# Trends in Automation:

## IIoT, Robotics and Data Analytics

The Industrial Internet of Things (IIoT) is taking automation to a new level, allowing more devices to be connected to one another, more machinery to be monitored, more insights to be discovered, and more efficiencies to be realized. What's happening in the world of IIoT, and why does it matter?

You're likely familiar with the Internet of Things (IoT) where all kinds of "things" can sense, communicate with, analyze, or interact with other things autonomously. The IoT makes it possible for input/output devices, such as sensors, actuators, pc controllers, video, drives, or even robotics in automation to interact and communicate with each other. Valuable data is collected and transferred for further analysis and actionable steps are formulated in response to the findings.

The IoT essentially connects the unconnected. However, the inherent value of IIoT isn't connectivity for the sake of connectivity. In order for IIoT to be embraced by the industry, there needs to be a business case for it -- and there is: improved performance and efficiency.

According to the Internet of Things: *Industrial Automation Industry Exploring and Implementing IoT* cover story featured on ISA.org, the vision of the IoT is that of a massively instrumented world of intelligent sensors and actuators that communicate

using IP to improve performance and efficiency. By incorporating big data and analytics in factory automation, further efficiency gains can be expected. Robotics used in factory automation have also been rising due to the advancement in hardware technology and the IoT phenomenon.

### Newest Technologies Powering IIoT in Automation

Various technologies power IIoT in automation, generally falling under the following categories:
- Edge Devices
- Networks and Standards
- Gateway Devices and Controllers
- Analytics

### Edge Devices

The "things" referenced in the Internet of Things are also known as edge devices. Edge devices often take the form of sensors, actuators, motors, drives, pumps, valves, and so on.

As with many devices on the market today, edge devices are becoming smarter. For example, a German startup, KONUX, recently raised $7.5 million to start developing smart sensors that combine with cloud-based analytics for industrial applications. KONUX intelligent sensor systems,

which feature Wi-Fi and Bluetooth modules, are designed to reduce downtime and enable predictive maintenance.

Robotic arms use in assembly lines are increasing in its popularity and have been used to perform tasks such as machine-precise assembly, quality control, handing dangerous materials or even lifting heavy products – all of which required highly skilled human factory workers with less tendency for human errors. The sale of robotics for industrial use has seen massive growth on a world-wide scale in the recent years. According to the International Federation of Robotics report released in 2015 - robot sales increased by 29% in 2014 to 229,261 units from an estimated 178,000 units in 2013. Between 2010 and 2014, industrial robotic sales saw a 48% increase in sales, giving a clear indication that robotics in industrial automation is on an upward trend. This trend will most likely continue to rise beyond 2016.



The rising popularity of warehouse usage of robots for picking/packing/delivering to shipping stations has also been a direct result of technology advancement in both hardware and software as well as communications between devices and human.

## Complex Automated Industrial System: EtherCAT Master and its Controllers

Though it's not new, EtherCAT fieldbus systems are growing in its popularity at a rapid rate. Typically, the network on the controller, sensors, actuators, robotic arms and HMI devices are linked to a programmable logic controller (PLC) via the Ethernet without real-time capabilities. This distributed control system has an ability to process information real-time, making it both fast and efficient for transmitting protocol between connected devices and humans (via the use Human Machine Interface). Quality EtherCAT devices, such as those offered by Axiomtek, offer embedded EtherCAT port(s) in the controller, eliminating the need for

external/additional switches in EtherCAT networks. Each EtherCAT device can have a variety of I/O ports in addition to the EtherCAT port that includes GbE LAN, RS-232/422/485, USB and various display connectors. Axiomtek's EtherCAT Master Controller allows each node to connect to one another, forming a chain of connected devices in a variety of topologies based on preferences.

EtherCAT Master Controllers provide higher production efficiency, with reduced hardware costs and communication time between devices.

## Gateway Devices and Other Controllers/PLCs

Sensors and diverse edge devices send their data to gateway devices, which at their most basic serve as a central hub, routing the data from the edge devices such as robotic arms to the appropriate controllers. But, as with other IoT devices, gateway devices have evolved with most IIoT architecture patterns listed in the Industrial Internet Consortium's (IIC) *Industrial Reference Architecture Technical Report*.

Gateway devices are no longer simple switches. They now include integrated CPUs, communications capabilities including LAN or wireless, 4G/3G/LTE/GPRS and storage security software stack and manageability software for the purpose of remote management. Axiomtek's gateway controllers, such as the ICO300-MI, collect data from devices and transfer operational information to a control center for further analysis, planning and actionable corrective steps needed for improvement. It also can be programmed to provide alerts and deliver such communications to appropriate personnel. Modern gateway devices play an important role in the IIoT, where data is key to operational and, ultimately, business success.

Controllers without EtherCAT software stack and ports serve a similar purpose and are used to control operations, machine-to-machine communications and also machine-to-human communications. Advanced controllers and industrial PCs such as Axiomtek's eBOX, rBOX and IPC product lines typically include high performance CPUs, feature-rich I/Os, serve a variety of options for communications and expandable storage. These systems can be used to control robotic arms to perform tasks at assembly lines. They can also be used to control warehouse robots for picking and packing.

## Axiomtek's Controller Used to Control Robotics' Operations at Warehouses

Axiomtek's eBOX controller was selected to be housed on robots that perform picking and distribution tasks by a renowned robotics integrator and are being used in fulfillment and logistics at a few popular warehouse chains. This particular eBOX offers choices for scalable CPUs with 5th Generation Intel® Core™ and Celeron®. The customer's choice was Core®I3. The controller was customized to ensure it met all of the requirements. Axiomtek's system is compact in size and offers the following features that the customer required:

- High performance 204-pin DDR3L SO-DIMM max. up to 8 GB
- Fanless operation with wireless communications capabilities
- One RS-232/422/485 and one RS-232 ports
- One 2.5" SATA HDD drive bay and mSATA interface
- Supports one PCI Express Mini Card slot and four USB 3.0 ports
- Supports DisplayPort and HDMI dual view
- Product longevity, with 7-year support

Axiomtek provided great flexibility and the ability to meet the short turnaround time. The products were customized to suit the exact needs of the customers. This resulted in a reliable and highly efficient robotic product that the customer desired.

With greater capacity, more processing power, a wide variety of communication options and many more innovative improvements, today's hardware controllers have helped factories produce more output in less time, and with higher quality and reduced waste. With higher productivity, lower costs and higher operational efficiency, the key results are higher profits and enhanced customer loyalty.

## IIoT Analytics

Intelligent gateway devices, in conjunction with embedded controllers and HMI devices, play an important role in ensuring that data is captured, analyzed and further acted on whether that processing takes place within the device or is routed to the cloud or directly to the control center servers.

Data such as a robot's performance, error rates, downtime, other limitations and key success indicators are now commonly captured and transfer for analysis and future improvement.
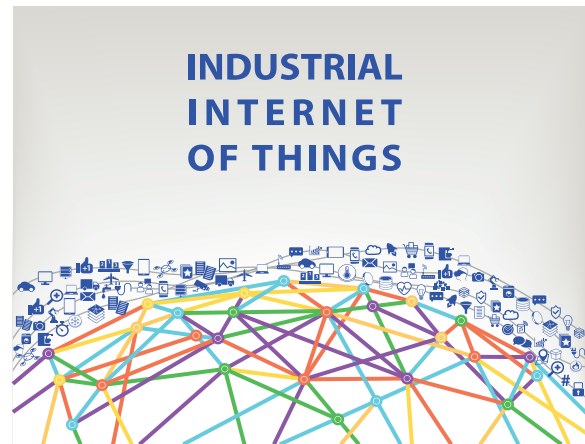


## The Information Value Loop

With the IIoT, you'll notice a cycle of action, data, communication, collection, analysis, and resulting action. This cycle is described as the "information value loop" in Deloitte University Press's *Inside the Internet of Things*.

The loop starts with an **action**, which **creates** information about that action (via sensors and other edge devices) and **communicates** that information (over networks according to standards). The information from various sources is **aggregated** and **analyzed** while future **actions** can be initiated, maintained, or modified (using gateway devices, controllers, augmented intelligence and augmented behavior).

All of these IIoT actions are facilitated by hardware that is getting smarter and faster. The end result: efficiency and performance improvements, increased automation, and innovation in the automation industry.

## Axiomtek's Automation Products

Axiomtek's Industrial PCs, EtherCAT Master Controllers, all-in-one touch panel PCs, DIN-rail embedded controllers, and IoT gateway devices are feature-rich and designed to meet the challenging requirements for operation in the automation industry. Axiomtek's solutions are designed for longevity and reliability to serve in a wide variety of automation applications such as automated robotic arms on assembly lines, data procurement and analysis, inventory management, quality control functions and for controlling production line applications.

## Embedded Systems for Robotics or General Assembly Line Controls

**eBOX671-885-FL-ECM**

- High performance 4th Generation Intel®Core™i7/i5/i3 or Celeron® processors with Intel Q87 chipset
- Verified with IntervalZero EtherCAT Master Solution KingStarIO32 for interoperability and one EtherCAT port for fast and reliable communication options between devices
- Two internal PCI Express Mini Card slots for 3G/LTE/4G/Wi-Fi for wireless communication options
- Wide operating temperature range of -20°C to +50°C for operational stability in rugged environments

**rBOX510-6COM**

- Low power consumption Intel®Atom™ E3827 processor
- Supports AXView 2.0 intelligent remote monitoring software solution for IIoT applications
- Extended operating temperature range of -40°C to +70°C for operational stability in rugged environments
- Four isolated RS-232/422/485 COM ports, two RS-232/422/485 COM ports and two isolated Gigabit Ethernet ports for reliable operation

## Industrial PCs for Process Control

**IPC934-230-FL**

- High performance 4th Generation Intel®Core™ i7/i5/i3 or Celeron® processors with Intel®Q87 chipse
- Supports 4-slot expansion for expandability options
- DC to DC power supply supports 10V - 30V for flexible power options
- Wide operating temperature range of -10°C to 50°C for operational stability in rugged environments

## Human Machine Interface All-in-one Industrial Touch Panel PC

**GOT3187W-881-PCT**

- High performance 4th Generation Intel®Core™ i7/i5/i3 or Celeron® processors
- 18.5-inch heavy duty touch panel PC with PCAP multi-touch screen
- Rugged full metal chassis design with IP65-rated front bezel protection for dust/liquid spillage
- Reliable and stable design with fanless cooling

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