

Chapter 10 : Emerging Trends

Introduction:-

- The rapid growth of technology is not at all surprising but what surprises is the rate the technology is growing and evolving , impacting our lives in a way no one could have imagined some decades ago.
- Today we can listen to news or play our favourite music without getting up from our place , by just giving spoken instructions.
- Based on our preferences or search history, our online shopping store recommends products for us and we are surprised with their thoughtful matching choices no ?
- All this and much more , is possible because of modern age technologies.

Artificial Intelligence

- Artificial Intelligence (AI) basically refers to the ability of a machine or a computer program to think and learn.
- Field of AI revolves around bringing out technologies that help build machines that can think, act, and learn like humans.
- It refers to the ability of a machine or a computer program to think, learn and evolve.

An AI based program and technology should bring out things like:

- It should be able to take off human thought process and behaviour e.g , learning from mistakes , catching up with new ideas, learning new things from new exposure, past experience(this ability is called heuristics.) etc.
- It should act in a human – like way ---intelligent, rational and ethical , i.e it should be able to take right decisions in ethical ways.

Modern AI machines are designed and programmed to :

- Work with minimum human intervention.
- Create and update knowledge base, which keeps updating.
- Having heuristic abilities (i.e to learn from past mistakes decision and outcomes)

Most famous example of AI

- **Social humanoid robot Sophia, who has been awarded citizenship of Saudi Arabia.**
- **Siri or Alexa:- The personal assistants that have already become the new normal for thousands of people around the globe.**
- **Smart home devices like Google's NEST,**
- **Self –driving cars like those produced by Tesla**
- **Online games like Alien : Isolation.**

Future aspects

- It is predicted that in coming 5 to 10 years AI will grow tremendously.
- AI based machines would outperform humans in tasks such as translating languages , writing school essays, driving trucks etc.
- More complicated tasks like operating in place of a surgeon or coming out with heart-touching emotional books or bestsellers etc.
- AI is expected to master these skills in coming decades.

Immersive Experience With Extended Reality(XR)

- Extended Reality(XR) is an umbrella term that covers all of the various technologies that enhance our senses and gives us immersive experience.
- It includes technologies Virtual Reality(VR), Augmented Reality(AR) and mixed Reality(MR) technologies.

Virtual Reality(VR)

- It is a technology that allows people to experience and interact with own sense in a 3D virtual environment that appears and feels like a real environment with the use of an electronic equipment.
- For virtual reality a 3D virtual environment is simulated which is generated and reproduced by the CPU of a specially designed VR device.
- Virtual Reality makes it possible for users to interact with a virtual environment with multiple senses(as many senses as possible), including sight, hearing, touch, and sometimes even smell and taste, this is called sensory synchronicity.
- VR Devices:--
 - VR headset or helmet , instrumented and sensory VR gloves(s) and sensory VR bodysuit.
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 - Oculus Rift, HTC Vive, Gear VR, PlayStation VR etc.

Some examples of virtual reality:

- If any Ski player and want to participate in coming Ski Race. But he live in a place where there is not enough snow and matching terrain where we can practice. A company helps in his practice with its VR setup and he get ample practice.
- Modern military training camps enable real fight and combat situations through VR environment.
- Pilots can learn and practice flying of the aeroplanes through VR environments.

Augmented Reality(VR)

- It is a technology that transforms the view of physical real-world environment with superimposed computer-generated images, thus changing the perception of reality.
- Augmented reality is a new age technology that expands our physical real world by adding layers of digital information onto it i.e , by adding digitally generated images/information etc., on it and thus transforms our view of our surroundings.

Devices support Augmented reality

- Digital devices that can support sensors, cameras, accelerometer, gyroscope, digital compass , GPS, CPU, projected displays etc.

Eg: mobile game 'Pokemon Go'? in which we have to walk around with the game app open on our ohone, which will buzz when Poke'mon are nearby, which we can catch using the 'Pokemon Go game app. This done by augmented reality wherein the computer generated 3D imagery in the form of Pokemon, is superimposed on our real world.

Augmented Reality(VR) vs Virtual reality"

SI no	Augmented Reality(AR)	Virtual Reality(VR)
i	Augmented reality is a mix of the real world and the virtual world.	Virtual reality creates an entire virtual world.
ii	It lets people interact with both worlds and distinguish clearly between both.	In this case, it is hard to differentiate between what is real and what is not real.
lii	This is generally achieved by holding a smartphone in front of you	This is generally achieved by wearing a helmet of goooles.

Mixed Reality(MR)”

- A combined technology that makes use of both Augmented Reality (AR) as well as Virtual Reality(VR) is called mixed reality (MR).

Machine learning(ML)

“ Machine learning is an application of artificial intelligence(AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed , after intial traings using test and training data and algorithms.”

Machine learning(ML)(Applications):--optical character recognition , political campaigns, Predictive policing, surveillance systems, Personal assistants (Google Now, Microsoft Cortana, Apple Siri etc), recommendation engines, Filtering algorithms/news feeds, advertising and business intelligence, autonomous(“self-driving” vehicles) , facial recognition.

Robotics

- Robotics is a branch of technology that deals with physical robots.
- Robots are programmable machines that are usually able to carry out a series of actions autonomously or semi-autonomously .
- Robots :
 - Interact with the physical world via sensors and actuators, the devices that actually move the robot joints.
 - Robots are programmable
 - Robots are usually autonomous or semi-autonomous.
- Most robots are mechanical and mainly carry out repetitive tasks. But there is a brach of robotics which helps create artificially intelligent robots, which can think and act like humans.

- These days robots are being used in many different and diverse fields such as aerospace(e.g
 - Mars Rover , which is still collecting images and samples from Mars' surface and Robonaut ;
 - household chores (eg house cleaning robots
 - Disaster management (e.g., Japan's Packbot , which inspected damage at the Fukushima Daiichi nuclear power station.
 - Unmanned aerial vehicles called Drones, which are used for a variety of purpose(filming , videography, journalism , delivery or shipping these days.
 - Industry(eg Amazon's warehouse robots
 - Humanoids , the AI based robots which look and act like humans(eg Honda's Asimo, Sophia, the robot etc)
 - To counter physical disabilities(e.g exoskeleton) and many other fields such as education , entertainment and so forth.

Big Data

- Big data is a term used to describe extremely large data sets that traditional database applications cannot deal with.
- Big Data mainly was used as a term to refer to the size and complexity of data sets.
- In one Internet minute, quintillions of data bytes are generated and exchanged over the internet.

Characteristics of Big Data

- Volume : It refers to the enormous amount of data generated.
- Variety : It refers to the number of types of data generated
- Velocity : Velocity is the measure of how fast data is coming in.
- Veracity : Data veracity is the degree of accuracy or truthfulness of a data set.
- Value : Data must be valuable for an organisation.

Data Analytics

Data analytics refers to discovering hidden patterns , trends and preferences, from the data set by employing specialised methods, programs, software and specialised systems.

Internet of Things(IoT)

- It is a new age technology that allows computing devices(devices that can be programmed and connect to Internet such as smart home appliances like smart refrigerators or smart air conditioners , a smart heart monitor chip etc). to transfer data over a network like Internet without requiring human –to-human or human –to-computer interaction.

Practical applications of IoT technology can be found in many fields/areas today, such as :

- Health and Fitness :- IoT smart gadgets like Fitbit, Jawbone , Nike and Misfit etc., that monitor our heart rate, blood pressure etc. and take action accordingly such as sending emergency messages or updating daily fitness log or contacting appointed doctor etc.
- Home Security:- There are many home safety and security devices for everyone that enable video surveillance, motion, temperature and air quality control to help us to protect our family and our home when we are not around.
- Transport:- Driverless cars can' not only' drive on road without drivers but also can be in touch with servers all time .
- Shopping :- There are smart refrigerators nowadays that can order for grocery items as soon their quantity in fridge goes below a set level.

- **Smart Cities:-** The IoT technology is main enabler of making 'Smart city' a reality. Smart surveillance, automated transportations, smarter energy management systems, water distribution, urban security and environmental monitoring etc. are examples of Internet of Things applications for smart cities.

Cloud Computing

- Cloud computing is the Internet –based computing, whereby shared resources, software, and information are provided to computers and other devices on demand, like the electricity grid.
- The “cloud” represents the internet.
- A basic definition of cloud computing is the use of the Internet for the tasks we perform on our computer for storage, retrieval and access.
- **Cloud computing is a new name for an old concept:** the delivery of computing services from a remote location.
- **Cloud computing services are delivered through a network, usually the internet.**

Characteristics of Cloud Computing

- **On-demand self-service** Users are able to provision, monitor and manage computing resources as needed without the help of human administrators.
- **Broad network access** : Computing services are delivered over standard networks .
- **Rapid elasticity** :- It resources are able to scale out and in quickly and on as needed basis.
- **Resource pooling**:- IT resources are shared across multiple application and tenants in a non-dedicated manner.
- **Measured service**:- IT resource utilization is tracked for each application and tenant typically for public cloud billing or private cloud chargeback

Eg

- Google Drive
- iCloud
- Microsoft Azure
- One Drive etc.

Grid Computing

- A computational grid is a hardware and software infrastructure that provides dependable, consistent, pervasive and inexpensive access to high –end computational capabilities.
- The grid links together computing resources(PC, workstations, servers, storage elements) and provides a mechanism to access them.
- It is best suited for applications in which many parallel computations can happen independently, without the need to communicate between processors.
- In this computing , each computing task is broken down into smaller pieces and distributed throughout the available computing resources for execution. This pieces
Are achieved in a smaller amount of time.

Requirement

- One computer , usually a server , which handles all the administrative duties for the System.
- A network of computers running special grid computing network software.
- A collection of computer software called middleware.

Type of Grid

- Computational grid (Compute Grid)
- Data Grid

Blockchain Technology keyterms

- A blockchain is a distributed ledger(storing all the transactions) across a peer-to-peer(P2P) network.
- **Blockchain Technology**:-It is decentralised, digitized, public ledger of each of the online transactions (most financial, but not always) occurring among a network of peers(peer-to-peer network)

- **Block:-** A block refers to a secured data chunk that stores encrypted details of a valid transaction that has occurred online. A block consists of two parts
 - **A header** , which is public to all
 - **Private details of transaction:-** Accessible only to the owner of the block.
- **Blockchain:-** It is the group of linked blocks, which are related to each other and are in a proper, linear chronological order. It stores the complete trail of transactions.
- **Public ledger:-** All confirmed transactions' linked blocks since the first transaction are available in the form of blockchain called public ledger.
- **Mining :** -It is the process of confirming a transaction after validation and adding it to the public ledger.
- **P2P network:-** It is type of network used in blockchain technology. It is distribution network where each participant computer with in the network maintains, approves and update the new entries. Each participant has equal power

Benefits of Blockchain Technology

- Increased time effectiveness due to the real time transactions.
- Direct Transactions eliminate the overheads and intermediary costs.
- Reduced risks related to cybercrimes , frauds and tampering.
- More transparent process with a proper record creation and tracking.
- Highly secure due to cryptographic and decentralized Blockchain protocols