

Development of Cloud-Based Information Collection System for Automated Guided Vehicle (AGV)

Yuya Matsushita,
Kotaro Takahashi,
Joji Imai

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Abstract

Automated Guided Vehicles (AGVs) play an important role as part of automation equipment in factory production lines and logistics warehouses. For these devices to operate smoothly, it is essential to prevent breakdowns and problems before they occur, and to prevent equipment from aging due to operation time, it is necessary to perform appropriate maintenance at the appropriate time. However, issues in Japan such as a shortage of maintenance personnel due to population decline and difficulties in passing on skills due to aging have also emerged.

We have built an AGV information collection system on MEIDEN CONNECT, a cloud-computing platform that utilizes the Internet of Things (IoT) and Information and Communication Technology (ICT).

With this system, we aim to improve maintenance and inspection work and create new value by utilizing the big data. Currently, data is being collected through a demonstration verification program at our in-house production lines.

1 Preface

We have supplied many Automated Guided Vehicle (AGV) systems using AGVs to manufacturing production lines and logistics facilities. When a malfunction or another problem occurs, maintenance service workers are dispatched to investigate the cause of the malfunction and restore operation, which disrupts the operation of the customer's production line or logistics facility. Therefore, from the perspective of equipment maintenance, it is important to shorten the downtime (mean time to repair) as much as possible.

To address this issue, we have developed an AGV information collection system that utilizes cloud technology. This paper introduces the features of this system.

2 MEIDEN CONNECT

MEIDEN CONNECT is our cloud-computing platform that collects AGV system data over the long term and uses it to analyze the operating status and deterioration status of AGVs and other equipment. By collecting on-site data, we can improve the quality level by dispatching maintenance serv-

ice workers based on the condition of the equipment and proposing part replacements. We also plan to analyze the accumulated data and provide feedback to our related research and development department. This will lead to the development of better products that are less likely to break down, and are better suited for customer usage.

In this way, we are developing MEIDEN CONNECT as a platform to provide better products and services to our customers. [Fig. 1](#) shows an example of how MEIDEN CONNECT can be used.

3 AGV Information Collection System

We have built a hardware configuration for connecting the AGV transport system to MEIDEN CONNECT platform and an interface function for linking it to the cloud. [Fig. 2](#) shows the configuration of the AGV information collection system.

The AGV constantly communicates with the system control panel, and the internal data sent from the AGV is temporarily stored in the data collection Programmable Logic Controller (PLC). The stored data is sent to a data collection terminal connected to the PLC, where it is processed for data transmission to the cloud, and the data is periodi-

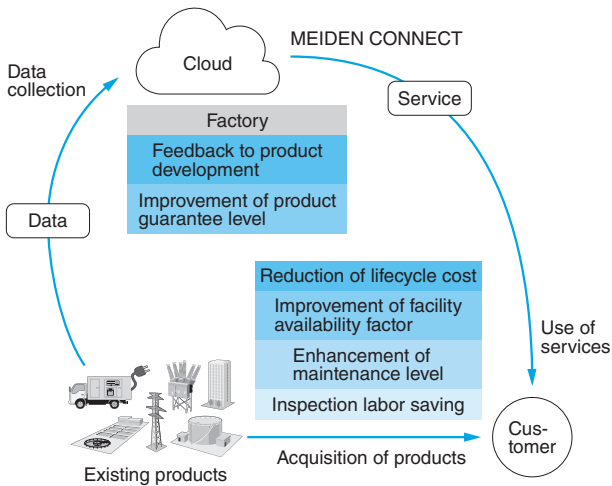


Fig. 1 Example of How MEIDEN CONNECT can be Used

The data obtained from facilities on the work site are collected through the Cloud system and these data are actively utilized for a variety of applications. By grasping the condition of facilities and the situation of management from a remote place, it realizes the support of on-site work and work efficiency improvement.

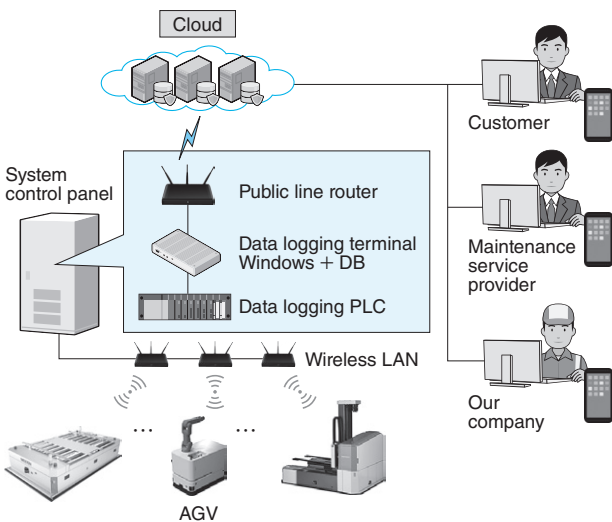


Fig. 2 Configuration of AGV Information Collection System

This system is mainly composed of the AGV, the system control panel, data logging PLC, data logging terminal, public line router, general public line, and the Cloud.

cally sent to the cloud. The data collected in the cloud can be viewed 24 hours a day from a web browser screen, and in addition to AGV information, operating status, and anomaly occurrence status, maintenance information such as battery voltage, number of charges, operating time, and tire wear status can be viewed and confirmed. **Fig. 3** shows an image of the Web browser screen.

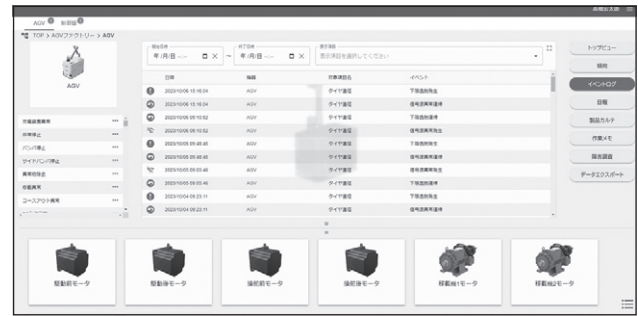


Fig. 3 Image of Web Browser Screen

Various information can be browsed from the Web browser, such as AGV-related information, operating conditions, anomaly happening status, battery voltage, charging frequency, operating time, and situation of tire abrasion.

3.1 Daily Report Function

This function can process data stored in the data collection terminal to perform trend analysis of transport history, average cycle time (average operation time of AGV), operation rate, anomaly information, etc., and can send files in a format that can be imported into the daily report. This function allows you to grasp the operation status of the entire facility and use it to improve productivity.

3.2 Preventive Maintenance Notice Function

This function will notify you when parts that require regular replacement reach the time of replacement. This function monitors data collected in the cloud, issues an alarm when a threshold is exceeded, and sends an e-mail to a registered email address.

Depending on the operating conditions, deterioration may progress earlier than the expected replacement time, such as tire wear, low battery capacity, and deterioration of sliding parts due to mileage and number of transfers. Even in such cases, the status of the AGV can be grasped, so maintenance can be performed at the appropriate time.

3.3 Remote Access Function

This function allows maintenance workers to access AGVs remotely without going through the cloud, referencing the AGV's anomaly logs and operation data, and to analyze and investigate the log data retrieved before and after the occurrence of a failure without going to the site, leading to an appropriate initial response and also reducing downtime.

4 Postscript

We are currently conducting demonstration tests on our in-house production lines to verify its usefulness from the customer's perspective. We will accumulate the big data, and in the future we will also work on diagnosis – detecting the early sign of future AGV system failure using Artificial Intelligence (AI).

Through these efforts, we aim to improve quality and service, and provide proposals that are valuable to our customers.

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