

Emerging technologies

Chapter objectives:

- Describe emerging technologies, how they work and what they are used for
- Evaluate impact of emerging technologies on individuals, organizations and health care
- Discuss advantages and disadvantages of storing data in the cloud

Emerging technologies:

- 3D Printing
- 4G & 5G Cellular Communications
- Artificial Intelligence(AI)
- Augmented Reality
- Biometrics
- Cloud Computing
- Computer-assisted translation(CAT)
- Holographic & 4G Optical data storage
- Holographic Imaging
- Quantum Cryptography
- Robotics
- Quick Response codes(QR codes)
- Wearable Computing
- Ultra-high Definition(UHD)
- Vision Enhancement
- Virtual Reality(VR)

3D Printing

Printing an object based upon a blueprint made by modeling software. It takes thousands and thousands of blueprints of cross-sectional layers of the model. It builds the objects layer by layer using plastic and a lot of other materials.

Uses of 3D Printers:

- In medicine
 1. Casts for broken bones
 2. Prosthetics
 3. Artificial blood vessels
- Industry
 1. Build houses
 2. Print tools for manufacturing companies and aerospace

Advantages of 3D Printers in Manufacturing:

1. Easier to customize the products according to customer requirements
2. Costs may be reduced due to reduce in tool costs and less requirement of specialist machinery
3. Manufacturing a product may be faster than while using traditional methods
4. Can be used to produce spare parts that have been stopped from production
5. Prototypes can be created and tested comparatively faster

Disadvantages of 3D Printers in Manufacturing:

1. Materials used for printing is limited hence the product range is restricted, in the sense few materials won't be the right choice for few products
2. Dangerous and illegal items may be printed like guns and other weapons
3. Size of the products is limited due to size of the printer
4. Copyright issues may arise because everyone with a printer can print nay product
5. Sometimes the printers may produce plastic or any other waste which is harmful to the environment

Advantages of 3D Printers in Medicine:

1. Organs can be printed for people waiting for organs, they can printed according to the requirement
2. Can be used to make casts for broken bones- Prosthetics
3. Personalized tablets or pills can be made according to the requirement of the user
4. Helps doctor in training for surgeries with organs printed by the 3D Printers and also for creating and testing prototypes
5. Saves a lot of money for health care, need not buy any medical devices and also saves time as it prints comparatively faster to normal method

Disadvantages of 3D Printers in Medicine:

1. Limited options of material for printing hence not all body parts can be created
2. Not at all times the product will be consistent, labors need to check for any faults and fix them after printing
3. Size of the printing space may not accommodate for all types of organs
4. People can use 3D printers to make counterfeit products which causes copyright issues

Cellular Communications

Types of Generations:

1G- First Generation

2G- Second Generation

3G- Third Generation

4G- Fourth Generation

5G- Fifth Generation

The aim of different generations is to improve the speed and capability of wireless connection.

3G

3G services work by using cellular based technology. The signals are passed from each cellular phone tower. This allows everyone to check their mails and browse the web on the move. The nearest tower to the device will be transmitting the signals, if the tower closer to the device changes there may be a decrease or increase in the signal strength during the change and throughout the use according to the various factors like number of users connected to the tower, the strength and more.

4G

4G was developed for 2 main reasons:

- Increased upload and download speed
- Reduced latency

4G is approximately 5 times faster than 3G, reduction in latency means the devices get a faster response to the requests made.

5G

There is a major restructure occurring on parts of the radio network which is used to transmit data which will be capable of providing 5G. Due to the restructure the data can be transmitted 100 times faster. It can provide approximately 800 Gbps which results in:

- Greater speed in internet access
- Faster loading speeds
- Ability to have multiple people in video conference calls
- More effective location services
- Ability to stream HD videos

Artificial Intelligence (AI)

Artificial Intelligence is when a computer can make decisions based upon stimuli. It is made by programming rules which must be obeyed. It also works by learning from previous actions and modifying behavior's based on them.

Examples of AI:

- An opponent in game of tic-tac-toe
- The famous computer system that plays chess Deep Blue
- Self driving cars
- Siri & Google

Advantages of AI:

1. People with disabilities can use voice-activated system like Siri or Google.
2. Development of self-driving car means people with disabilities can travel alone in a car.
3. Entertainment in games as the challenge mode can be increased or decreased
4. Create expert systems to allow for easy diagnosis
5. Can work continuously without any break unlike humans

Disadvantages of AI:

1. In self-driving cars the problem is that in case of an accident who should take the responsibility
2. Voice activated systems are improving but have a lot of errors
3. AI is only as good as it's programming
4. Humans become dependent on technologies like AI

Augmented Reality

The technology overlay computer generated images onto the real world. It works by taking signals from the real world using a camera and then check and comprehend the image.

Examples of Augmented Reality:

- HoloLens
- Google glass
- Nintendo 3DS

Advantages of Augmented Reality:

1. More information will be known to the user, Google glass can present the user with the information about the places around them including street names
2. Just like an VR (which will be discussed later in the notes) it can produce a 3D view

3. Easier for visualization that can be used in fashion industry
4. AR can be made more personalized for the users liking

Disadvantages of Augmented Reality:

1. Users vision may be blocked while driving or walking which can cause accidents
2. Technology is still developing, has issues with object recognition due to lighting or angle of the camera
3. These technologies can suffer from security issues when streaming data
4. The technology is very expensive, sometimes may cause mental health issues

Biometrics

Use of technology that tracks the user values and stores the data. These could be voice recognition software, fingerprint, iris recognition and DNA patters recognition. Multiple examples of patterns or voices are taken as input and stored in the user's details.

Examples of biometrics:

- A lot of mobile devices have fingerprint enabled in them
- In some airports there are devices that can read biometric passport which contains all details about the person
- The use of iris scanners or hand scanners in spy movies are also biometrics

Advantages of Biometrics:

1. Vey high security, only the user will be able to access the data
2. Quick and fast, compared to typing out passwords placing the user's finger is easier
3. No one has the same set of biometrics, it is unique for everyone
4. It is very difficult to fake a biometric system

Disadvantages of Biometrics:

1. The technology is expensive which is the main reason why it is not used everywhere
2. Even though the system is protected the database in which it is stored can be hacked
3. False rejections and false acceptance can also be possible
4. Managing and maintaining day to day back-up operations will be complex for many, hence organizations may not be comfortable with that

Cloud Computing

Collections of servers are used to process the data instead of doing it on our own computers. For yours or anyone's computer to connect with the server an internet connection is required.

Advantages of Cloud Computing:

1. Users can access data from anywhere with any device that has a stable internet connection
2. IT support staff are not required hence less cost for the company
3. Reduced requirement of space
4. Need not take backups the computer will automatically take backups

Disadvantages of Cloud Computing:

1. Stable internet connection is required
2. If the cloud server is hacked then everyone's details will be accessible to the hacker
3. Data may not be stored in the same country as the user hence the laws and regulation will be different
4. It is very expensive to store data

Computer-assisted Translation

It is the use of software to assist a human translator in the translation process.

Example:

- Google translator
- Spell checkers in Word document

Advantages of Computer-assisted Translation:

1. Ensures consistency across all translations
2. Most CAT tools have built-in quality assurance features
3. Content can be easily aligned to create a translation memory (TM)
4. Concordance search can easily identify previous translations
5. CAT tools can handle a variety of source files

Disadvantages of Computer-assisted Translation:

1. Contextual errors
2. It is impossible to use this type of software if an artistic and creative approach is necessary.
3. Understanding of direct translations may not be understood by the users
4. Security can be a problem if the data is highly confidential

Holographic Data Storage

Traditional methods of data storage, magnetic and optical, rely on each bit of data being stored as magnetic or optical changes on the surface of the medium. Holographic data storage works by recording data throughout the volume of the medium. Magnetic and optical storage methods store data in a linear

way, each bit is placed side by side. Holographic data storage stores bits in parallel in the sense; bits are stored layer upon layer. It can save large amount of data for a long period of time because it degrades slower. One main disadvantage is the cost; it costs thousands of dollars for the drive to read data.

Fourth Gen Optical Media

3rd Gen allowed storage of HD videos, storage data of 400GB. 4th Gen will be capable of about 1TB. This is done by the use of smaller pits and lands (bumps) and addition of more layers. Pits and lands (bumps) are indents made on the disc for storage of data.

Holographic Imaging

Hologram or Holography is a 3D image created with photographic projections. It is a free standing 3D image that anyone can see around.

Quantum Cryptography

Quantum Cryptography is one of the safest ways to encrypt data. Most encryption methods use mathematics and algorithms to encrypt data but quantum cryptography uses Physics. It generates a key from the photons which are tiny packets of light. This is the key to scramble (encrypt) and unscramble (decrypt) the data. This is transmitted through Optical Cable.

In normal encryption mathematical algorithms can be replicated to decrypt the data, but in quantum cryptography that is not possible. It uses a polarized light which cannot be replicated or created exactly like the key used for encryption.

Robotics

Robotics is the creation of computers that perform tasks that humans cannot or are less efficient at performing. It works by having a processor that controls its movements. The use of sensors helps to feed data back to the processor to decide its next movement.

Advantages of Robotics:

1. Can be used for mundane and repetitive tasks
2. Can be used in dangerous places where it's not safe for humans
3. Used for everyday tasks, they need not have breaks during work like humans can work all the time
4. The output will be always consistent

Disadvantages of Robotics:

1. Takes away the jobs from people
2. May overpower humans

3. Cannot respond to emotions
4. Work done is only based on programming, if the task changes then the program must be re-written

QR Codes

Quick response codes are type of barcodes that is made up of black and white squares.

Examples of QR Codes:

- On gym equipments which when scanned shows the tutorial on how to use it
- Marketing purposes
- On products to share nutritional values
- Easier for users to read and get more information

Advantages of QR Codes:

1. QR codes are versatile
2. Faster access to more information
3. Business can save money by advertising through QR codes which will be available in their website
4. The technology is free and anyone can use it

Disadvantages of QR Codes:

1. Smart phone is required and an QR code reader must be installed in it
2. Not everyone knows about it and how to use it
3. Interface issues can occur when the user is redirected to a website
4. Sometimes the QR code may be distorted or the camera quality is poor

Wearable Computing

There are 2 major forms: fitness devices and smart watches. There are also wearable technology t-shirts which have gif.

Ultra High Definition

This refers to the pixels for the screen, UHD (2560×1080) which is also known as 2K (HD). Many users don't buy 4K and 8K because TV programs are not created for 4K or 8K. Most of the games require 4K and 8K.

Vision Enhancement

It is a field of technology that is able to restore vision for those who don't have. The main goal is to help blind people enjoy the nature just like everybody else. This can also be used by people with color blindness.

Virtual Reality (VR)

A place where the users can be part of a 3D space, it will be a replica of what you are viewing but it will feel like reality. A headset must be worn by the user which will have 2 cameras one for each eye.

Examples of VR:

- Oculus Rift
- HTC Vive
- Play Station VR

Advantages of VR:

1. Doctors can VR to get first-hand experience before a real surgery
2. All types of training programs can be simulated with all conditions and environment
3. Helps to gain confidence
4. Easier for teachers to get students attention and interest in a subject

Disadvantages of VR:

1. It is an expensive technology
2. Still in development, the calibration of the camera and the user's eye needs to be corrected
3. The VR is pretty heavy which can cause neck pain
4. VR takes up a lot of computer space and power due to the amount of programming