Introduction to Emerging Technologies (CoSc1012)

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Chapter 1: Outline

- **Evolution of Technologies**
  - Introduction to the Industrial Revolution (IR)
  - The Most Important Inventions of the Industrial Revolution
  - Historical Background (IR 1.0, IR 2.0, IR 3.0)
- **Role of Data for Emerging Technologies**
- **Enabling devices and network (Programmable devices)**
  - List of some Programmable devices
- **Human to Machine Interaction**
  - Disciplines Contributing to Human-Computer Interaction (HCI)
- **Future Trends in Emerging Technologies**
  - Emerging technology trends in 2019
  - Some emerging technologies that will shape the future of you and your business

Outcomes

After completing this chapter, the students will be able to:

- ➢ Develop knowledge about the era of industrial evolutions
- ➢ Identify the technological advances that made the industrial revolution possible
- ➢ Analyze the changing conditions created by the industrial revolution in both Europe and the united states
- ➢ Understand the causes of the Industrial Revolution in Great Britain, continental Europe, and the United States.
- ➢ Describe the technological innovations that encouraged industrialization
- ➢ Identifies and understand the programmable device
- ➢ Understand concepts relating to the design of HCI
- ➢ Develop general knowledge about emerging technologies

Evolution of Technologies

- Emerging technology: a term is used to describe
  - ✓ a new technology
  - ✓ the continuing development of existing technology
  - ✓ Technologies that are expected to be available within the next five to ten years
  - ✓ technologies that are creating or are expected to create significant social or economic effects.
- Technological evolution is a theory of radical transformation of society through technological development.

Evolution of Technologies(cont..)

What is the root word of technology and evolution?

- Technology: 1610s, “discourse or treatise on an art or the arts," from Greek tekhnologia” systematic treatment of an art, craft, or technique,“ (see techno-) + -logy.
- Evolution: evolution means the process of developing by gradual changes.

Evolution of Technologies(cont..)

- **List of some currently available emerged technologies**
  - Artificial Intelligence
  - Blockchain
  - Augmented Reality and Virtual Reality
  - Cloud Computing
  - Angular and React
  - DevOps
  - Internet of Things (IoT)
  - Intelligent Apps (I-Apps)
  - Big Data
  - Robotic Processor Automation (RPA)

Introduction to the Industrial Revolution (IR)

- The IR was a period of major industrialization and innovation that took place during the late 1700s and early 1800s. It was a time when :
  - ✓ the society shifts from using tools to make products to use new sources of energy, such as coal, to power machines in factories.
  - ✓ the manufacturing of goods moved from small shops and homes to large factories.
- It started in England, with a series of innovations to make labor more efficient and productive.
- This shift brought about changes in culture as people moved from rural areas to big cities in order to work.

Introduction to the Industrial Revolution (IR)

- The American IR, commonly referred to as the Second IR, started sometime between 1820 and 1870.
- Industries such as textile manufacturing, mining, glass making, and agriculture all had undergone changes.
- There was the mass production and assembly lines using electricity
- Generally, the following IRs fundamentally changed and transfer the world around us into modern society.
  - The steam engine,
  - The age of science and mass production, and
  - The rise of digital technology
  - Smart and autonomous systems fueled by data and machine learning.

Inventions of the IR

- **The Most Important inventions of IR:**
  - Transportation: The Steam Engine, The Railroad, The Diesel Engine, The Airplane.
  - Communication: The Telegraph. The Transatlantic Cable. The Phonograph. The Telephone.
  - Industry: The Cotton Gin. The Sewing Machine. Electric Lights.

Historical Background of IR

- The IR began in Great Britain in the late 1770s before spreading to the rest of Europe.
- The first European countries to be industrialized after England were Belgium, France, and the German states.
- The final cause of the IR was the effects, increase in food production, created by the Agricultural Revolution.
- **The four types of industries are:**
  - The primary industry involves getting raw materials e.g. mining, farming, and fishing.
  - The secondary industry involves manufacturing e.g. making cars and steel.
  - Tertiary industries provide a service e.g. teaching and nursing.
  - The quaternary industry involves research and development industries e.g. IT.

Industrial Revolution (IR 1.0)

- The IR is described as a transition to new manufacturing processes.
- IR was first coined in the 1760s, during the time where this revolution began.
- The transitions in the first (IR 1.0) included
  - going from hand production methods to machines,
  - the increasing use of steam power (see Figure below),
  - the development of machine tools and the rise of the factory system.



Industrial Revolution (IR 2.0)

- known as the Technological Revolution, began somewhere in the 1870s. The **advancements** included
  - the development of methods for manufacturing interchangeable parts
  - widespread adoption of pre-existing technological systems such as telegraph and railroad networks. This adoption allowed the vast movement of people and ideas, enhancing communication.
  - Moreover, new technological systems were introduced, such as electrical power (see Figure below) and telephones.



Industrial Revolution (IR 3.0)

- IR 3.0 introduced the transition from mechanical and analog electronic technology to digital electronics which began from the late 1950s.
- IR 3.0 was given the nickname, "Digital Revolution".
- The core factor of this revolution is:
  - the mass production
  - widespread use of digital logic circuits and its derived technologies such as the computer, handphones and the Internet.
- These innovations enabled people to communicate with another without the need of being physically present.
- Certain practices that were enabled during IR 3.0 is still being practiced until this current day, for example – the proliferation of digital computers and digital record.

Industrial Revolution (IR 3.0)



High Tech Digital Electronics

Industrial Revolution (IR 4.0)

- Now, with advancements in various technologies such as robotics, Internet of Things, additive manufacturing and autonomous vehicles.
- IR 4.0 was coined by Klaus Schwab, in the year 2016.
- The technologies mentioned above are what you call – cyber-physical systems.
- A cyber-physical system is a mechanism that is controlled or monitored by computer-based algorithms, tightly integrated with the Internet and its users.

Industrial Revolution (IR 4.0)

- One example that is being widely practiced in industries today is the usage of Computer Numerical Control (CNC) machines.
- These machines are operated by giving it instructions using a computer.
- Another major breakthrough that is associated with IR 4.0 is the adoption of Artificial Intelligence (AI),
- AI is also one of the main elements that give life to Autonomous Vehicles and Automated Robots.

Industrial Revolution (IR 4.0)



Anybody Connected device (ABCD)

Role of Data for Emerging Technologies

- Data is regarded as the new oil and strategic asset since we are living in the age of big data, and drives or even determines the future of science, technology, the economy, and possibly everything in our world today and tomorrow.
- More importantly, data presents enormous challenges that in turn bring incredible innovation and economic opportunities.
- This reshaping and paradigm-shifting are driven not just by data itself but all other aspects that could be created, transformed, and/or adjusted by understanding, exploring, and utilizing data.
- The preceding trend and its potential have triggered new debate about data-intensive scientific discovery as an emerging technology, the so-called "fourth industrial revolution,"

Role of Data for Emerging Technologies

- There is no doubt, that the potential of data science and analytics to enable data-driven theory, economy, and professional development is increasingly being recognized.
- This involves not only core disciplines such as computing, informatics, and statistics, but also the broad-based fields of business, social science, and health/medical science.

Enabling devices and network (Programmable devices)

- In the world of digital electronic systems, there are **four basic kinds of devices.**

1. Memory devices store random information such as the contents of a spreadsheet or database.
2. Microprocessors execute software instructions to perform a wide variety of tasks such as running a word processing program or video game.
3. Logic devices provide specific functions, including device-to-device interfacing, data communication, signal processing, data display, timing and control operations, and almost every other function a system must perform.
4. The network is a collection of computers, servers, mainframes, network devices, peripherals, or other devices connected to one another to allow the sharing of data. E.g. the Internet, which connects millions of people all over the world

Enabling devices and network (Programmable devices)

- Programmable devices usually refer to chips that incorporate field programmable logic devices (FPGAs), complex programmable logic devices (CPLD) and programmable logic devices (PLD).
- There are also devices that are the analog equivalent of these called field-programmable analog arrays.



Enabling devices and network (Programmable devices)

- **Why is a computer referred to as a programmable device?**
- Because what makes a computer a computer is that it follows a set of instructions.
- Many electronic devices are computers that perform only one operation, but they are still following instructions that reside permanently in the unit.

List of some Programmable devices

- Achronix Speedster SPD60
- Actel’s
- Altera Stratix IV GT and Arria II GX
- Atmel’s AT91CAP7L
- Cypress Semiconductor’s programmable system-on-chip (PSoC) family
- Lattice Semiconductor’s ECP3
- Lime Microsystems’ LMS6002
- Silicon Blue Technologies
- Xilinx Virtex 6 and Spartan 6
- Xmos Semiconductor L series

List of some Programmable devices

- A full range of network-related equipment referred to as Service Enabling Devices (SEDs), which can include:

- Traditional channel service unit (CSU) and data service unit (DSU)
- Modems
- Routers
- Switches
- Conferencing equipment
- Network appliances (NIDs and SIDs)
- Hosting equipment and servers

Human to Machine Interaction(HMI)

- HMI refers to the communication and interaction between a human and a machine via a user interface.
- Nowadays, natural user interfaces such as gestures have gained increasing attention as they allow humans to control machines through natural and intuitive behaviors

What is interaction in human-computer interaction?

- HCI is the study of how people interact with computers and to what extent computers are or are not developed for successful interaction with human beings.
- HCI consists of three parts: the user, the computer itself, and the ways they work together.

Human to Machine Interaction

- How do users interact with computers?
- The user interacts directly with hardware for the human input and output such as displays, e.g. through a graphical user interface, software interface using the given input and output (I/O) hardware.
- How important is human-computer interaction?
- The goal of HCI is to improve the interactions by making computers more user-friendly and receptive to the user's needs.
- The main advantages of HCI are:
  - simplicity
  - ease of deployment & operations
  - cost savings for smaller set-ups
  - reduce solution design time and integration complexity.

Disciplines Contributing to (HCI)

- **Cognitive psychology: Limitations, information processing, performance prediction, cooperative working, and capabilities.**
- **Computer science: Including graphics, technology, prototyping tools, user interface management systems.**
- **Linguistics.**
- **Engineering and design.**
- **Artificial intelligence.**
- **Human factors.**

Future Trends in Emerging Technologies

- **Emerging technology trends in 2019**
  - 5G Networks
  - Artificial Intelligence (AI)
  - Autonomous Devices
  - Blockchain
  - Augmented Analytics
  - Digital Twins
  - Enhanced Edge Computing and
  - Immersive Experiences in Smart Spaces

Some emerging technologies that will shape the future of you and your business

- Emerging technologies are taking over our minds more and more each day.
- Emerging technologies such as
  - Chatbots
  - virtual/augmented reality
  - blockchain
  - Ephemeral Apps
  - Artificial Intelligence are already shaping your life whether you like it or not.

Q. Classify the following as IR 1.0,2.0,3.0,4.0

1. going from hand production methods to machines
2. mechanical and analog electronic technology were used
3. the development of methods for manufacturing interchangeable parts
4. the increasing use of steam power
5. cyber-physical systems
6. widespread adoption of pre-existing technological systems such as telegraph and railroad networks.
7. the development of machine tools and the rise of the factory system.
8. electrical power and telephones were introduced
9. digital electronics were introduced
10. widespread use of digital logic circuits
11. advancements in robotics and autonomous vehicles
12. the usage of Computer Numerical Control (CNC) machines
13. Digital Revolution

Review Questions

1. Where did the Industrial Revolution start and why did it begin there?
2. What does “emerging” mean, emerging technologies and how are they found?
3. What makes “emerging technologies” happen and what impact will they have on Individuals, Society, and Environment?
4. How do recent approaches to “embodied interaction” differ from earlier accounts of the role of cognition in human-computer interaction?
5. Which emerging technologies will have more effect on our day to day life & How?
6. List and explain three of Service Enabling Devices(SEDs).

Assignment

1.Barfly discussed these emerging technologies how it could be shaping the future of you and your business

- **Chatbots**
- **Virtual/Augmented Reality**
- **Blockchain.**
- **Ephemeral Apps**
- **Artificial Intelligence.**
- **Autonomous Devices**

2. Prepare a debate about an innovation or invention from the IR to the importance of, stating why it was the most important advancement of the time, the impact on society of their innovation.

- **Steam Engine**
- **Railroad**
- **Interchangeable Parts**
- **Steamboat**
- **Spinning Jenny**
- **High-quality iron**