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INDUSTRIAL INTERNET OF THINGS

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ABSTRACT

The industrial Internet of things (IIoT) can be regarded as machines, computers, and people enabling intelligent industrial operations using advanced data analytics. It is a network of systems, objects, platforms, and applications that can communicate and share intelligence. It is the biggest and most important part of the overall Internet of things picture. This paper provides a brief introduction to IIoT.

Key Words: *Internet of Things, Industrial Internet of Things, Industrial Internet.*

1. INTRODUCTION

The growth of the internet of things (IoT) is drastically making impact on home and industry. While the IoT affects among others transportation, healthcare, or smart homes, the Industrial Internet of Things (IIoT) refers in particular to industrial environments. IIoT is a new industrial ecosystem that combines intelligent and autonomous machines, advanced predictive analytics, and machine-human collaboration to improve productivity, efficiency and reliability. It is bringing about a world where smart, connected embedded systems and products operate as part of larger systems.

The industrial Internet of things (IIoT) refers to the application of the Internet of things (IoT) across several industries such as manufacturing, logistics, oil and gas, transportation, energy/utilities, chemical, aviation and other industrial sectors. A typical industrial Internet of things is shown in Figure 1 [1].

IIoT is often used in the context of Industry 4.0, the Industrial Internet and related initiatives across the globe. Industry 4.0 describes a new industrial revolution with a focus on automation, innovation, data, cyber-physical systems, processes, and people [2]. With Industry 4.0, the fourth industrial revolution is set on merging automation and information domains into the industrial Internet of things, services, and people. The communication infrastructure of Industry 4.0 allows devices to be accessible in barrier-free manner in the industrial Internet of things, without sacrificing the integrity of safety and security [3].

The term "industrial Internet" was coined by Industrial giant GE to describe industrial transformation in the connected context of machines, cyber-physical systems, advanced analytics, AI, people, cloud, and so on. GE and the Industrial Internet Consortium (IIC) decided that IIoT was a synonym for the Industrial Internet. IIoT is poised to bring unprecedented opportunities to business and society. Organizations like IIC and IEEE are working hard to define and develop the IIoT.

2. IOT BASICS

The Internet of things (IoT) is a new paradigm that promises to allow a variety of things (such as cars, refrigerators, microwaves, thermostats, mobile devices, machines, animals, people, etc.) to be augmented with networking and sensing capabilities, enabling

them to work together. The term, Internet of things, was first coined by Kevin Ashton, a British entrepreneur in 1999. He meant to represent the concept of computers and machines with sensors, which are connected to the Internet to report status and accept control commands [4].

IoT (also known as sensor network or Industrial Internet) is a global network of interconnected devices (such as sensors, actuators, personal electronic devices, laptops, tablets, digital cameras, smart phones, alarm systems, home appliances, or industrial machines, and other smart devices) that are enabled with technology of interacting and communicating with each other. It mainly enables the interconnection of Thing to Thing (T2T), Human to Thing (H2T) and Human to Human (H2H). By collecting and combining data from various IoT devices and using big data analytics, decision-makers can take appropriate actions with important economic, social, and environmental implications.

The IoT can be divided into three layers [5]: perception (or sensing) layer, network layer and application layer three levels:
(1) the perception layer collects from devices, RFID tags and readers, camera, GPS, sensors. In this layer, the wireless smart systems with or sensors can automatically sense and exchange information among different devices and remotely control them.
(2) the network layer is mainly messaging and processing information. The role of this layer is to connect all things together and allow them to share the information with each other.
(3) the application layer is the Internet of things and the application systems.

Technologies associated with IoT are shown in Figure 2 [6]. These include radio frequency identification (RFID), wireless sensor networks (WSN), middleware, cloud computing, and IoT application software. These five IoT technologies are widely used for the deployment of successful IoT-based products and services. In addition to these, software defined networking (SDN) is a key enabling technology of industrial Internet of things [7].

3. APPLICATIONS

Like IoT, the Industrial IoT covers many industries and applications. It opens plenty of opportunities in automation, optimization, manufacturing, transportation, and intelligent industry, and chemical industry.

- *Manufacturing*: This is the largest IIoT market. It is also the largest industry from an IoT spending (software, hardware, connectivity and services) perspective. Manufacturing is among the industrial sectors that will be directly impacted by the disruption springing from IIoT. A smart production unit may consist of a large connected industrial system of materials, parts, machines, tools, inventory, and logistics that can relay data and communicate with each other. IIoT connectivity drives the convergence of operational technology (robots, conveyor belt, smart meters, generator, etc.) and information technology. Within manufacturing, intelligent sensors, distributed control, and secure software are the glue. Forward-thinking manufacturers connect their products to IIoT. They will position themselves as future leaders, while those that fail to act now risk being left behind [8].
- *Transportation*: This represents the second largest IIoT market from an Internet of things spending perspective. Today's transportation infrastructure is stressed to the breaking point. Many cities have begun smart transportation initiatives to optimize their public transportation routes, create safer roads, reduce infrastructure costs, and alleviate traffic congestion Airlines, rail companies, and public transit agencies can aggregate huge quantities of data to optimize operations.

Other applications include digital supply chain, retail, automotive, unmanned aerial vehicles or drones, aerospace, agriculture, predictive maintenance, data-enabled services, connected logistics, smart homes, smart grid, smart city, smart farming, energy consumption optimization, safety and health monitoring of workers.

4. CHALLENGES

The industrial Internet of things is still in its early age. Although it is poised to grow significantly, there are challenges which can hinder future growth. Data integration is a major challenge because it is not easy to move from data to business value. Another major challenge making companies not to be ready for the industrial Internet of things is a lack of skilled workers. There is lack of systematic research for reaping the benefits of IIot.

A major challenge for executives is cybersecurity and data security, which is rising in importance due to increased vulnerability to attacks and data breaches. In the IIoT context, data is considered sensitive because data will encapsulate various aspects of industrial operation, including highly sensitive information about products, business strategies, and companies. The transition to more open network architectures and data sharing of IoT poses challenges in industrial markets. The loss of sensitive information can lead to significant business loss and cause reputational damage [9].

One challenge is the very large scope of IIoT applications. Standards are needed to enable smart connected machines and assets to interact. They are vital to ensure that any new device added to the infrastructure can interact with existing equipment. The question of standardization is currently being address by the Industry 4.0 and the Industrial Internet Consortium [10].

In spite of these challenges or barriers, adoption of IIoT is growing rapidly.

5. CONCLUSION

The Industrial Internet of things refers to a vast number of interconnected industrial systems that are communicating, sharing data, and improving industrial performance to benefit the society. Recently, IIoT has emerged as a subparadigm which focuses more in safety-critical applications in industries like aerospace, energy, and heaIthcare.

Companies that want to stay competitive should embrace the IIoT as soon as possible. In virtually every industry, areas can be indentified to get started where implementation costs are low. For information about IioT can be found in several books on it available on Amazon.com and *IEEE Internet of Things Journal*, which is devoted exclusively for IoT.

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Annexures

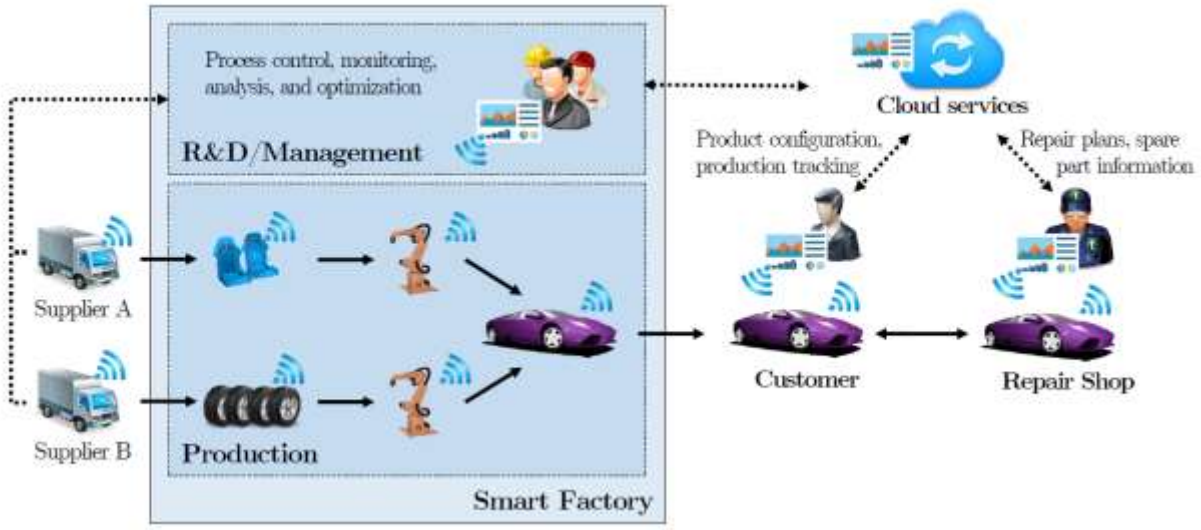

Figure 1 A typical Industrial Internet of things [1].

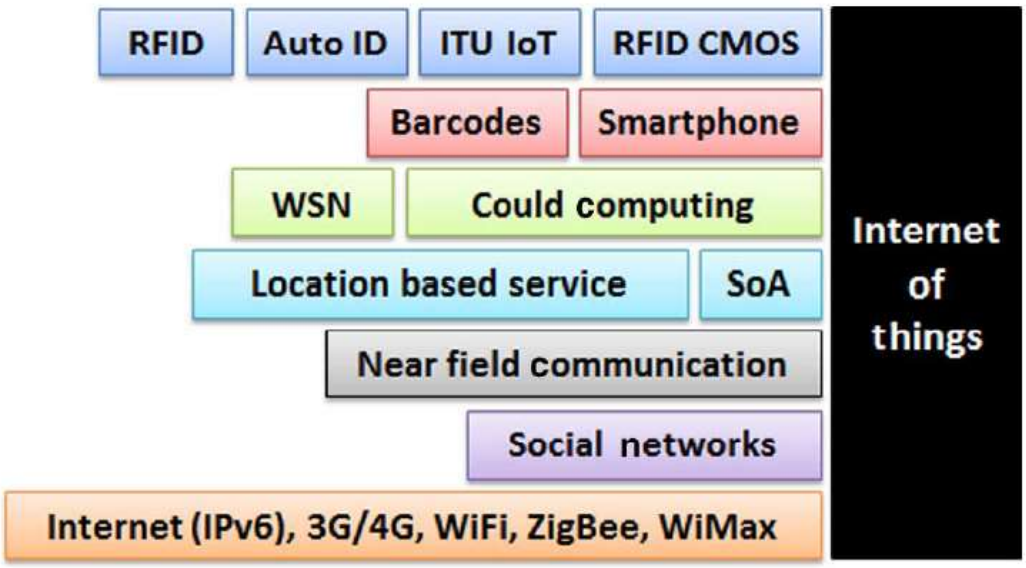

Figure 2 - Technologies associated with IoT [6].

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