Cross-system Integration of an Intelligent Factory

Introduction

IoT-based Industry 4.0 has been a hot topic in the manufacturing world for the last few years and will probably continue to lead industrial trends for the foreseeable future, bringing abundant new business opportunities for equipment builders and System Integrators as they help to revamp traditional factories into Industry 4.0 manufacturing environments. The principle Industry 4.0 concept is connecting machines, work pieces, and systems to a network, allowing them to communicate with each other to become an intelligent system where individual units influence each other automatically to maximize quality and throughput. A factory that practices Industry 4.0 is called an iFactory.

In a traditional factory, when a workstation on a production line is out of components or material, it needs a human attendant to check and replenish the supply, but in an iFactory the machine can automatically alert a conveyor system for needed materials. If a machine in an iFactory starts to overheat, it will automatically cease operation and cool down to avoid a breakdown and minimize loss. As all data from devices and systems are converted into a standard protocol, the data can be exchanged, computed and displayed on a dashboard, where factory managers can oversee operating status of all machines and systems on all production lines of all of their facilities, and implement remote management and control. All the devices and systems in the factory are virtually combined into one big system. And this intelligent automatic production system can be incorporated with other information systems such as a Manufacturing Execution System (MES), a Warehouse Management System (WMS) or an Enterprise Resource Planning (ERP) system to streamline corporate operations. Data can also be pushed to the cloud for implementation of big data analyses that extract meaningful intelligence.

Application Requirements

Most of the time, an iFactory is not built from the ground up, but is upgraded from a traditional factory that already has equipment with a certain degree of automation. These machines and systems often differ in control logic, interfaces, software use and field level communication protocols, such as CANOpen, Modbus, and more.

Therefore, the biggest challenges for an iFactory developer is to bring all these heterogeneous systems to an intelligent network, transform their data into a unified format standard for IoT communication and central management, and establish logical control flows to coordinate the systems so they work synergistically.

System Solution

Advantech provides ARK-2230as a gateway system and WISE-PaaS/RMM as software platform for developing an IoT-based iFactory, bundled with comprehensive developer tools and cloud service readiness to speed up deployment.TheARK-2230is a fanless PC box carrying an Intel®Celeron®J1900 Quad Core 2.0GHz SoC, suitable for the integration and control needs of a smart factory. The ARK-2230supports Advantech's unique iDoor modules and ARK-Plus modules, which provide two arrays of optional I/O interfaces including isolated/non-isolated COM ports, CANBus, LAN, digital I/O and PoE ports that can be used to flexibly connect with various devices and systems already existing on the factory floor.

WISE-PaaS/RMM, Advantech's IoT software solution deployed at the gateway and server level, contains the WISE-agent on the gateway side to process and convert data sent from the field level, with different data formats, into the IoT-standard MQTT protocol and pass the unified data to the backend WISE-PaaS/RMM server and cloud database. It also integrates the IBM Node-RED rule engine that can be used to establish data logic flow of the IoT system with simple drag-and-drop operations. With this tool, the user can establish logical operating rules for the iFactory to allow different systems in the factory to work in synergy and achieve production goals. The Advantech WISE-PaaS/RMM software suite also provides a dashboard builder and a rich cluster of RESTful APIs that System Integrators can use to design and generate user interfaces and create various web-services and mobile applications. The RESTful support is important for quick and easy system integration with new data and functions, and with other applications.

For cloud analytics, the WISE-PaaS/RMM provides both a correlation database and a non-correlation database for convenient data management, and Microsoft Azure cloud service access, which allows users to easily establish cloud applications in the Azure Marketplace.

Benefits

- A total solution for IoT data acquisition provided by computer-based and controller-based gateways, and WISE-PaaS/RMM software
- Streamlined intelligent control and management enabled by modularized and easy-to-edit rule logic engine
- Easy hardware integration provided by flexible I/O modules
- Quick integration of software and functions provided by RESTful API support
- Convenient and efficient database management