ENERGY CLOUD™ + Netmation eFinder™ Package Easy and Safe Management for Data & Multiple Locations

MHPS Control Systems Co., Ltd.

In recent years, data collection using IoT (Internet of Things) equipment and the application of cloud-based artificial intelligence (AI) technology is also expected in manufacturing facilities.

While various IoT devices are available, we have developed our unique product that can realize not only Facility Visualization, but also the optimization of production QCD by fully utilizing advanced AI technology. This paper introduces the developed IoT tool, Netmation eFinder™, which is simple to install and ideal to introduce AI.

1. Introduction

MHPS Control Systems Co., Ltd. not only offers control systems for various power generation facilities using the DIASYS Netmation™ control system, but also widely offers control and business solutions in various fields requiring high reliability such as environmental equipment, transportation systems, transportation machinery, etc.

We are operating the manufacturing factories and aiming to optimize the production QCD. This know-how brings important insight into data analysis and has delivered Netmation eFinder™.

Netmation eFinder™ consists of the wireless measuring unit and aggregator ①, the dedicated network ②, and the web application software ④ on the private cloud ③, (**Figure 1**).

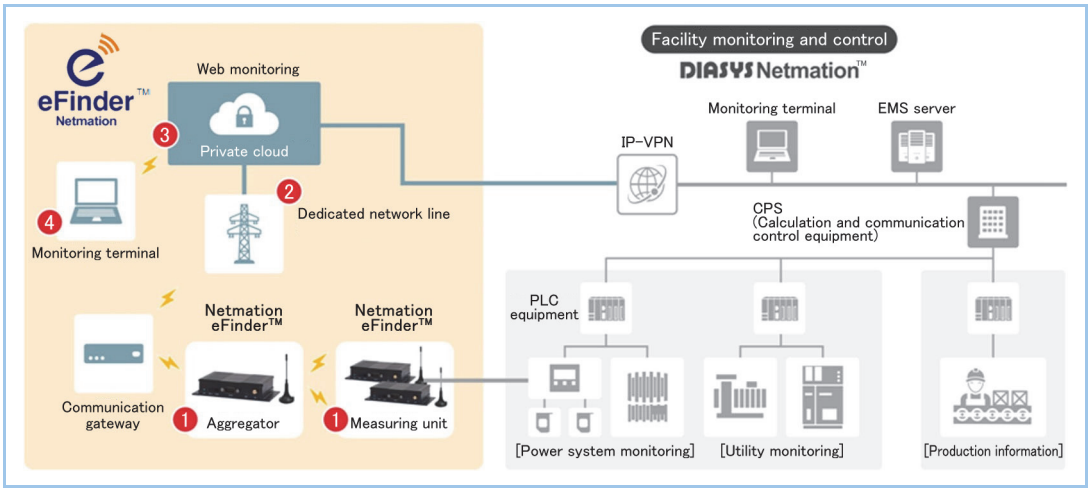

Figure 1 System configuration

2. Features of product

2.1 Simple installation and data collection

Netmation eFinder™ measuring unit is designed to meet the needs of facility users who require simple and low cost installation and is field proven.

The number of input points by one measuring unit is set to 10 based on our expertise of

facility operation and management. This can cover the case of one place with many points and the case of multiple places with several points. The number of analog inputs, digital inputs, and pulse inputs are well-balanced and convenient for field application.

From the perspective of the data analyst, electric power data is valuable for factory management such as operation management. Therefore, improvements were made so that electric power data can be simply collected. The CT (current sensor) signal conversion function in the measuring unit enables the current to be measured directly, and electric power is calculated on the cloud server side. This makes it possible to reduce the number of watt meters and to simplify installation work.

The data sampling period of typical data collection is less than one second. However, from the perspective of AI prediction services and factory users, rough trends rather than such detailed data are often valuable. Therefore, the sampling period is set to one minute at a minimum (**Figure 2**).

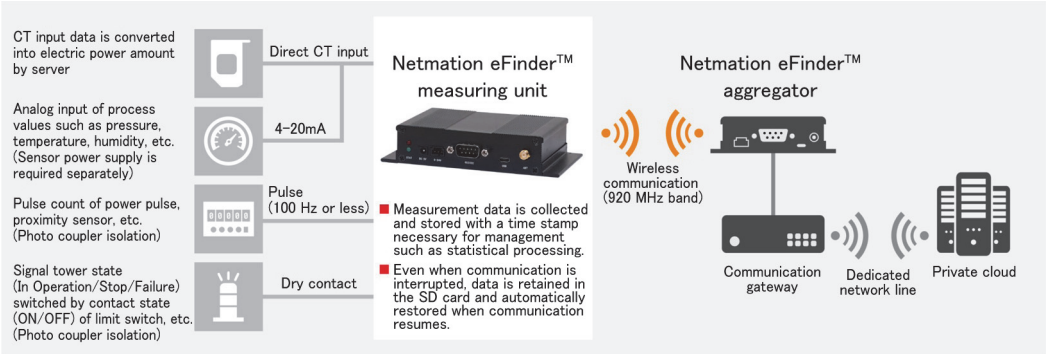

Figure 2 Features of product

2.2 Secure and safe information security

There is a need to install IoT equipment that performs measurement without affecting the production process as much as possible. Therefore, to eliminate the need to modify PLC[*1] and DCS[*2] or connect to the customer's network, Netmation eFinder™ directly measures the target facility so that data can be transmitted using a wireless and independent network. Since there is no connection with the customer's existing control system, there is no concern of data leakage, etc., thereby ensuring security.

In facility use, there is a need that data collection is stable even in case of wireless communication. Therefore, a mesh type (ad hoc) network that can find a better route according to the radio wave conditions is adopted. In addition, with a memory card in the measuring unit, it can retain data during a temporary communication interruption caused by a blocking object, etc., and can send data after communication is recovered.

Data is transmitted from the plant to the private cloud using a dedicated network. Transmitted data is accumulated in a dedicated private cloud with high security. By downloading accumulated data, the customer can use it easily for analysis (Figure 2).

*1: PLC (Programmable Logic Controller)

*2: DCS (Distributed Control System)

2.3 Collective monitoring and management of data of multiple factories

Collected data can be visualized on the screen by the web application software in the standard package. This section explains the functions related to factory operation and asset management.

(1) Factory Operation Management

From the perspective of Factory Operation Management, users need to monitor multiple factories which are located in separate regions. They can be collectively monitored and managed by grouping the facilities of each factory using the web application software. As a result, it is possible to monitor multiple separated factories as a virtual plant on the web screen as if they were a single factory (**Figure 3**).

In addition, this Factory Operation Management has the report functions of the facility operation rate, date and time summary, monthly output, etc.

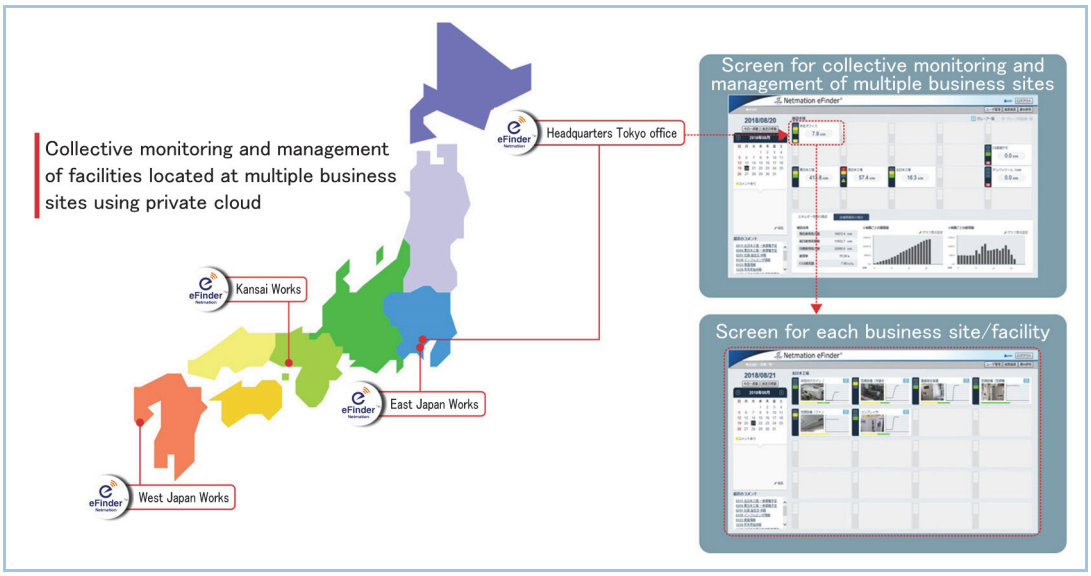

Figure 3 Collective monitoring of multiple business sites

(2) Factory Asset Management

From the perspective of Factory Asset Management, users need to level out management criteria because the judgment criteria for failure and operation differed among the management department, equipment manufacturer, and installation time. Each facility is equipped with an indicator light which is called a signal tower and indicates the facility operating status. However, in some cases even the same orange lighting indicates different facility operating statuses such as "stopped", "settings underway", "failure", etc. In the case of Netmation eFinder^{TM}, the operating status is set based on the same judgment criteria on the web application software, and the web signal tower indication is available regardless of the facility manufacturer or installation time. As a result, customers can now level out the management criteria of the operating status (**Figure 4**).

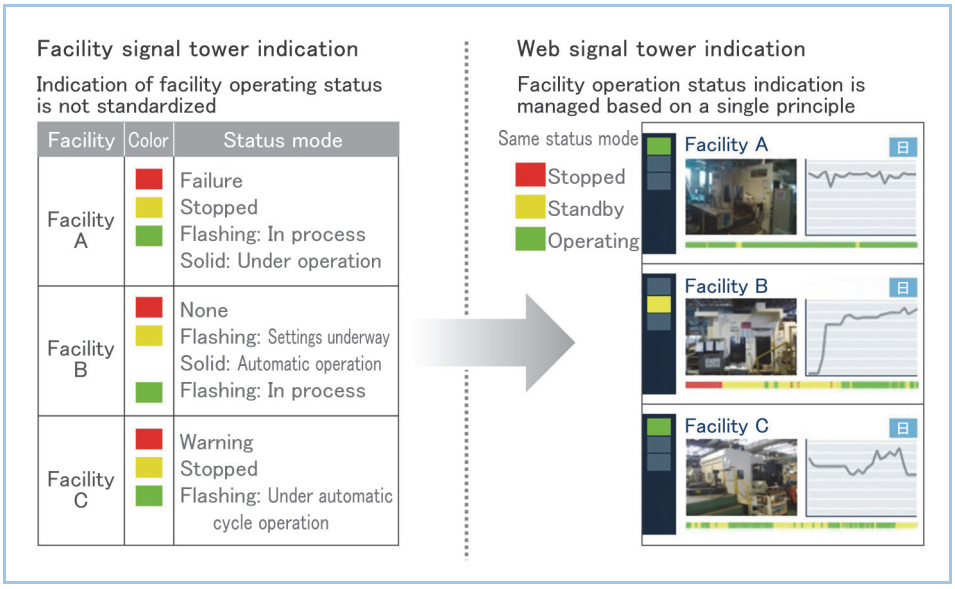

Figure 4 Facility operation status setting

2.4 Application Utilization examples

(1) Netmation eFinder^{TM}

After field tests in Mitsubishi Heavy Industries Group factories, Netmation eFinder^{TM} is operating at Mitsubishi Heavy Industries Group's factories in eight regions (472 units in total) as an IoT facility visualization tool. Even when one business sector handles multiple factories, confirmation on one screen is possible (**Figure 5**).

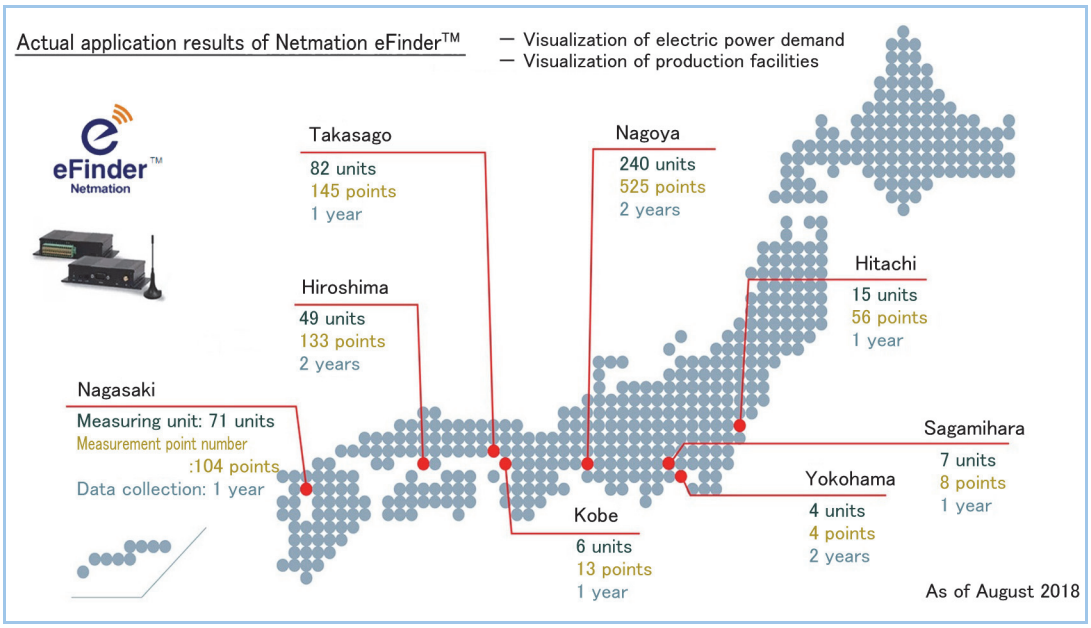

Figure 5 Actual application results of Netmation eFinder™

(2) ENERGY CLOUD™ Service

The ENERGY CLOUD™ Service which coordinates Netmation eFinder™ has already been adopted by Mitsubishi Heavy Industries Group's six factories as a standard IoT tool for the power demand prediction service released commercially in July 2018. The power demand prediction service provides the visualization of power demand peak forecasts, the study of possible power demand shift by the simulation function, and the optimization of power generation equipment operation targeting power peak-shaving (**Figure 6**).

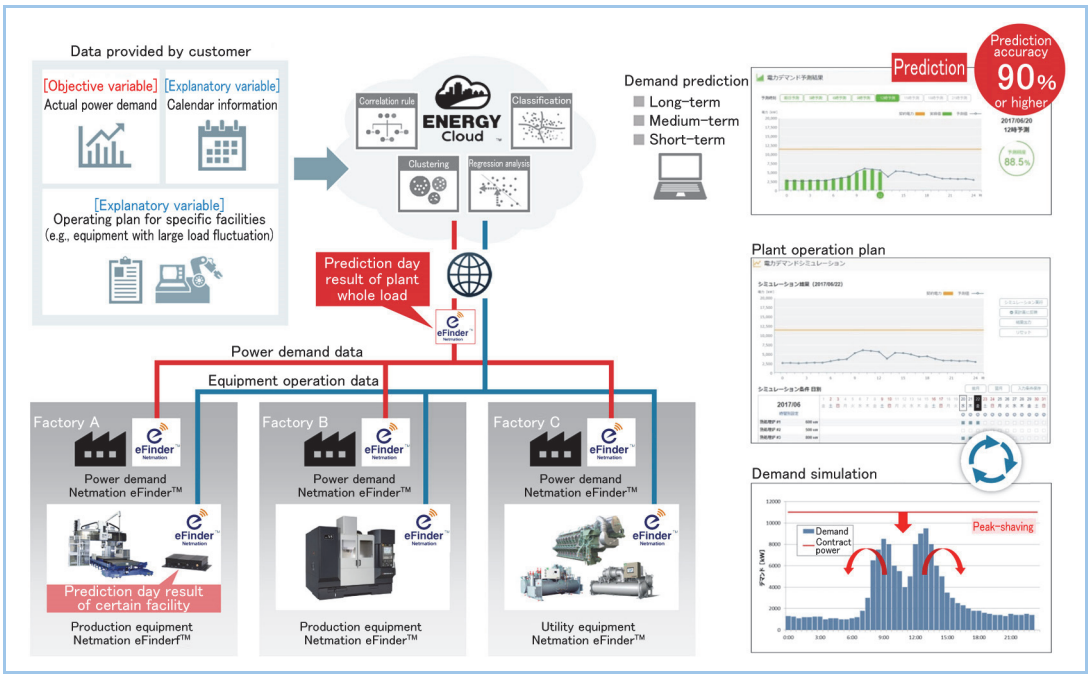

Figure 6 ENERGY CLOUD™ Service

3. Product specifications

3.1 Equipment specifications

Figure 7 shows the equipment specifications of Netmation eFinder™

[Measuring unit (aggregator) basic specifications]

Item	Content	Electrical specifications
Digital Inputs	No. of Channels	Pulse: 4CH; Contact: 2CH
	Input Type	Photo coupler Isolation
	Input Voltage	DC5V
	Input Current	OFF: 0.1 mA or less ON: 1 mA or more
	Digital Filter	1 msec (For more than 1 msec, set using software)
	Response Speed	Within 10 msec
Analog Inputs	No. of Channels	4CH
	Input Type	Differential operational amplifier input 4–20 mA sensor: DC input CT sensor: AC input ＊4 Channel dual function, input type switchable by setting
	Terminating Resistance	4–20 mA sensor: 120Ω CT sensor: 8Ω/120Ω/1.8kΩ ＊Automatic switching by measurement range
	Measured Current Range	4–20 mA sensor: 0–25 mA CT sensor: 0.01–125 mA

[Measuring unit (aggregator) communication specifications]

Item	Specifications
Frequency Band	920.6–928.0 MHz (Bandwidth: 200 kHz)
Antenna Power	20mW
No. of Channels	24–61 (SIM 20–C: Radio Law approved)
Communication Distance	1000 m (Outdoor)
Network Configuration	Mesh type (Ad hoc network, Multihop)
Communication Speed	9.6 kbps
Connection Method	P2P
Max. No. of Connected Units	99 Units
Max. No. of Measurement Points	200 points (Including analog and digital)
Data Collection Interval	1, 5, 10, 30, 60 minutes

[Communication gateway specifications]

Item	Content
Transmission Line	3G
Communication method	Private network IP–VPN

Figure 7 Specifications

3.2 Web screen specification

Figure 8 shows the web screen functions.

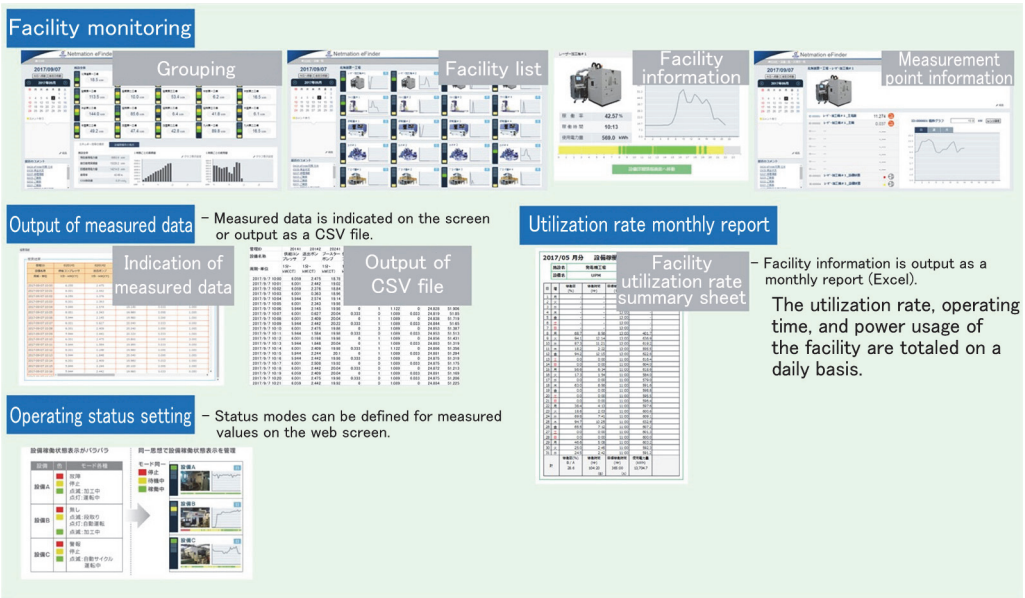

Figure 8 Web screen functions

4. Planned prospect

The ENERGY CLOUD™ Service, which is an energy solution service using Mitsubishi Heavy Industries Group's unique AI & IoT technology, can simply communicate using the standard interface, so the services can be introduced smoothly. From now, we will expand the ENERGY CLOUD™ Service, utilize AI technology further and provide various solution services, such as the realization of a virtual factory that collectively monitors factories in the United States, Southeast Asia, Europe and other regions. This will contribute to strengthen customer competitiveness.

Information on this product is available on our website:

http://www.cs.mhps.com/products/energy_management/e-finder.html