Cloud Technologies and the Internet of Things — Syllabus

» Course Overview

First, we had the internet of computers. Then with the advent of email and social media, along with mobile technology, it became the internet of people. Today's world is increasingly becoming the internet of things. With advances in battery power, sensors, and computer chips, more and more devices are being connected to the internet. This will allow them to be monitored, controlled, and used more effectively for people and businesses. This course will examine the trends and opportunities surrounding the Internet of Things (IoT). Students will learn about the technologies, hardware, and software that underpin the Internet of Things. The course will examine a variety of end-market applications in our homes, businesses, and cities. Finally, students will learn about the many career opportunities that the Internet of Things will enable.

» Course Outline by Module

Module 1	What is the Internet of Things?	**Module 6**	Internet of things in Healthcare
Module 2	The Internet and the Cloud	**Module 7**	Internet of Things and Cars
Module 3	Internet of Things at Home	**Module 8**	Internet of Things at the Store
Module 4	Internet of Things and People	**Module 9**	Internet of Things and Farming
Module 5	The Industrial Internet of Things	**Module 10**	Internet of Things and Cities

» Module Overview and Learning Objectives

| Module 1. What is the Internet of Things?

Imagine living in a world where you didn't tell your technology what you wanted. In this world, the technology already knows what you want. In fact, the technology even knows what you need. It knows why the check engine light has come on in your car and will automatically let your dealership know to schedule a visit. Your refrigerator knows your favorite foods and can tell you the best recipes for the ingredients you have on-hand. This isn't just a dream. It's a system that is currently being developed and integrated all around us. It is the Internet of Things.

This module will introduce you to the Internet of Things (IoT) concept. You'll begin the module learning about the workings of the Internet of Things and the elements that make the technology possible, like machine-to-machine technology and smart devices. Secondly, you will learn how miniaturization of electronic devices, affordability of components, and wireless power construct a sustainable infrastructure for IoT. Next, you will learn about two laws: Moore's Law and Metcalf's Law and how these laws have transformed digital electronics and networking, ultimately paving the way for IoT. After that, the module describes the projected growth of connected devices and real-world applications for the Internet of things. Finally, this module will present some initial pros and cons relating to the Internet of Things as well as potential security risks associated with the concept

Learning Objectives: In this module, students will:
- Define Internet of Things (IoT), machine-to-machine, and "smart" machine
- Identify key trends that are driving technological development: miniaturization, affordability, and de-wireization
- Evaluate Moore's law and Metcalf's law and describe how they have contributed to the growth of connected machines
- Recognize the number of connected devices globally and predict the growth of connected devices
- Examine the impact that artificial intelligence, fog computing, and blockchain technology will have on the growth of IoT

| Module 2. The Internet and the Cloud

Can you imagine your life without the internet? How would you communicate remotely with friends, find where you need to go, or look up information for a school assignment? Before the Internet was created, you had to carry an actual physical map (without turn-by-turn instructions). You had to go to the library and look up information in a card catalog or encyclopedias, instead of just googling it. The internet has changed society in a profound way. We'll explore how it came to be, and some additional developments that have been built on it to enable the Internet of Things.

This module will examine the Internet and the Cloud. You'll begin the module learning about the history of the Internet and significant technological advances. Secondly, you will learn about cloud computing, how cloud computing works, and how fog computing will work with cloud computing to improve how the Internet of Things functions. Next, you will learn about people who have made significant contributions to the Internet and cloud computing technology. After that, the module describes the differences between the Internet and IoT along with the technology adoption curve and five categories of people and their reaction to technology adoption. Finally, this module will present the impact that new technology can have on various industries.

Learning Objectives: In this module, students will:

- Outline the history of the internet and the world wide web
- Define cloud computing and fog computing and explain how they work
- Identify key contributors to internet and cloud computing technology
- Differentiate between the internet and the internet of things
- Describe the technology adoption curve and examine examples of adoption such as the internet and mobile phones
- Discuss the impact the internet has had on industries such as mail delivery and bookstores

| Module 3. Internet of Things at Home

More and more products are designed every day to make our homes more convenient, more efficient, and safer! These include smart lightbulbs, connected locks, and of course, the smart refrigerator. In this module, we'll see how they communicate with each other and use AI principles such as machine learning and natural language recognition to give us a more personalized experience. We'll discuss the many benefits these devices bring with them but also the potential risks in opening up our homes to hacking.

Learning Objectives: In this module, students will:

- Define key terms related to IoT applications in the home
- Describe use cases of the Internet of Things within a house
- Evaluate how the use of IoT in home systems such as heating, cooling, and sprinklers can improve resource efficiency and reduce maintenance problems
- Discuss the benefits and drawbacks of relying on connected devices within the home
- Evaluate the challenges of reliability on connected devices that may malfunction, run out of batteries, or be hacked

| Module 4. Internet of Things and People

This module will look at putting IoT sensors and devices right on people, which is also known as wearable technology. This encompasses everything from hearing aids to smartwatches, to embedded fabrics. Students will learn about the various uses of wearable technology in fitness and sports, fashion, and business. Finally, the module will explore career opportunities for those interested in wearable technologies.

Learning Objectives: In this module, students will:

- Define wearable technology and describe how wearable technology relates to the internet of things
- List and describe key sensors used in various wearable applications
- Describe applications of wearable technology across fitness & sports and business
- Examine the potential risks of utilizing wearable technologies
- Evaluate how wearable technology can contribute to digital distraction and what students can do to increase focus and attention
- Identify career opportunities in wearable technologies and educational paths to enter those careers

| Module 5. The Industrial Internet of Things

This module will explore a behind-the-scenes look at what the industrial internet of things could mean for the global economy. While the applications in this module might not be as familiar and recognizable to high school students, the technologies of the Industrial IoT (or IIoT) has the possibility to reinvent entire industries across the world. Even with this tremendous potential, many companies are still far behind in recognizing and implementing an IoT strategy. However, this creates an opportunity for students to learn about this growing field and discover career opportunities within the industrial Internet of Things.

Learning Objectives: In this module, students will:

- Define key terms related to the Industrial IoT
- Examine companies and projects that are utilizing the Industrial IoT
- Discuss how IoT technologies will enable Factories to become more efficient
- Identify the risks associated with ransomware attacks on the IoT
- Identify career opportunities in the industrial internet of things and educational paths to enter those careers

| Module 6. Internet of Things in Healthcare

Introducing technology into healthcare should be first about improving care, and second about making it more affordable. Applying the Internet of Things to healthcare will do both of those! In fact, healthcare is a sector where IoT has already made significant inroads. Students will learn about the devices, tools, and technologies used by doctors and other healthcare professionals. The module will also examine the important issue of patient privacy, given the explosion of new information made possible by the IoT.

***Learning Objectives*:** In this module, students will:

- Define key terms related to Healthcare IoT
- Describe use cases of the Internet of Things in healthcare, including: blood pressure monitors, blood sugar monitors, in-home medication dispensers
- Examine how IoT technology can be used track and monitor contagious diseases
- Evaluate key risks associated with the IoT and connected devices
- Discuss the importance of data collection in healthcare and describe how IoT devices collect and process data
- Identify career opportunities in the IoT at Healthcare industry and educational paths to enter those careers

| Module 7. Internet of Things and Cars

Who wants a self-driving car that can take them wherever they want, whenever they want? Now that self-driving cars have become a reality, how does this technology work? In this module, students will learn how algorithms and robotic systems allow self-driving cars to operate. A contrast will be defined between the benefits and limitations of utilizing connected sensors, robots, and artificial intelligence in transportation. Students will also investigate other ways that the IoT is impacting auto transportation. Finally, students will be able to review the educational paths and identify career opportunities with self-driving and connected cars.

Learning Objectives: In this module, students will:

- Describe applications of the Internet of Things in cars, including tire pressure monitoring, connected cars, and driverless car sensors
- Identify key technologies that enable self-driving cars (Lidar, radar, other sensors)
- Define algorithm and explain how algorithms allow self-driving cars to operate
- Compare the benefits and limitations of utilizing sensors and artificial intelligence in transportation
- Determine the impact of robots on jobs in transportation
- Identify career opportunities in self-driving cars and educational paths to enter those careers

|Module 8. Internet of Things at the Store

How will the IoT impact the way that we shop? How will it impact the things we buy, how we buy them, and how they got to the store in the first place? This module will seek to answer these questions and explore the use of IoT technology in retail. Students will discover the exciting innovations that are being tested and perfected to improve the shopping experience for everyone.

Learning Objectives: In this module, students will:

- Define key terms related to IoT applications in retail
- Describe use cases of the Internet of Things in stores
- Examine how the IoT will impact the supply chain of how products are delivered
- Identify and discuss risks, including privacy and security, with the use of IoT in stores
- Discuss the impact of IoT on jobs in retail and the environment
- Identify career opportunities in IoT Retail and educational paths to enter those careers

| Module 9. Internet of Things and Farming

Self-driving tractors… a robot that herds cattle… a drone that scans fields to identify the specific spots where crops should be planted… Think you've woken up in the future? Then, you'll be surprised to know that these innovations are already here!

When looking at the progress made in agriculture from 1900 to 2000, it's hard not to be impressed. However, progress has accelerated in this century. In the last few years, the affordability of IoT technology has contributed to the growth in smart farming. Lower costs mean it's easier for farmers to use sensor-based devices to monitor their lands remotely including weather monitoring, automated machinery, optimized irrigation, and real-time decisions. (1) And it's only the beginning of things to come.

But just like in other industries, not everything is perfect. Intensive farming has been able to produce tremendous amounts of food but at the same time, it's been forced to rely more and more on fertilizers and pesticides, which are chemical-based, to feed the soil so it keeps producing.

This module will explore the many applications of the IoT in farming, including automated milking systems, harvest automation, and precision application of fertilizer. Prior technologies, such as plows, tractors, and even fertilizer and pesticides, have had a tremendous impact on farming jobs in the past. We'll examine the impact IoT will have in continuing this trend. The module will also discuss the impact these technologies might have on the environment, as well as careers in agricultural technology.

***Learning Objectives*:** In this module, students will:
- Define key terms related to IoT applications in agriculture
- Describe the change in agriculture employment from 1900 to today and the causes of the change
- Describe use cases of the Internet of Things in farming
- Discuss the challenges of feeding a growing global population and how improvements from IoT can help with this challenge
- Examine how the use of IoT applications in agriculture could produce environmental benefits
- Identify career opportunities in Agricultural technology and educational paths to enter those careers

| Module 10. Internet of Things and Cities

What would be possible if an entire city was connected? The IoT has the potential to improve public services, make citizens more engaged, and even help the environment. The module will explore applications of the IoT in things such as parking meters, street lamps, traffic cameras, and roads, as well as connected or smart buildings. Students will also gain an understanding of career paths in urban development, and how the IoT could be a big part of this development in the years to come.

*Learning Objectives***:** In this module, students will:

- Define key terms related to IoT applications in cities
- Describe use cases of the Internet of Things within cities
- Evaluate the impact of smart cities on public sector jobs
- Discuss the potential for smart cities to impact the environment positively or negatively
- Examine efforts by companies and governments to address risks and concerns of the Internet of Things
- Identify career opportunities in the IoT and Cities industry and educational paths to enter those careers