Advanced Manufacturing and IIoT

A WIL Digital Initiative

Presented by the Information and Communications Technology Council

Welcome to ICTC's WIL Digital: Advanced Manufacturing & IIoT

ICTC's WIL Digital is an innovative Work Integrated Learning (WIL) program that helps students gain insight and skills to advance learning and meaningful work experience.

COURSE OVERVIEW

Hello and welcome to the **Advanced Manufacturing & IIoT** course. This course will help you develop skills in advanced manufacturing and the Industrial Internet of Things (IIoT). It discusses the concepts and architectures that support these technologies and covers many aspects such as the components, design, implementation, and use of these technologies in the very specific context of the manufacturing industry. This course will allow you to understand the evolution of technologies in this rapidly-changing field and to understand the possibilities that result from it.

This ICTC course is a great learning opportunity in one of the most exciting industries today, as well as a source of knowledge for technologies related to advanced manufacturing (also known as "Manufacturing 4.0"), the Internet of Things (IoT) and Industrial Internet of Things (IIoT) and their impact on businesses around the world, with a focus on Canada .

TARGETED AUDIENCE

This course is designed for learners who wish to develop fundamental skills in the areas listed above, as a first level introduction. Students who are already proficient in this subject are encouraged to take another of AIT's digital courses available, which provide excellent lateral understanding of the concepts associated with this course (like our Telecommunications, Internet of Things, 5G course for example).

Each module of this course lasts approximately 1-2 hours and should be completed during your work placement. It is advisable to devote one week to each module and four weeks to the case study.

As a participant, you will:

- Have access to six unique micro-learning modules;
- Discover ways to potentially launch your future career in advanced manufacturing and the Industrial Internet of Things;
- Add new skills to your professional portfolio;
- Become the next generation of talent in the world of advanced manufacturing and the IIoT.

ABOUT THIS COURSE

Upon completion of this training, you will be able to:

- Identify and explain the role of the main technologies that make up the Industrial Internet of Things (IIoT) and how they contribute to a company's value chain;
- Identify the opportunities and uses of the Industrial Internet of Things (IIoT) in a Canadian business context by considering their business value and operational efficiency;
- Design a simple solution using Industrial Internet of Things (IIoT) technologies, covering the entire life cycle of data in an industrial context.

The course is comprised of a total of six modules that cover a wide range of topics:

Module	Subjects	Learning goals
Module 1: IoT and IIoT: concepts and components	• History of IoT and IIoT • IIoT structure and technologies used • Benefits of IIoT • Main uses of IIoT • IIoT Challenges	• Define the concept of IoT and IIoT • Explain the structure of high-level IIoT • Identify the main benefits and challenges related to IIoT
Module 2: Industrial Data Sources	• Introduction to data sources (sensors, machines, processes) • Sensor technology and industrial application • Types of sensors • Calibration and veracity of sensors	• Contextualize the use of sensors • Identify the different types of sensors • Distinguish the characteristics of different types of sensors
Module 3: IIoT Ecosystem: the transformation of industrial data	• Cloud computing • IIoT Ecosystem • Gateways and other integrated systems • IIoT implementation • Network security and other types of security	• Recognize the central role of cloud computing in the transformation of industrial data • Distinguish between public and private clouds • Identify the main functions of the Internet of Things (IoT) platforms • Identify the challenges in securing the Industrial Internet of Things (IIoT)
Module 4: Industrial Data Life Cycle	• Databases (data, RDBMS/NoSQL, basic data architecture) • Data Collection Methods • Data analysis	• Identify technologies to collect, store and transmit data • Contextualize the use of these technologies • Identify beneficial approaches to the maintenance, cost, and operation of sensor systems • Discover Industry 4.0, business intelligence and artificial intelligence systems
Module 5: Applications and intelligence of industrial data	• Presentation of basic knowledge • Data visualization • Connection and reports • Examples of IIoT usage	• Explain what is valuable information • Explain the communication process with the experience/user interface • Define the concept of a digital twin • Establish the role of augmented reality in IIoT
Module 6: IIoT trends, career opportunities and future solutions	• Future trends in IIoT • The Canadian labour market, roles in demand • Ethics, laws and IoT • Solutions to meet international goals and standards	• Identify some future trends in the Industrial Internet of Things (IIoT) • Identify the jobs in demand in the field of the Internet of Industrial Things (IIoT) • Assess the consequences and risks of using shared data and infrastructure

TOPIC OVERVIEW

Watch this introductory video for a more in-depth synopsis of what this course offers.

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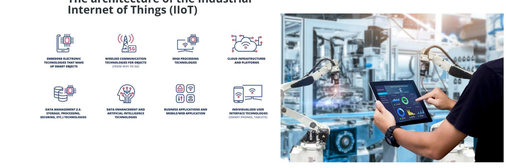
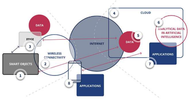
The challenges of the Industrial Internet of Things (IIoT)

Read the following scenario to identify some of the challenges of the Industrial Internet of Things (IIoT).

PrecisionMakers 2

The architecture of the Industrial Internet of Things (IIoT)





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Overall trend : accelerated adoption of Industrial Internet of Things (IIoT) technologies

Today, IoT is applied in most industrial and commercial fields, including :

- **CONNECTED HEALTH** – e.g.: monitoring the elderly at home
- **CONSTRUCTION** – e.g.: robotization of processes
- **ADVANCED AGRICULTURE** – e.g.: crop and vine monitoring, seasonal cover
- **THE INTELLIGENT BUILDING** – e.g.: air quality, energy efficiency, asset management
- **THE SMART CITY** – e.g.: smart lighting, monitoring of garbage and water network
- **HOME AUTOMATION** – e.g.: remote control of garage door, door intercommunication
- **MOBILITY** – e.g.: intelligent parking, autonomous vehicles

The application of the Internet of Things (IoT) in the industrial domain has greatly accelerated in recent years and will continue to do so due to the operational gains now well understood by the international community.

To date, The Industrial Internet of Things (IIoT) has mostly been implemented to **optimize production quality and the efficiency of work processes** (called "workflow"). Data from production lines is analyzed in real time to help with maintenance and decision-making. This is called preventive maintenance and, in the best case, predictive maintenance. This practice improves and intensifies with time and will remain one of the main returns on investment in the manufacturing field.

Cloud platforms

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Internet of Things (IoT) Labour Market in Canada

What are the functions of a gateway?

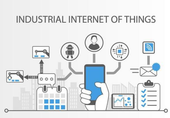
An Internet of Things (IoT) gateway can perform many of the following functions.

- **FACILITATING COMMUNICATION** with unaffiliated or non-connected connected industrial devices
- **DATA VISUALIZATION AND BASIC DATA ANALYSIS** on IoT gateway applications
- **CACHING, BUFFERING, AND STREAMING OF DATA**
- **SHORT-TERM DATA HISTORY FEATURES**
- **DATA PRE-PROCESSING, CLEANING, FILTERING, AND OPTIMIZATION**
- **SECURITY** user access management and network security features
- **DEVICE-TO-DEVICE COMMUNICATION SUPPORT**
- **DEVICE CONFIGURATION MANAGEMENT**
- **HELP WITH HOSTING CERTAIN DATA**
- **SYSTEM DIAGNOSTICS**

The Internet of Things (IoT) sector creates many jobs and represents a particularly promising market for students who are passionate about new technologies. So, what are the most in-demand Internet of Things (IoT) professions?

TRADES RELATED TO OBJECTS	TELECOMMUNICATIONS	CLOUD INFRASTRUCTURE AND EDGE

Relying massively on cloud infrastructures, the Internet of Things (IoT) generates significant needs for specialist/technician resources in Internet of Things (IoT) cloud platforms and virtualization technologies, dockers, containers, Kubernetes, Edge platforms and devices, Microsoft Azure Internet of Things (IoT) specialists, cloud hosting, or massive data storage.



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Module 7: Case study

You have now completed the first six modules. This is the final activity of the course, the case study, i.e. a typical industry situation that you will be working on. We explain an issue, a "case" that could arise in the advanced manufacturing industry and the Industrial Internet of Things. We also provide you with instructions, and you must find a solution to this issue or challenge.

Here is the case in question.

7.0 The context

The pharmaceutical company PROTECTME manufactures vaccines for the Canadian population and wishes to significantly increase the performance of its laboratory in order to better respond to the government's demand and to win future tenders.

The PROTECTME laboratory is currently running at 90% of its production capacity.

In order to remain effective, vaccines must be stored at the correct temperature, between 2°C and 8°C. Vaccines are as sensitive to heat as they are to freezing; they should not be stored in a refrigerator. The cold chain must be respected at every stage of the process, from the production of the vaccine to all successive phases of storage and transport, right up to its use.

The supply chain consists of 6 steps (simplified process):

1. Antigen development in the laboratory 1
2. Transport to the main laboratory
3. Vaccine manufacturing and batch assembly
4. Storage awaiting delivery
5. Transport to injection centers
6. Final quality control and batch approval

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