Arm-Based Linux IIoT Gateway Application Guidebook

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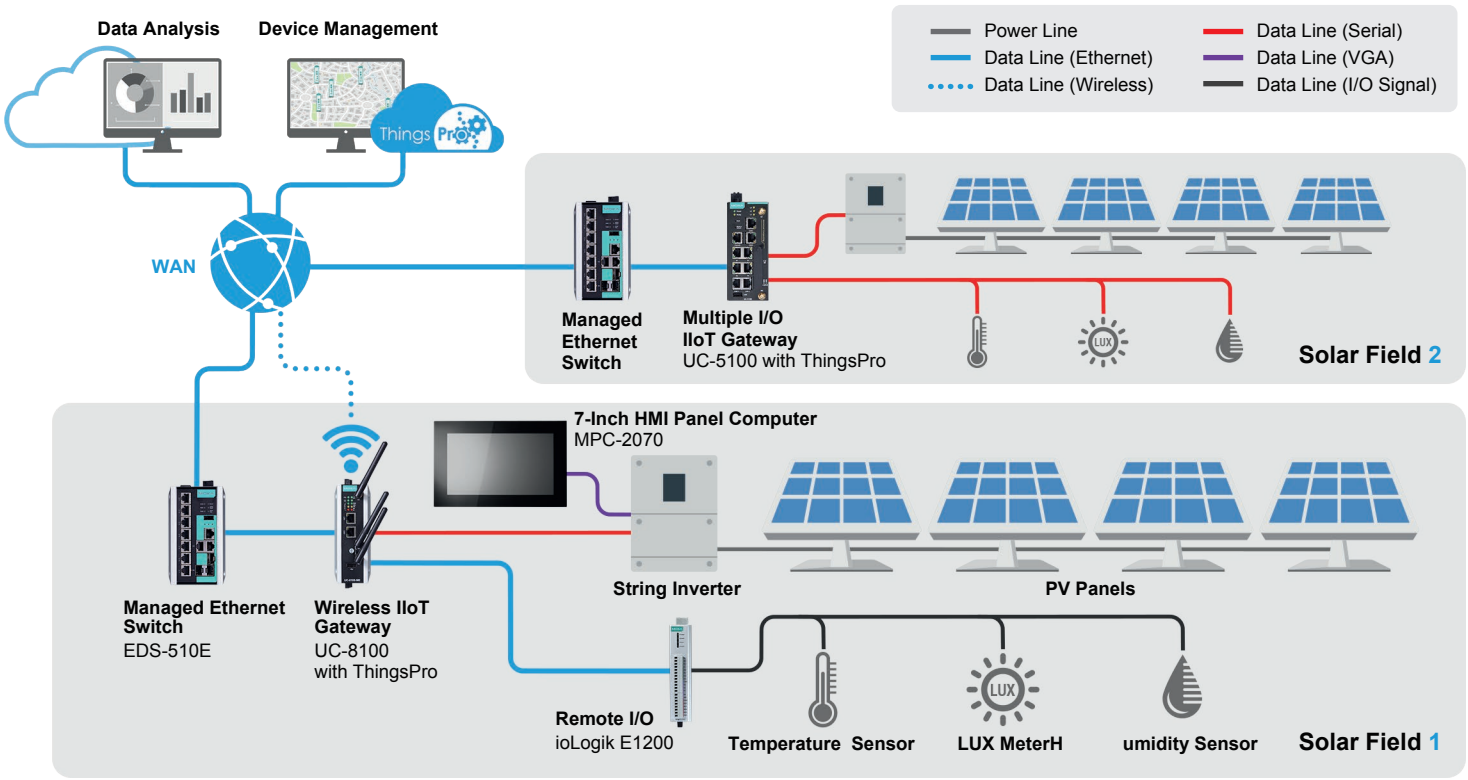
Solar Power Plant Monitoring and Control System

Background

The power industry is now ready for clean energy such as solar energy. Utility-scale solar power stations with electric power capacity of more than 50 MW and the capability to feed excess power back to the electric grid for future consumption, are being built to meet the growing demand for solar power.

A utility-scale solar power plant can consist of hundreds to thousands of solar collectors. Plant operators need to collect and process data from numerous devices located at remote sites to achieve high energy efficiency.

System Architecture



System Requirements

- Industrial-grade embedded edge computer for remote monitoring, data acquisition, data logging, and protocol conversion of inverter data to monitor solar panel effectiveness
- Low power consumption to maximize the electrical output of a solar power plant
- Reliable operation in wide-temperature outdoor environments
- Web-based remote monitoring of solar array performance, battery load, and environmental data from sensors
- Sunlight-readable HMI for inverter control

Why Moxa

- Rugged fanless UC-8100 and UC-5100 IIoT gateways with wide -40 to 70°C operating temperature range
- Multiple I/O UC-5100 IIoT gateway to directly connect with sensors
- Ready-to-run ThingsPro software solution for Modbus data acquisition, remote device management, and Modbus-to-MQTT protocol conversion
- 1000-nit sunlight-readable MPC-2070 HMI panel computer

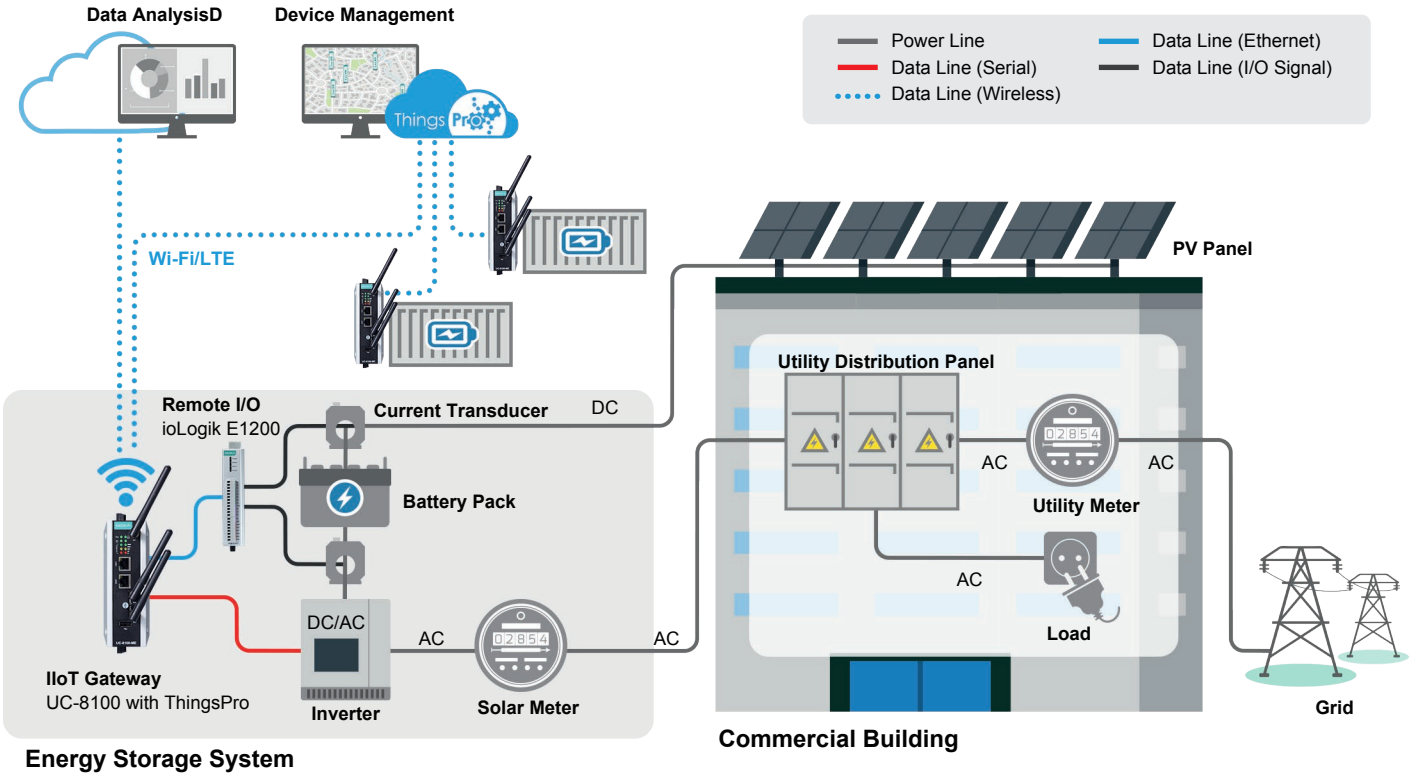
Commercial Solar Power and Energy Storage Monitoring

Background

Commercial-scale solar power systems are providing users with supplemental power for their buildings to save costs. Many of these solar power systems have the capability to store energy so that they can continue to provide power even when the sun is not shining.

Energy storage systems are typically installed in outdoor containers and require equipment that can operate reliably in a wide temperature range.

System Architecture



System Requirements

- Industrial-grade embedded edge computer for remote monitoring, data acquisition, data logging, and protocol conversion of inverter data to monitor solar panel effectiveness
- Reliable operation in wide temperature environments
- Optimize battery performance by monitoring the amount of current used to charge/discharge the energy storage system's battery modules
- Remotely monitor the battery temperature for cooling system control

Why Moxa

- Rugged fanless UC-8100 wireless IIoT gateway with wide operating temperature
- Compact ioLogik E1200 remote I/O that fits inside space-limited battery modules; supports daisy chain connections for easy integration of multiple battery stacks
- Ready-to-run ThingsPro software solution for Modbus data acquisition, remote device management, and Modbus-to-MQTT protocol conversion

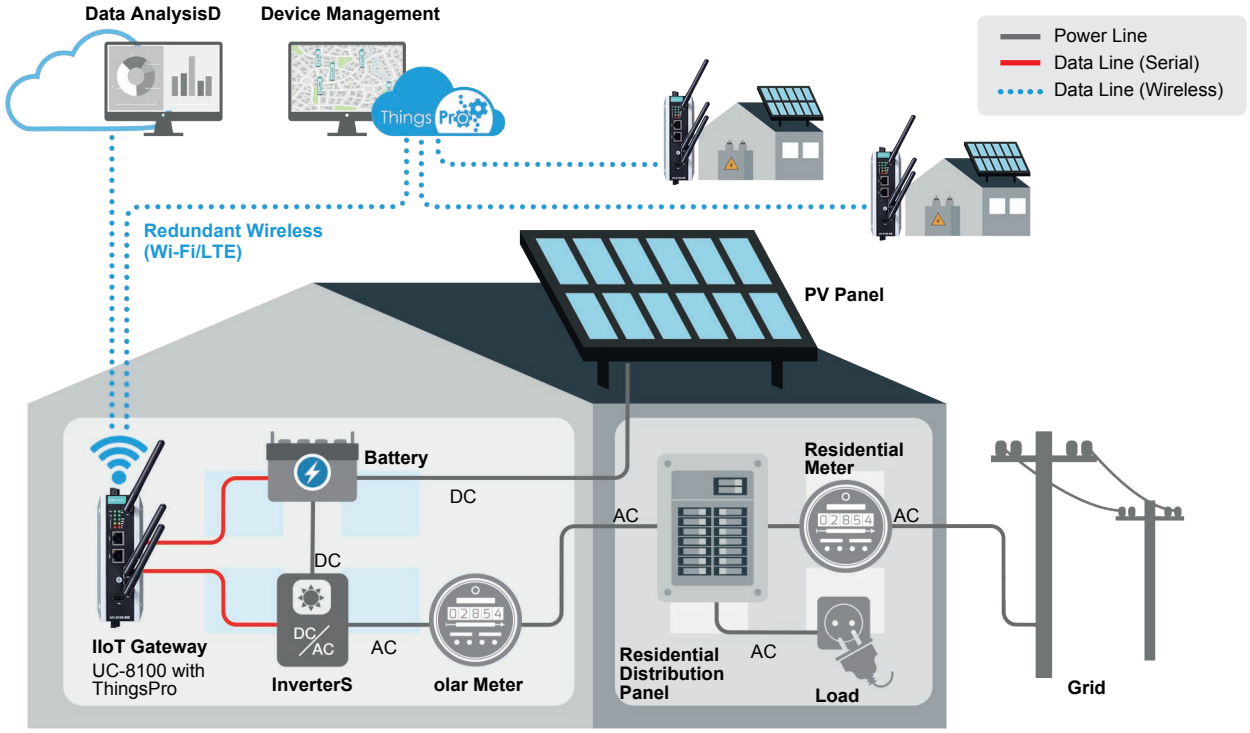
Residential Solar Power Monitoring System

Background

Residential solar energy has received a substantial boost because of the clean-energy initiatives and tax credit extensions by many governments around the world that have enabled solar service providers to bring costs down low enough to attract residential users. In addition, changes in the power grids have made it possible for residential solar energy providers to sell excess energy to utility companies.

Residential solar power systems require to process data from various devices that use a variety of protocols while reliably managing accounting, monitoring, and control tasks for DC to AC conversion; electrical generation; meters, alarms, and other I/O; and for overall system efficiency. Additionally, residential systems are now relying more and more heavily on wireless communications, such as LTE, and Wi-Fi, particularly with regard to troubleshooting and maintenance.

System Architecture



Residential Solar Inverter

System Requirements

- Wi-Fi and 4G LTE communication redundancy ensures data accuracy for energy usage and billing
- Open platform for application development
- Web-based device management for easy remote maintenance

Why Moxa

- UC-8100 IIoT gateway supports Wi-Fi and 4G LTE with carrier approvals (Verizon and AT&T)
- UC-8100 IIoT gateway supports Moxa's ThingsPro software with easy-to-use Modbus GUI to reduce the programming effort required for data acquisition
- ThingsPro software supports remote batch firmware upgrades and user-program uploads with device group task queues to help IT administrators easily manage IIoT gateways

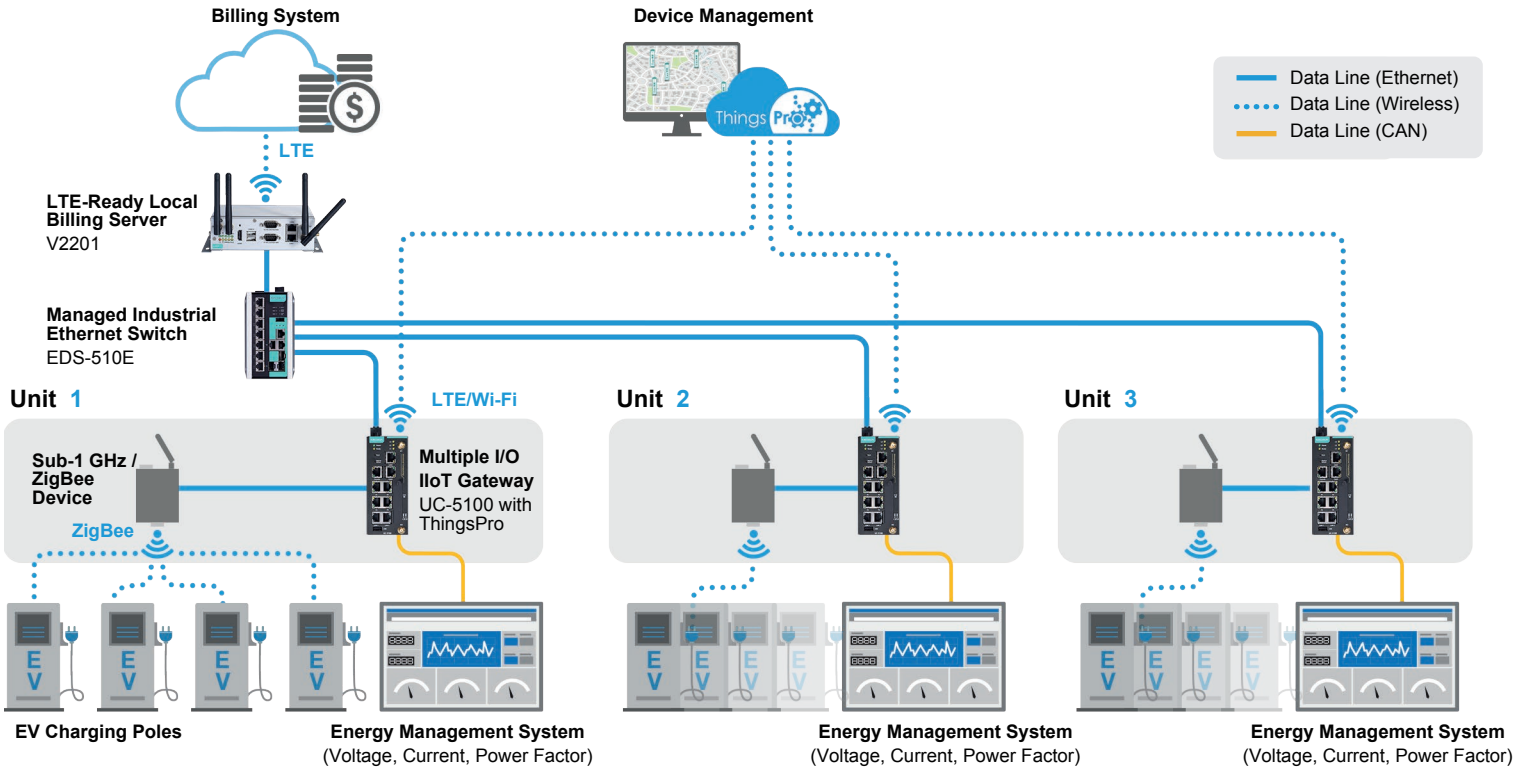
Electric Vehicle Charging Control and Monitoring System

Background

The growth in the plug-in electric vehicles (PEV) market is creating an opportunity for utility companies to deploy PEV charging infrastructure, which can help PEV manufacturers support the vehicular load, increase customer engagement, and grow the PEV market.

The PEV charging infrastructure consists of charging stations spread over a large area, which require a fair amount of energy if they are used on a regular basis. Most charging stations are unmanned, and many are located in suburban areas, far away from centralized control rooms. With the increase in the number of charging stations, operators face multiple challenges in maintaining good network connections and centralized management of billing and maintenance.

System Architecture



System Requirements

- Remote device management and monitoring of a large number of charging stations
- Low power consumption to maximize electrical output
- Reliable operation in wide temperature outdoor environments
- 4G LTE and Sub-1 GHz communication redundancy to ensure accurate billing for battery charging operations
- Open platform for billing program development

Why Moxa

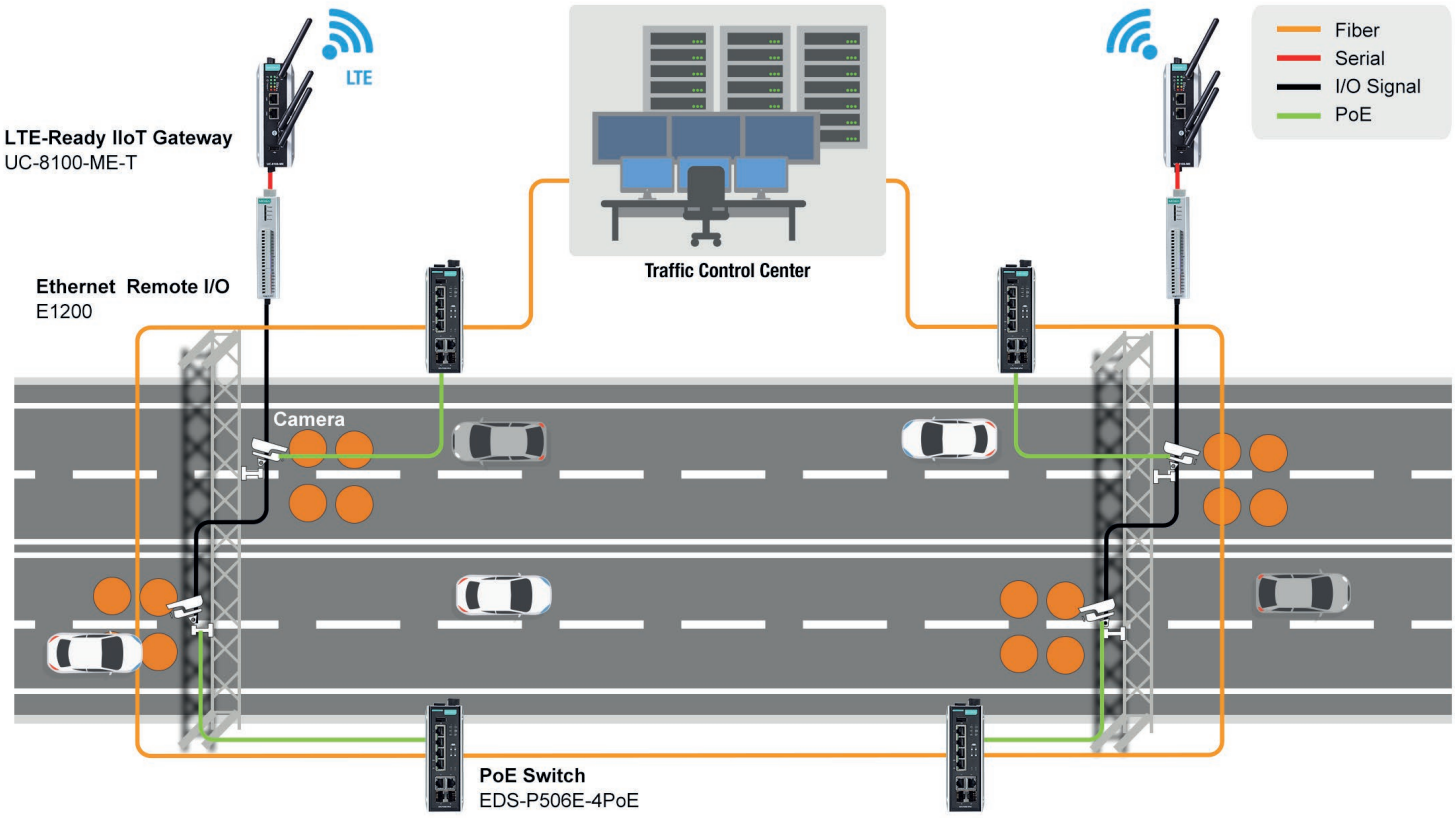
- ThingsPro software supports batch remote firmware upgrades and user-program uploads with device group task queues for easier device management by IT administrators
- UC-5100 fanless, RISC-based, wide-temperature IIoT gateway with power consumption under 10 W
- V2201 fanless, LTE-ready, wide temperature x86 computer for use as a local billing server
- Open platform with RESTful APIs to enable easy integration with a user's billing and monitoring dashboard

Remote Asset Management for Intelligent Transportation Systems (ITS)

Background

In smart cities, intelligent transportation systems are already an essential part of people's daily lives. Keeping such a complex system operating smoothly is a big challenge for city transportation authorities who typically incur high costs sending personnel to sites where equipment has malfunctioned. In addition, some operators have noted that the real challenge is to know that a malfunction has occurred.

System Architecture



System Requirements

- Industrial-grade embedded computer with LTE/Wi-Fi connectivity for remote monitoring and data logging in a wide operating temperature range.
- Ability to remotely reboot multiple devices and systems without deploying personnel
- Keep track of the health of the equipment and provide preventative maintenance to avoid system failures, and be able to remotely configure and manage on-site equipment.
- Outdoor network reliability

Why Moxa

- LTE-ready, rugged fanless UC-8100 IIoT gateway with wide -40 to 70°C operating temperature range
- Ready-to-run ThingsPro software solution with MQTT and AWS cloud client for easy data logging and remote device management function to reboot devices and upgrade firmware
- EDS-P506E-4PoE Series PoE switch operates at 180 watts full PoE+ loading at -40 to 75°C

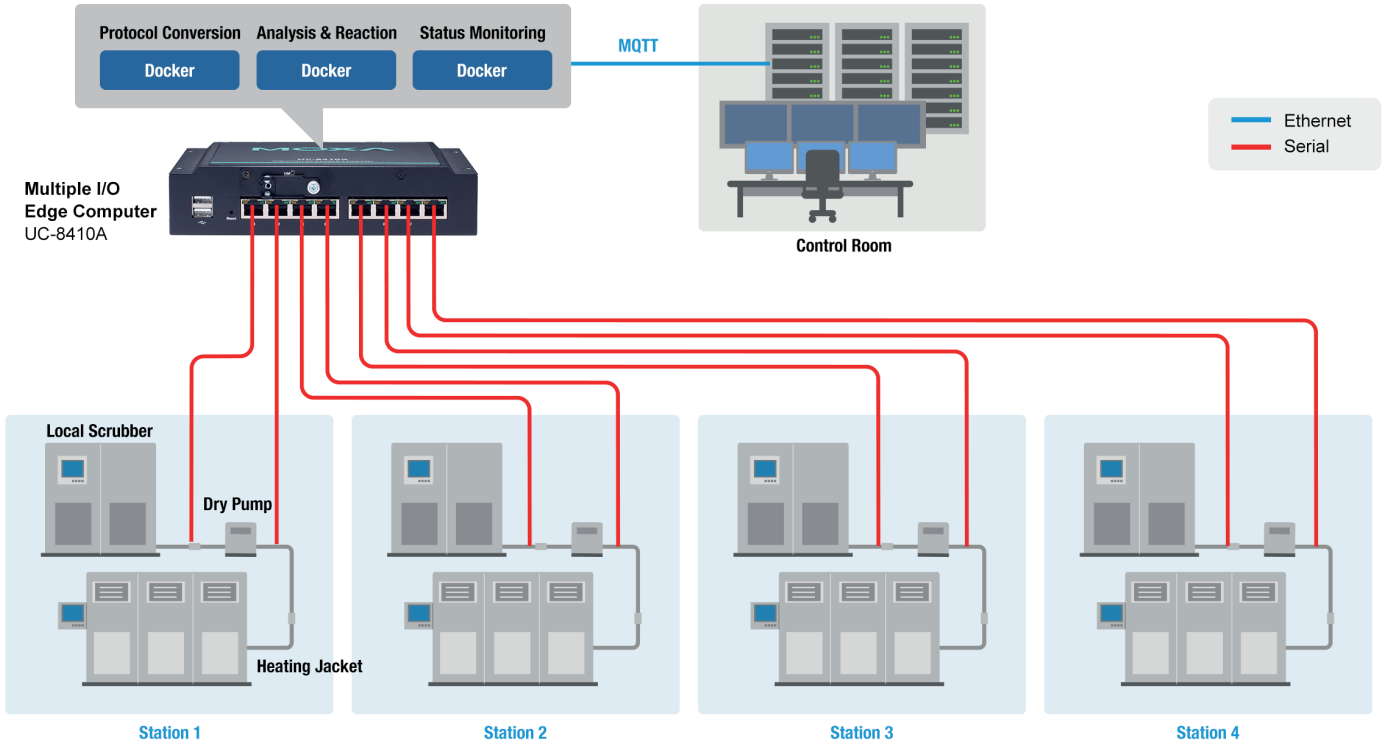
Edge Computing Solution for Semiconductor Machine Status Analysis

Background

In semiconductor manufacturing, local-scrubber systems are used to treat and process the inflammable and toxic gases generated by the manufacturing equipment before the air is sent to a central scrubber. Because of the high risk of leakage of gas and solvents, the treatment system including scrubber, dry pumps, and heating jackets are critical elements that need to be monitored in a semiconductor factory.

Computing platforms, deployed at field sites, should be able to connect equipment that use different communication protocols to a central control room for machine status monitoring, event monitoring, and data analysis. The data collected from the field sites is processed and then sent to the control center through Ethernet and using IT protocols. Hence, a reliable high-performance computing platform is required at the field sites in order to derive the full benefit of the edge computing architecture.

System Architecture



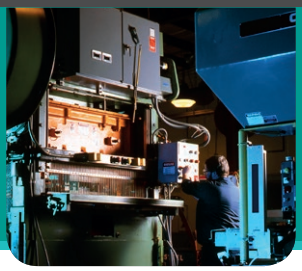
System Requirements

- A computing system to share the computing load from the server so as to implement edge data analysis
- Multi-serial port connectivity
- Stable and reliable systems
- Open Linux-based platform for quick application development

Why Moxa

- Dual Core RISC CPU with low power consumption for edge computing applications
- UC-8410A fanless embedded computer with 8 serial ports & 3 Giga LANs
- Industrial-grade and fanless design for reliable operations
- Moxa Industrial Linux with 10-year long-term support* and Debian-compatible open platform for Linux docker software

* Terms and conditions apply. Contact Moxa for details.



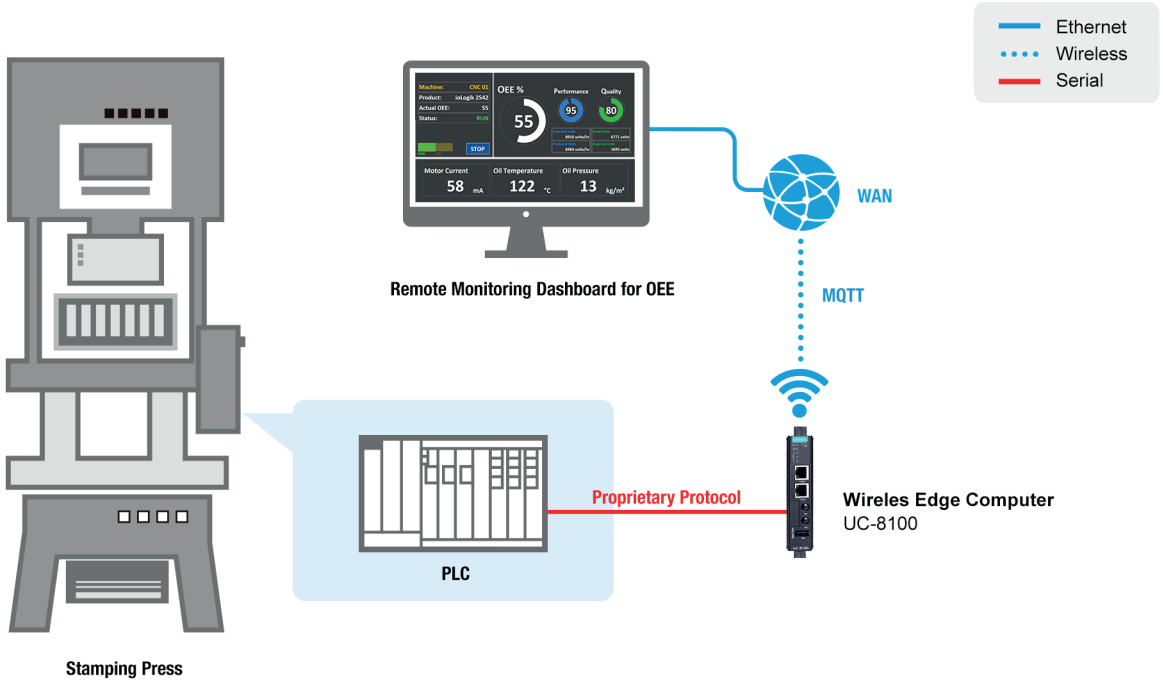
Machine Data Acquisition through PLCs for Machine Tool Builders

Background

Traditional machine tool builders are now willing to invest in new IIoT trends so that they can provide more value with their products and improve the quality of machine status data collected for post-sales management and services.

The data acquisition system must be capable of acquiring data from different brands of PLCs with their own proprietary protocols, send the data to backstage control server, and display the data on a dashboard remotely and locally. Furthermore, a compact and reliable device for data acquisition is required without having to changing the structure of machines. Which means, the system should be small enough to fit in existing control cabinets.

System Architecture



System Requirements

- Computing solution to collect data from PLC to monitor the status of the stamping press remotely and locally through Wi-Fi
- The solution should work with PLCs from Mitsubishi, Delta, and Allen-Bradley
- Compact-sized and vibration-proofed systems for reliable operation in the cabinet of the stamping press

Why Moxa

- The UC-8100 Series embedded computer that can collect proprietary data from PLC and perform local intelligence as well as wireless capability
- DIN-rail and compact size industrial-grade computer for cabinet installation with limited space
- Moxa Industrial Linux with 10-year long-term support* and Debian-compatible open platform for local database and dashboard applications

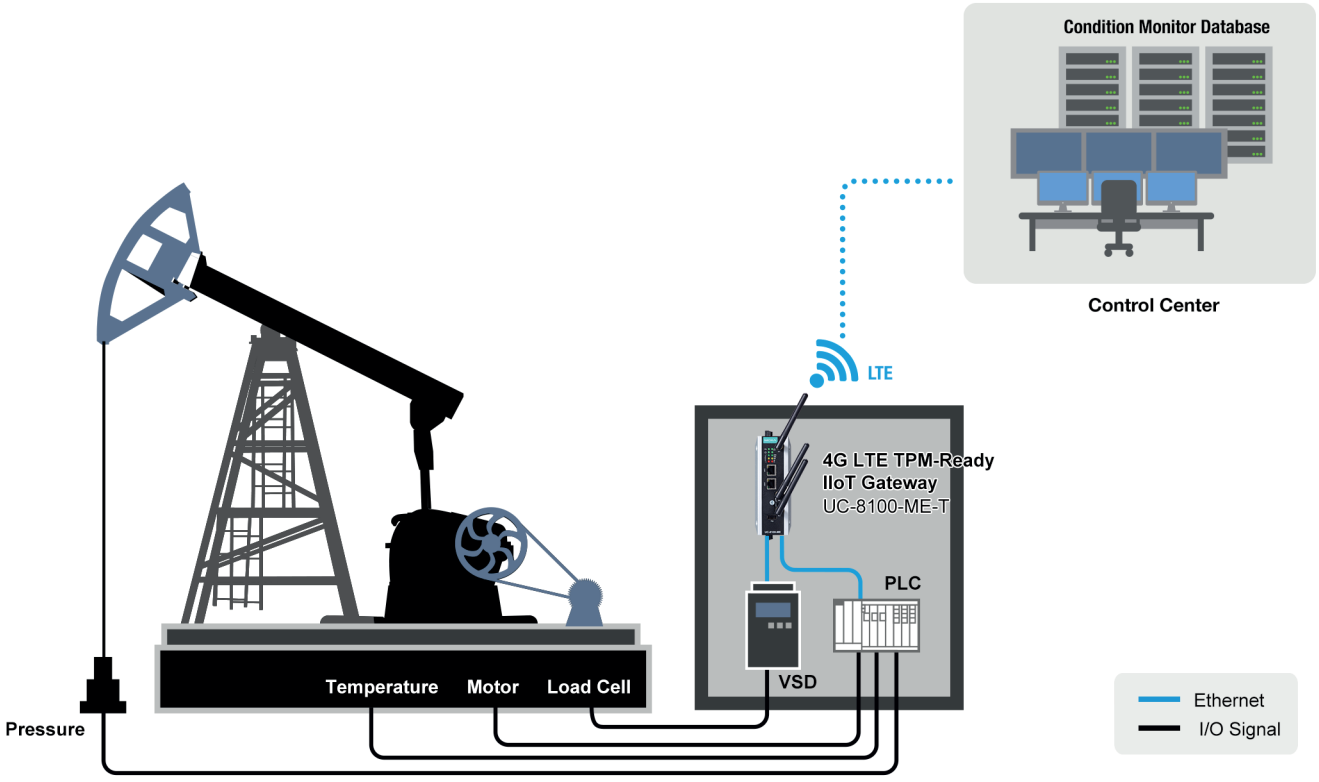
* Terms and conditions apply. Contact Moxa for details.

Enabling Predictive Maintenance in Artificial Lift Monitoring Systems

Background

With the trend of oil field digitization gaining momentum, telematics can be tremendously useful in understanding equipment status so as to facilitate predictive maintenance and to avoid operation downtime. Leading oil and gas service companies are building telematics solutions for their customers to run smooth operations and conduct predictive maintenance for artificial lifts in oil fields. Collecting the data generated by the equipment during the operations is the key to achieving this goal. As a result, oil and gas service companies need a reliable and secure solution to ensure that the data needed is brought back to the control center for further analysis.

System Architecture



System Requirements

- Computers with low power consumption and C1D2 certification
- Reliable 4G LTE connectivity in high operating temperatures for constant data aggregation
- Computers with Trusted Platform Module (TPM) to ensure data integrity
- Open platform for customers to develop their applications

Why Moxa

- Compact Arm-based UC-8100-ME-T IIoT gateway compliant with C1D2 & ATEX certification standards for harsh industrial environments
- Deliver reliable 4G LTE connectivity in a wide operating temperature range of -40 to 70°C
- Featuring TPM and long-term Linux support for security patches for Moxa Industrial Linux
- Open platform for rapid development of customer applications for variable speed drives (VSDs) and PLC RMAC

Recommended Products

Industrial IoT Gateways / Industrial Computers





Model	UC-2100	UC-3100	UC-5100	UC-8100-ME-T	UC-8410A Series
CPU	TI AM335x Cortex-A8 600 MHz / 1 GHz	TI AM335x Cortex-A8 1 GHz	TI AM335x Cortex-A8 1 GHz	TI AM335x Cortex-A8 1 GHz	NXP LS1021A Cortex-A7 Dual 1GHz
RAM / Storage	Up to 512 MB / 8 GB	512 MB / 4 GB	512 MB / 8 GB	512 MB / 4 GB	1 GB / 8 GB
Serial Ports	Up to 2	Up to 2 (supports 1 additional CAN port)	4 (supports 2 additional CAN ports)	2	8
LAN Ports	Up to 2	2	2	2	3
Wireless Expansion	Wi-Fi/LTE	Wi-Fi/LTE	Wi-Fi/LTE	LTE	Wi-Fi/LTE
Operating Temperature	-40 to 75°C	-30 to 70°C (with LTE module)	• -40 to 85°C • -40 to 70°C (with LTE module)	• -40 to 85°C • -40 to 70°C (with LTE module)	-40 to 75°C

IIoT Software

Model	ThingsPro™ Suite
Features	• **ThingsPro Gateway**: Ready-to-use Modbus data acquisition platform with LTE connectivity, MQTT communication capabilities, and a built-in AWS IoT client • **ThingsPro Server**: Device management platform for locating and remotely managing ThingsPro Gateways

HMI Panel Computers

Model	MPC-2070/2120
Panel Size	7" (16:9) / 12" (4:3)
Light Intensity	350/1,000 nits
CPU	Intel Atom E3826/E3845
Operating Temperature	-40 to 70°C

Ethernet Remote I/O

Model	ioLogik E1200
Input/Output Interface	E1210: 16 DI E1211: 16 DO E1212: 8 DI, 8 DIO E1213: 8 DI, 4 DO, 4 DIO E1214: 6 DI, 6 Relay E1240: 8 AI E1241: 4 AO E1242: 4 AI, 4 DI, 4 DIO E1260: 6 RTD E1262: 8 TC
Unmanaged Switch Ports	2
Operating Temperature	• -10 to 60°C • -40 to 75°C (-T model)

Industrial Networking Solution


Model	EDS-510E	EDS-P506E-4PoE
Type	Managed DIN-rail switch	Managed DIN-rail switch
No. of Ports	10	6
Gigabit Ethernet	3	2
Power Supplies	12/24/48/-48 VDC	12/24/48 VDC
Operating Temperature	• -10 to 60°C • -40 to 75°C (-T model)	• -10 to 60°C • -40 to 75°C (-T model)
Redundancy	RSTP, MSTP, Turbo Ring, and Turbo Chain	RSTP, MSTP, Turbo Ring, and Turbo Chain

Your Trusted Partner in Automation

Moxa is a leading provider of edge connectivity, industrial computing, and network infrastructure solutions for enabling connectivity for the Industrial Internet of Things. With over 30 years of industry experience, Moxa has connected more than 50 million devices worldwide and has a distribution and service network that reaches customers in more than 70 countries. Moxa delivers lasting business value by empowering industry with reliable networks and sincere service for industrial communications infrastructures.

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