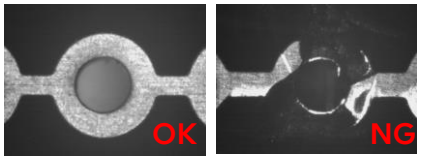
Solution

- ☐ To provide support for the work using HMD/AR
- ☐ To collect video data of movements and operation flow lines of the operators in charge of production line and production equipment data to analyze with AI. With the use of the private 5G network, sending real-time feedback to production line operators to compare with skilled operators can contribute to improving productivity.

Effect (Expectation)

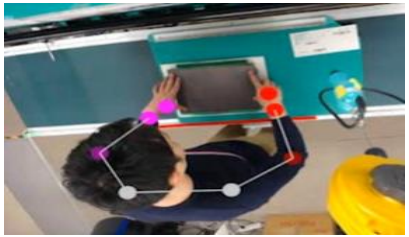
- ☐ To enable technology transfer (leading to improved productivity)

Use of high-resolution video



Anomaly detection by comparison and analysis

Analyze operators' movements with AI



Private 5G network

Use cases of private 5G (7)
Automated patrol

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Automated patrol AGV

Issue

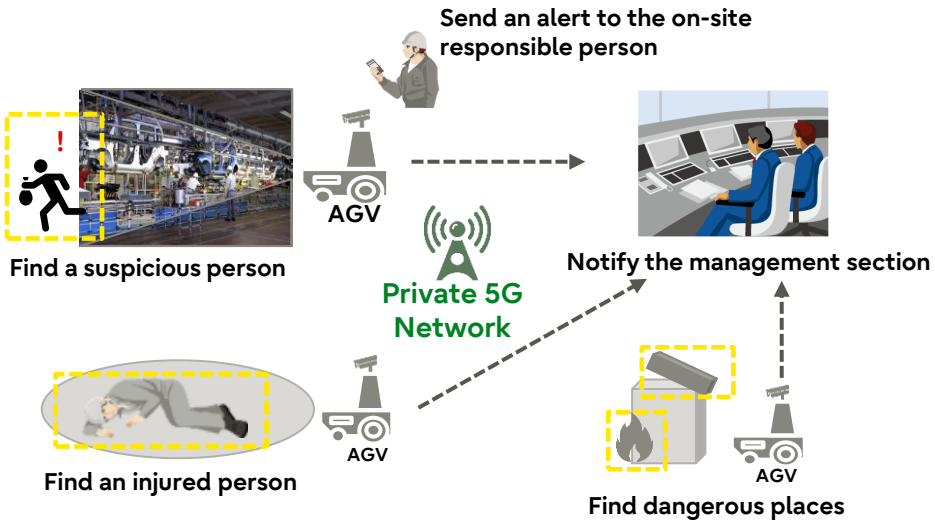
- ◆ Issue with labor shortage
- ☐ Lowered quality of patrol work due to labor shortage
- ☐ Manufacturing site equipment is secured and maintained by human power through in-plant patrol, which imposes significant workloads on the operators. There is also a risk of oversight due to fatigue and human error while patrolling

Solution

- ☐ Automated robotic patrolling
- ☐ To enable automated patrol by using high-resolution videos of products taken using 4K/8K cameras and AI image analysis

Effect (Expectation)

- ☐ To resolve the issue of labor shortage through automated patrol



Use cases of private 5G (8)
Unattended operations in dangerous sites

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Dangerous places

Issue

- ◆ Issue with safety and security
- ☐ Potential risk of accidents in dangerous work areas
- ☐ To eradicate the causes of accidents that threaten the safety and security of the operators during maintenance/inspection work in places where their physical security can be endangered
  - (1) Places with a risk of radiation exposure or infection
  - (2) Places with high temperatures (e.g. steelwork) or low temperatures (e.g. freezer)
  - (3) High places including chimneys

Solution

- ☐ To eradicate the causes of accidents by eliminating dangerous operations with unattended remote operation using robots
- ☐ To enable inspection/maintenance work in places that have been too dangerous to enter

Effect (Expectation)

- ☐ To ensure safety and security
- ☐ To appropriately manage maintenance/management costs and depreciation period for equipment

Work in dangerous places

Monitor the dangerous places with a risk of high temperature, radiation exposure or infection on the screen and perform inspection work by remotely controlling the robot.

Inspection work at high places

Shoot a video in high places including steel towers and chimneys using a drone. Remotely perform inspection work while viewing the video from the drone.

Remote real-time control

Private 5G Network

Collection of real-time information mainly including high-resolution images

Equipment operations from remote locations

Supporter remotely checks the operation video in dangerous places.
Remotely operate the robot or drone while viewing a video sent in real time.

Use cases of private 5G (9)
Improvement in manufacturing process/cost reduction

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Improvement/cost reduction by analyzing manufacturing process data

Issue

- ◆ Issue with productivity growth
- ☐ Problems with improvement in manufacturing process are not adequately identified
- ☐ In the manufacturing process, it is necessary to locate actual bottlenecks and identify improvements. However, operational flow cannot be tracked in real time

Solution

- ☐ To keep track of the manufacturing process in real time using sensors and cameras installed in manufacturing sites and manufacturing equipment. Grasping the whole process in real time makes it possible to locate problematic bottlenecks to take actions for improving lead times

Effect (Expectation)

- ☐ Improvement in manufacturing process (productivity growth)

Improving manufacturing process through real-time data analysis at manufacturing sites

Automated and remotely-controllable manufacturing robots

Sensor devices to acquire data related to person-hour (month), quality and cost

Cameras to record videos of on-site operations at 4K/8K high resolution

Private 5G network

To centrally manage and remotely control the status of the manufacturing site

A failure is occurring in the painting equipment!
The line will stop.

Visualize the manufacturing process in real time to identify problems. Provide a quick response

We see a delay in the assembly process.

Why is the yield rate high in the assembly process?

Inspection equipment needs to be strengthened.