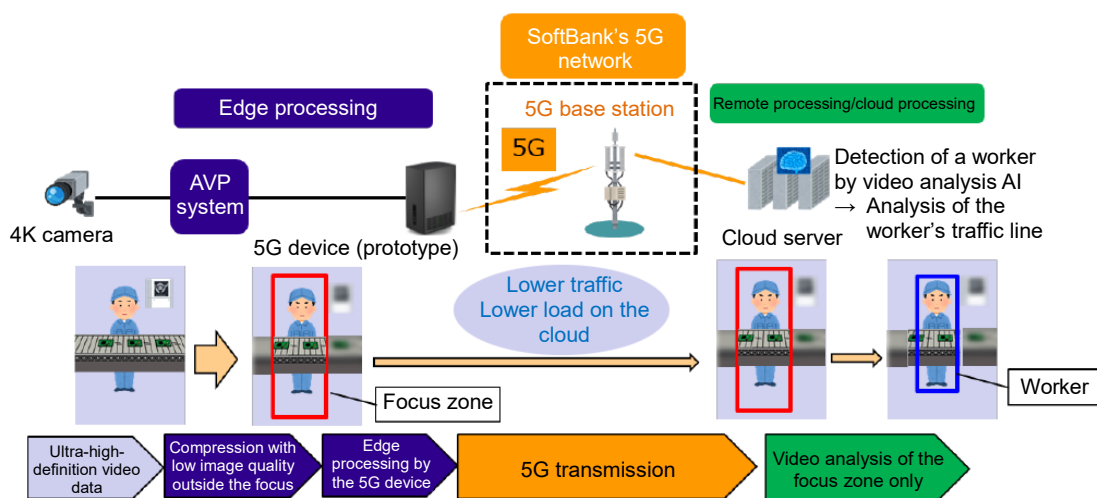■ **Background to the demonstration**

SoftBank and Sumitomo Electric have been working on demonstrations to improve productivity at plants by using 5G, AI, and IoT with the aim of realizing smart factories. SoftBank's 5G networks and Sumitomo Electric's industrial 5G terminals are used to transmit data from sensors, equipment, and cameras in factories to cloud servers to conduct AI-based video analysis. This enables the visualization of various production site conditions, including equipment operation status, manufacturing quality, and worker movements. To improve productivity at factories, it is essential to visualize the movement of workers and accurately ascertain their tasks. In a demonstration experiment in 2021,[*3] workers were detected in a video captured by a full-HD camera installed in a factory to visualize the work time in real time based on 5G-based video transmission and AI-based video analysis. A mechanism was established to quickly give feedback to the site about tasks whose expected time was significantly different from the actual time.

However, distant workers whose image sizes were small could not be detected due to the low resolution of the camera. An effective countermeasure is to use multiple high-resolution cameras, including 4K cameras. However, this requires the transmission of a large amount of video data. It is required to increase the video transmission efficiency even if high-speed, large-capacity 5G is used.

A demonstration was conducted to compress the video using an AVP system developed by Sumitomo Electric and efficiently transmit the 4K video. AVP is an AI-based video processing method. Lightweight AI which can operate on the edge side extracts the focus zone (where workers were captured in this demonstration experiment), and compresses the video with high image quality. The data outside the focus zone is compressed with low image quality to reduce the overall amount of video data. The amount of data to be transmitted can be reduced by AVP compression as edge processing before transmission to the 5G network.

■ **Results of the demonstration**

In the demonstration experiment, a 4K camera was installed in a factory of Sumitomo Electric. Workers who performed tasks were captured, and the video was compressed by the AVP system. The data was transmitted to a cloud server via SoftBank's 5G network. On the cloud server, video analysis AI only detected workers in the focus zone, and analyzed their traffic lines to visualize the movement of the workers.

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The Details of the demonstration

Configuration diagram of the demonstration

Video compression by the AVP system and edge processing before data transmission via the 5G network reduced the amount of data by 88% compared to the H.264 compression and transmission without designating the focus zone. Theoretically, it will become possible to transmit video data of eight times more 4K cameras simultaneously than by a conventional system via a single 5G network.

The worker detection rate by video analysis AI on the cloud server was measured. The focus zone that captured workers was subjected to high-resolution compression by AVP. Thus, distant workers who could not be easily detected by full-HD cameras due to their small image size were accurately captured. The detection rate improved from 89% to 100%.

[Overview of the demonstration]
Period: December 14, 2021 to July 6, 2022
Location: Osaka Works, Sumitomo Electric
Objective: efficient 5G transmission of 4K video by using AVP
Camera used: one 4K camera (captured area: 60 m2)