Empowering Smart IIoT Management

Axiomtek's Agent MaaS Suite (AMS)

The Industrial Internet of Things (IIoT) is on the rise. While continuously driven by technologies like the cloud, edge computing and artificial intelligence (AI), global IIoT expansion is gaining further momentum as we are headed towards 5G (the fifth generation of mobile network technology), which promises to bring the fastest wireless connection ever experienced. This ongoing proliferation of IIoT has started to transform a great many aspects of present-day lifestyle: from automated assembly lines where remotely controlled robots are at work, to smart farms utilizing sensors to monitor subtle environmental changes, or smart cities relying on intelligent transportation facilities to regulate public commuting services. IIoT is not just remodeling the way businesses operate – it is essentially going to redefine how people live in a world of ubiquitous connectivity where everything becomes digitally linked.

Making Sense of Data

The IIoT is an immense network with numerous machines and sensors connecting to the Internet and to other devices. It provides a platform where connected devices can share their data and interact with each other using common communication methods. The IIoT platform further aggregates sensor-generated data from various sources and utilizes computing capabilities and analytics to extract valuable information. IIoT creates its core value when it delivers meaningful, data-driven insights, which can be used to help companies identify emerging issues and formulate actionable plans to eliminate problems or improve processes, whether it is optimizing business operations, adding productivity, or reducing risk and costs.

Edge Gateway – the Intermediary of IIoT

The industrial IoT gateway is a key data communication device that makes an IIoT platform work. Situated at the "edge" of an IIoT network near a number of sensors, machines and other data sources, the gateway serves as a medium that bridges connected devices on the local network and the data center on the remote cloud server. All data moving to the cloud or to another network must first go through and communicate with the gateway. IIoT gateways perform the following critical tasks:

Data communication and protocol translation. IIoT networks may use a diverse range of protocols to communicate, such as the serial communications standard Modbus for connecting industrial equipment, or the wireless LoRaWAN protocol for transporting data over long distances. IIoT gateways are able to collect and translate data signals from devices that are running different types of protocols, providing a communication control interface across disparate systems.

Edge processing. The most important role of an IIoT gateway is that it pre-processes and screens out massive chunks of raw data on the edge side, and then forwards filtered information to a remote data center for further analysis. The concept of processing data closer to the source helps minimize the amount of data to be sent to the cloud, thus significantly reducing response time and workload on network resources, in the meantime allowing local devices to quickly respond to urgent situations by triggering real-time actions based on sensor data. With

more intelligence being shifted towards the edge, gateways with computing capabilities are even powerful enough to run data analytics like smart IIoT systems.

Agent MaaS Suite (AMS) – Streamlining IIoT Management

Explosive Growth of Connected Devices

Following the fast-paced IIoT evolution has come an explosive growth in the number of networked devices worldwide. The rapid increase of connected devices, coupled with their increasingly diverse networks, makes effective management of these scattered devices a challenge, resulting in a pressing need for enterprises to come up with better strategies and approaches that will allow them to efficiently control and consolidate their fragmented IIoT assets in order to produce optimal synergy.

Software Platform for Managing IIoT Projects and Devices

Enabling smooth IIoT operations requires more than just hardware appliances. To harness a highly dispersed IIoT environment – particularly one with tons of devices scattered over multiple locations using different communication protocols and operating systems – specialized software tools dedicated to accelerating IIoT deployment and simplifying device management are also in increased demand. In response to this trend, Axiomtek has rolled out a new IIoT management platform – Agent MaaS Suite (AMS) – which aims to enable organizations to rapidly develop IIoT solutions and achieve greater control across all environments to make the most of IIoT data.

The Agent MaaS Suite (AMS) is a set of highly integrated intelligent device management software targeting IIoT applications and is supported by most Axiomtek hardware platform models. Designed to reduce development time and effort when deploying and running IIoT projects, AMS offers a management platform featuring data visualization and cloud-connectivity functionalities, allowing users to easily manage and handle tasks from end-point machines all the way up to remote control centers, whether it is protocol communication, data collection and processing, message transmission, or information presentation. The AMS was developed as a web service, meaning users can manage their operating equipment anytime, anywhere by using a networked device with a browser.

AMS Framework

Based on a master-slave architecture, the AMS comprises two packages according to their functional roles: AXView 3.0 as a slave for device management, and MaaS (Management as a Service) as a master for remote management.

AXView 3.0 is used as a local device manager and data visualizer, which controls and monitors end devices such as sensors, gateways or HMI (Human-Machine Interface) systems at a local site. It also notifies events and regulates how device information is transmitted and processed. To make it easy for users to conduct data collection, AXView 3.0 supports three common protocols used in industrial applications: Modbus TCP/RTU, OPC UA and LoRaWAN, while containing a set of built-in dashboard components for users to quickly visualize data and information.

MaaS, on the other hand, serves as a centralized remote administrator that performs online monitoring and management of multiple hardware devices with AXView 3.0 installed. By synchronizing with local devices running AXView 3.0, MaaS enables a remote control center to instantly grasp the status of all operating equipment activities in different locations and stay alert to signs of unusual conditions. For enhanced security, MaaS also integrates a Virtual Private Network (VPN) tunnel for secure connection and data transmission with AXView 3.0.
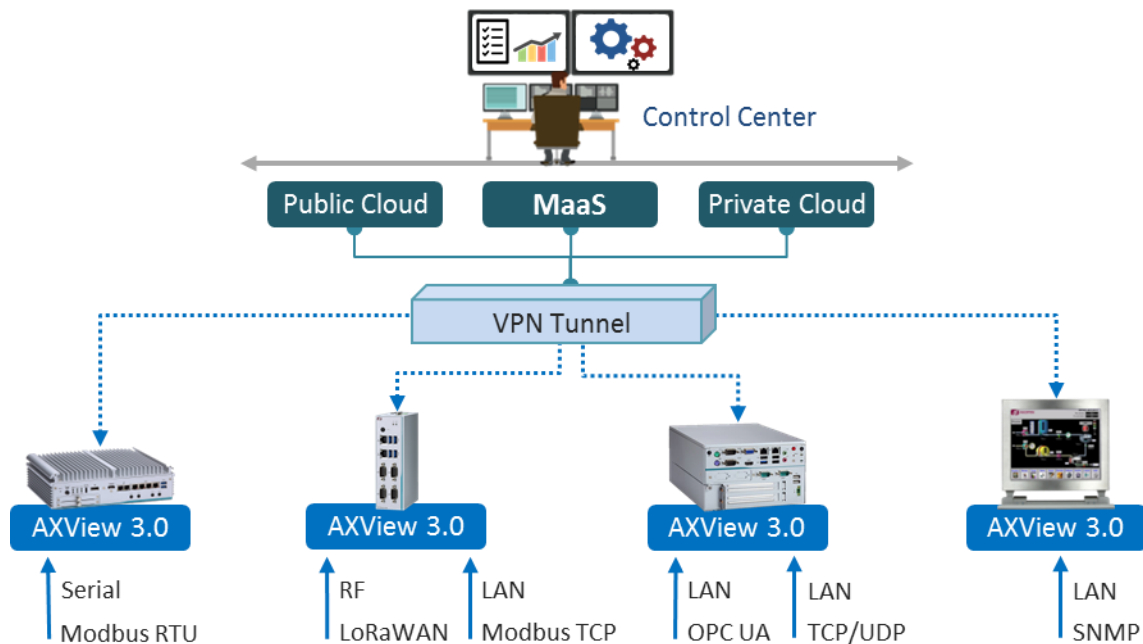
(Figure 1: Agent MaaS Suite (AMS) within an IIoT architecture)

AXView 3.0 – the Local Device Manager

Built on an open Linux platform, AXView 3.0 consists of two functional building blocks: Device Management and Data Management:
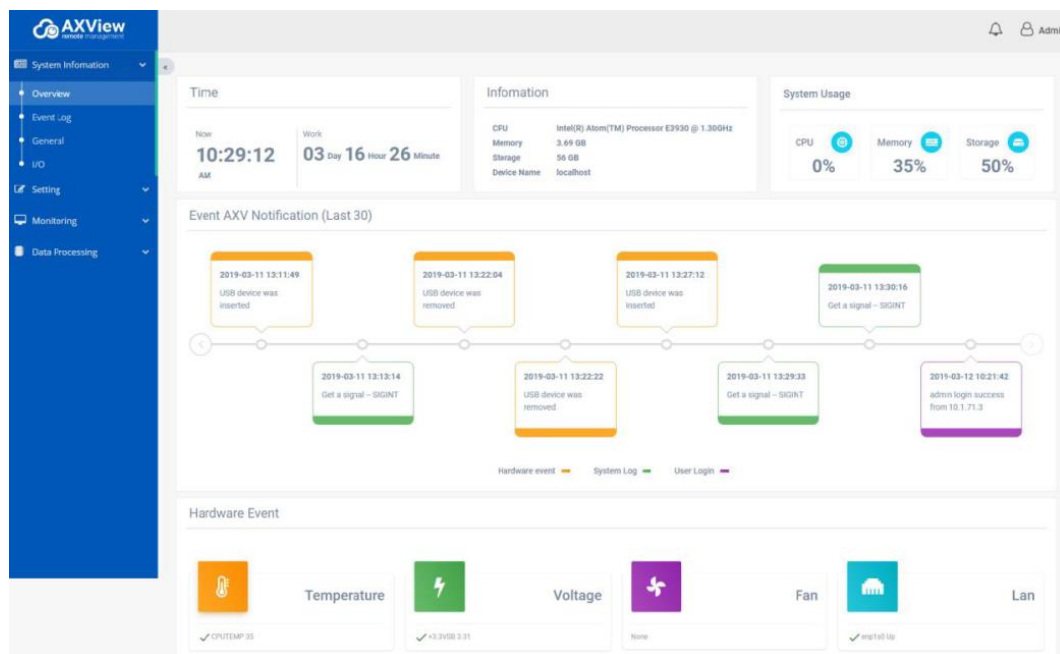
Device Management

With AXView 3.0 users can perform efficient device and system management using the following features:

Device information. AXView 3.0 provides all information about the hardware platform in which it is installed. Users can either get a preview of the overall device status on the overview page or enter sub-menus to find out more details about specific items, which include:

- Hardware status: CPU/memory/storage usage, working hours, etc.
- Operating system.
- Connected I/O peripherals.

(Figure 2: AXView 3.0 overview page)

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Event management. AXView 3.0 can act as an event tracker to trace all device related activities, such as user login actions, USB device insertion/removal, data transmission, system anomaly alerts and more. Its overview page has a timeline diagram showing the latest events, allowing users to view all recent events at a glance. Meanwhile, users can find more information on specific events by checking event logs, define the types of events they wish to receive, as well as set AXView to send notifications by email or via other network media like Twitter.
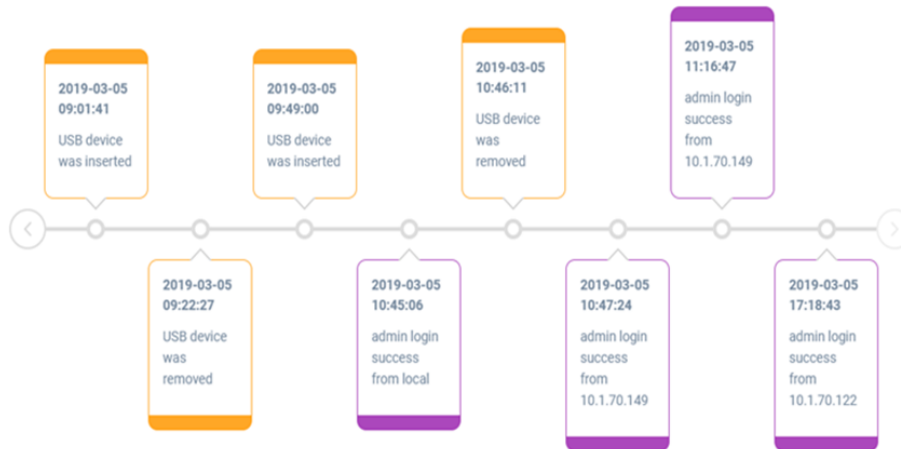

(Figure 3: Event notification timeline)

Online hardware monitoring & DIO detection. With AXView 3.0, the system can conduct 24/7 self-monitoring on its hardware and digital input/output (DIO) status, and users can set up threshold values for monitoring individual items:

- Hardware conditions: system temperatures, power supply voltages, USB/LAN plug in and out detection, fan speeds, etc.
- State changes of DIO signals.
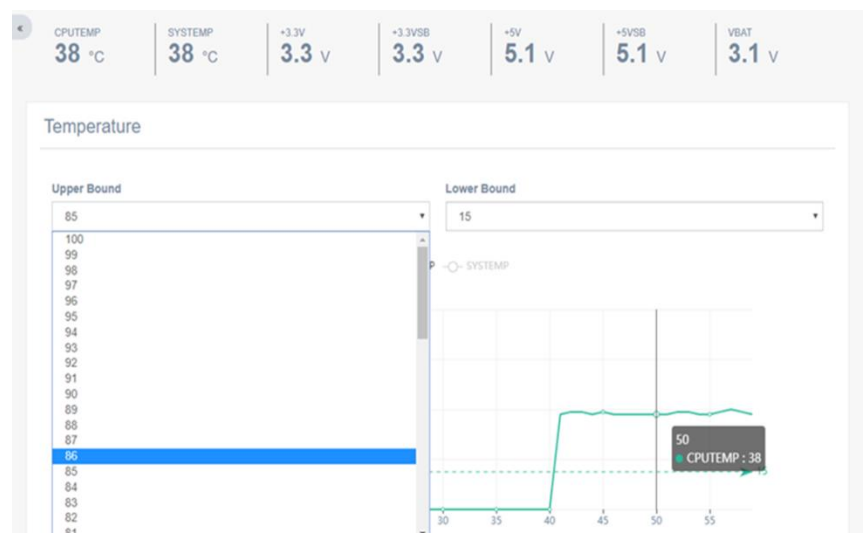
(Figure 4: Hardware status monitoring)

Data Management

With AXView 3.0's data processing features, users can easily deploy reliable communication between connected devices.

Extensive protocol support for data acquisition. AXView 3.0 integrates field device management and data acquisition by supporting plug-in Modbus (RTU and TCP), OPC UA, LoRaWAN and other common communication protocols including MQTT, REST, Socket, WebSocket, HTTP, etc. Users can add edge devices or sensors to the gateway system using available protocols and, by entering specific parameters, quickly configure connected devices to transport desired data to the system. When leveraging AXView 3.0's cloud-networking functionality, users can further build RESTful /web-socket APIs or MQTT data pushing applications for uploading data to private servers or public cloud services like Microsoft Azure and AWS.

Data flow programming with Node-RED. AXView 3.0 features Node-RED in replacement to complex programming procedures. It is a visual programming tool with a webpage interface, where developers can design data flows based on their own project needs. This programming editor provides a set of graphical elements known as nodes, each representing a prebuilt function, API or task item. By defining and "wiring" these nodes together to create specific data flowcharts, users can program how their IIoT platforms handle devices and data to suit particular use cases or applications. It can be setting up how edge devices feed sensor signals and how their IIoT systems process, broadcast and forward sensor data, or configuring a piece of hardware to carry out a particular operation – such as automatically switching on/off lighting and adjusting AC according to ambient conditions, or triggering alarm when sensor data indicates imminent risks.

The node palette includes a set of preinstalled nodes as the basic building blocks for creating flows
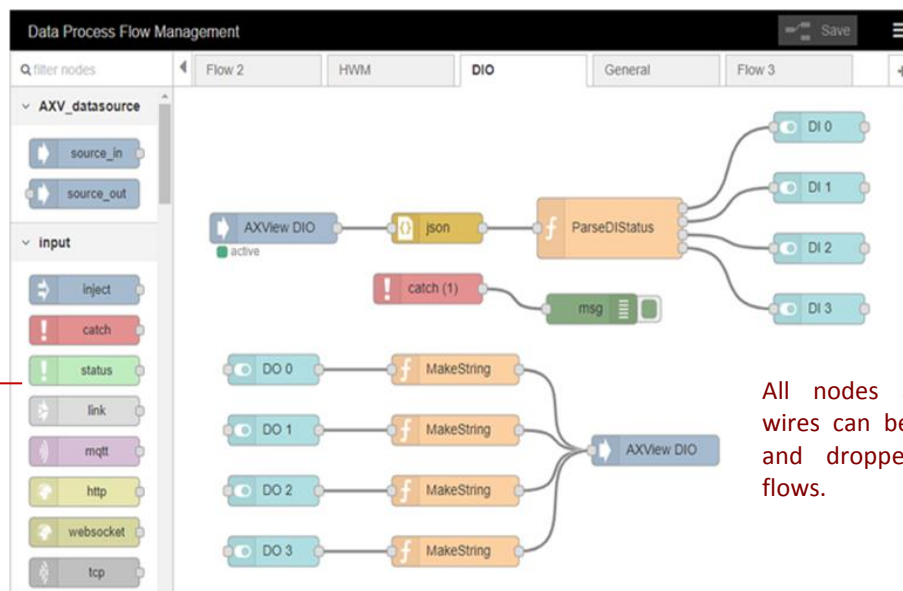
All nodes and connecting wires can be easily dragged and dropped to compose flows.

(Figure 5: Node-RED's flow editor interface with wired nodes)

Data visualization. Dashboards facilitate precise monitoring and management by presenting numbers and statistical values in organized charts and graphs, in the meantime making content viewing comfortable. AXView 3.0 comes with a set of built-in dashboard components for users to visualize data into dynamic diagrams fast and easy.

MaaS – the Remote Manager

As the term "Management as a Service" (MaaS) implies, MaaS is a management server designed for the control center to remotely manage and monitor multiple sets of hardware devices running AXView 3.0. Not only can MaaS integrate pieces of information received from all hardware devices scattered in different places, but it also helps locate, identify and control a specific hardware system at a given location. It's all done over an Internet connection – which makes live data streaming and information display possible, so that remote administrators can manage all operating devices online and track events in real time.

Multi-Device Manageability

Once the connection is established, MaaS will be able to display all hardware devices registered to the MaaS server, as well as the user accounts under which the devices are registered. The MaaS administrator has full authority to access all user accounts and their devices, create new accounts, and accept/reject connection requests from local devices, whereas registered MaaS users can only manage the devices under their respective accounts. After login, users will get a one-stop summary of all connected devices and events on the MaaS homepage dashboard, which shows a device map highlighting device locations, numbers of device and event counts, plus an event history bar chart at the bottom.
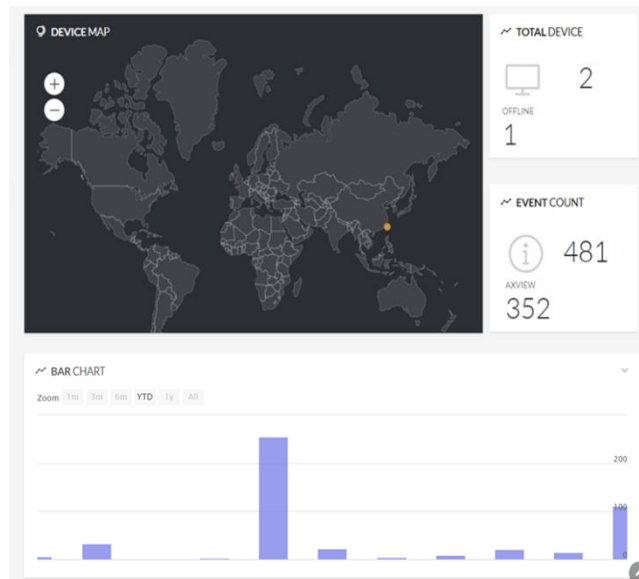
(Figure 6: MaaS homepage dashboard)

Users can also go to the DEVICE TABLES page which lists all devices.
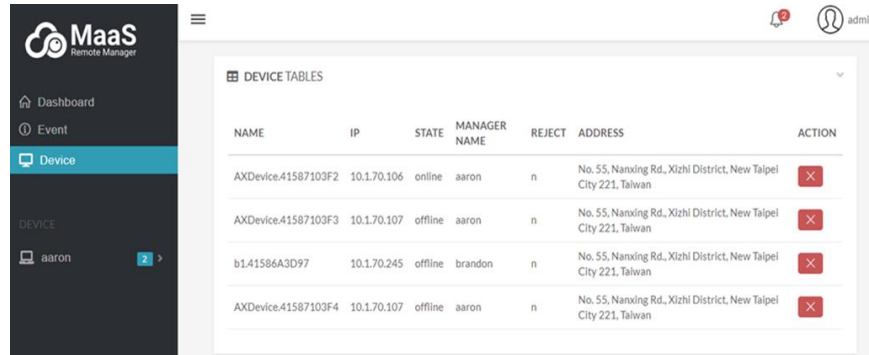
(Figure 7: MaaS DEVICE TABLES page)

Remote Device Monitoring

Users can go to the page of an individual device to check its system and operation status. The device overview page will display the online/offline state, device owner information, network topology, total work time, the number of device events, etc.
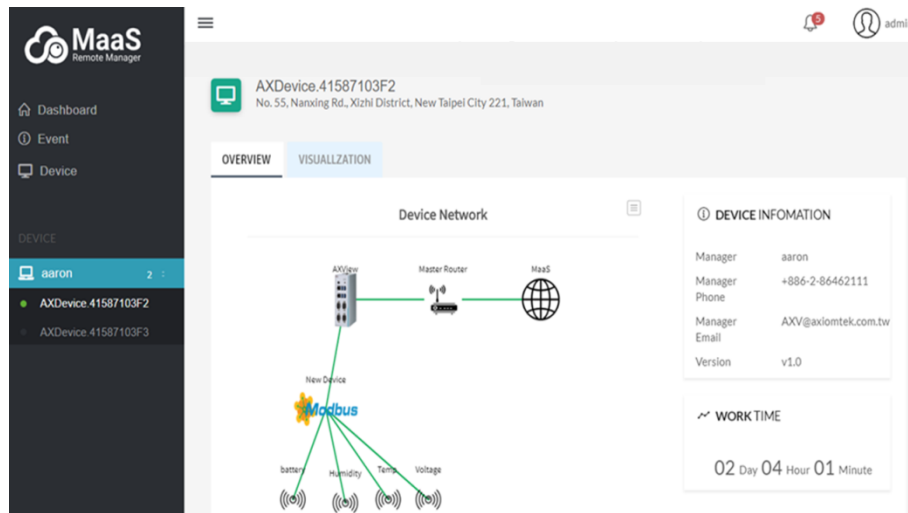
(Figure 8: Single device overview)

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Dashboard view. The device visualization page shows a dashboard view of hardware conditions, DIO data, system usage and more. These data are in sync between the MaaS server and the AXView 3.0 platform running on local devices, making it possible for the remote control center to implement 24/7 real-time monitoring and stay updated on device status and performance.
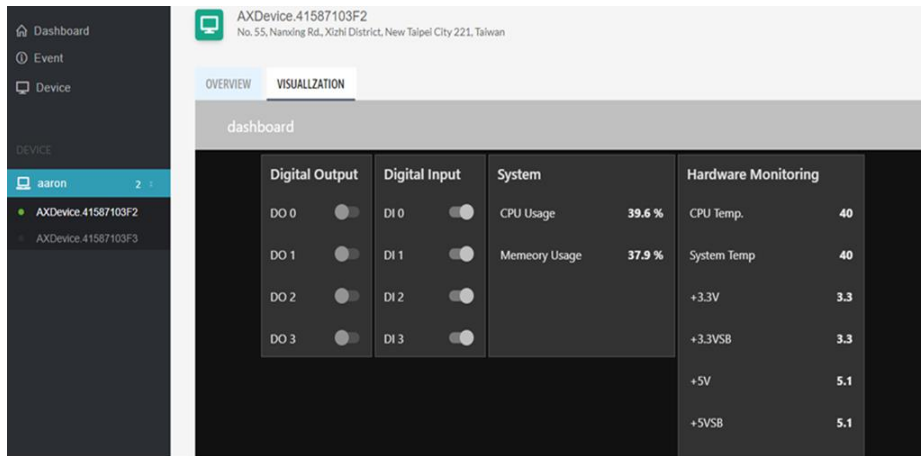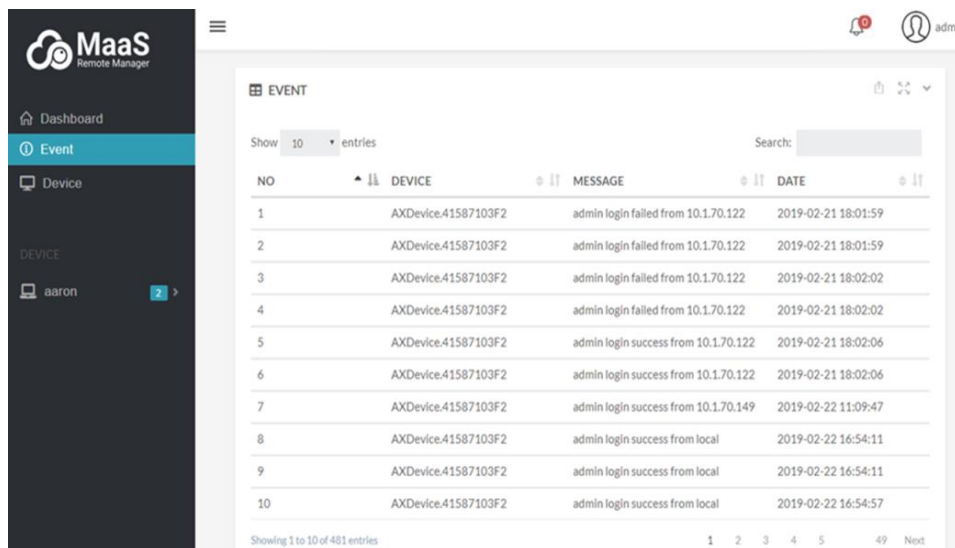

(Figure 9: Dashboard view)

Event Notification & Retracing

Since the MaaS server is synchronized to AXView 3.0 installed on local devices, MaaS users will be notified of a device event as it occurs. It also allows users to retrace all historical event records.

(Figure 10: Event list view)

How AMS Benefits IIoT Operation

Simplified IIoT Integration and Deployment

A management platform's ability to ensure a future-proofing IIoT ecosystem is crucial, particularly when the IIoT is evolving at an unprecedented rate with plenty more devices anticipated to join. By supporting widely adopted communication protocols across multiple industries, Axiomtek's AMS software package enables fast cross-platform integration and seamless interoperability among a huge variety of devices, networks and cloud services, significantly lowering the difficulty of setting up network environments for multi-site device management. On top of that, its standardized, easy-to-use interface helps users manage their hardware equipment effortlessly, while saving the trouble of having to modify project software when switching among different Axiomtek hardware products.

High Degree Flexibility in Personalizing IIoT Applications

AXView 3.0 includes an easy-to-use visual programming tool, Node-RED, for software development. Node-RED gives developers tremendous freedom to design data processing flows using its graphical nodes, allowing them to tailor their IIoT systems to unique scenarios with minimum programming effort. AXView 3.0's rich dashboard elements and flow templates also make it easier to visualize incoming data, thus speeding up the development of IIoT solutions.

Remote Online Management with Real-Time Data

With AMS's web-based services providing a real-time management platform that breaks geographical limitations, remote equipment management has never been easier. Through online data sync and streaming, supervisors can get immediate access to real-time data from far away by using their PCs or smartphones, monitor machine health and configure how devices execute their computerized tasks, as well as take instant measures when receiving alerts on abnormal events.

About Axiomtek Co., Ltd.

As one of the world's leading designers and manufacturers of PC-based industrial computer products, Axiomtek specializes in data acquisitions and control systems of rich diversity and modularization. With the upmost enthusiasm in serving their customers, Axiomtek has mirrored PC evolutions in various industries by shifting its focus toward the design and manufacture of PC-based industrial automation solutions, standing as a trustworthy long-term provider of industrial computers.

Established in 1990, Axiomtek has partnered with more than 60 distributors globally, offering more than 400 products through product lines of Industrial PCs (IPCs), Single Board Computers (SBCs), System on Modules (SoMs), Fanless and Rugged Embedded Systems (eBOX and rBOX), Intelligent Transportation Systems (tBOX and UST), Industrial IoT Gateway, Touch Panel Computers (TPCs), Medical Panel Computers (MPCs), Digital Signage Solutions (DSSs) and Network Appliances (NAs).

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