CROSS-SYSTEM INTEGRATION OF AN INTELLIGENT FACTORY

Introduction

IoT-based Industry 4.0 has become a hot topic in the manufacturing world in the last few years and will probably continue to lead industrial trends for the foreseeable future, bringing bounteous 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 can influence each other automatically to maximize throughput and quality. A factory that practices Industry 4.0 is called an iFactory.

In a traditional factory, when a workstation at a production line is out of components

or materials, it needs human attendance to check for the supply, but in an iFactory the machine can automatically alert the conveyor system for material feeding. If a machine in an iFactory starts to overheat, it will automatically cease operation and cool down to avoid a breakdown and minimize loss. Since all data is converted into a standard protocol, the data can be exchanged, computed, and displayed on a dashboard. From there, factory managers can oversee the operating status of all machines and systems on all of their facilities' production lines and implement remote management and control. All the things and systems in the factory are virtually combined into one big system. This intelligent automatic production system can be incorporated with other information systems such as a Manufacturing Execution System (MES), Ware-

house Management System (WMS), or Enterprise Resource Planning (ERP) systems to streamline corporate operations. Data can also be pushed to the cloud for implementing big data analyses to 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 to establish logical control flows to coordinate all the systems so they work synergistically.

System Solution

Advantech's team provided a solution based on IoT gateway systems - ARK-2230L, ARK-1124U and WISE-PaaS-/RMM software platform, bundled with comprehensive developer tools and cloud services to speed up deployment of IoT-based iFactory.

The ARK-2230L embedded computer is a fanless PC, carrying the Intel® Celeron™ Quad Core J1900 2.0GHz processor, suitable for the integration and control needs of a smart factory.

The ARK-1124U IoT gateway is based on Intel's Celeron N3350 Dual Core SoC processor and is suitable for the more simplified data transmission of production lines.

Both the ARK-2230L and ARK-1124C are modular embedded systems, rated for an operating temperature from -20 to 60 °C, and provide excellent expansion capabilities through the addition of a combination of Advantech's proprietary iDoor Modules or ARK Plus expansion modules. iDoor Modules provide a series of optional I/O interfaces including isolated/non-isolated COM ports, CANBus, LAN and digital I/O to flexibly connect with various already existing equipment and systems on the factory floor.

WISE-PaaS/RMM, Advantech's IoT software solution, deployed at the IoT gateway and server levels, contains WISE-agent at the gateway side to process and convert data of different formats sent from the field into the IoT-standard MQTT protocol. It then passes 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 operation rules and logics of 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, which system integrators can use to design and generate user interfaces and create various web-services and mobile applications. The support for RESTful is important for easy and quick system integration with new data and functions and other applications.

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

Benefits

• IoT data acquisition total solution provided by computer-based and controller-based gateway 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 brought by RESTful API support

• Convenient and efficient database management

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