Unit 4: Introduction to the Emerging Trends

Artificial Intelligence, Machine Learning, Natural Language Processing, Immersive experience (AR, VR), Robotics, Big data and its characteristics, Internet of Things (IoT), Sensors, Smart cities, Cloud Computing and Cloud Services (SaaS, IaaS, PaaS); Grid Computing, Block chain technology

4.1 Artificial Intelligence (AI): Artificial intelligence, or I, refers to devices or programmes that resemble human intelligence in order to carry out tasks and have the ability to iteratively improve themselves based on the data they gather.

Artificial intelligence aims to imitate human intelligence naturally in machines so that they will act intelligently. An intelligent machine should be able to mimic some of the cognitive processes that people use to learn, make decisions, and solve problems.

Machines are trained to build a knowledge base and base judgments off of it in order to complete jobs with the least amount of human involvement. In order to make new judgments, AI systems can also learn from their prior actions or results.

4.1.1 Machine Learning: Machine learning is a branch of artificial intelligence that enables computers to learn from data using statistical methods without explicit human programming. It includes algorithms that use information to learn on their own and anticipate the future.

4.1.2 Natural Language Processing (NLP): Natural Language Processing (NLP) It deals with how people and computers communicate using human spoken languages like Hindi, English, etc. In fact, using our voice to conduct a web search, use a device, or control another device is achievable. NLP has made all of this feasible. An NLP system can convert speech to text and text to speech.

4.2 Immersive Experiences: Now movies are three dimensional, video games are also being developed to provide immersive experiences to the player. Immersive experiences allow us to visualize, feel and react by stimulating our senses. It enhances our interaction and involvement, making them more realistic and engaging. Immersive experiences have been used in the field of training, such as driving simulators , flight simulators and so on.

- **Virtual Reality** – Virtual Reality (VR) is a three-dimensional, computer-generated situation that simulates the real world. The user can interact with and explore that environment by getting immersed in it while interacting with the objects and other actions of the user.
- **Augmented Reality** – The term “augmented reality” refers to the superimposition of computer-generated perceptual information over the actual physical surroundings (AR). Consider Pokémon Go as an illustration, where players look for animated characters that appear in their real-world surroundings on their phone or tablet.

4.3 Robotics: A robot is essentially a machine that can complete one or more activities accurately and precisely on its own. A robot is programmable by a computer, which implies it can obey commands supplied by computer programmes, unlike other devices.

Mars Exploration Rover (MER) is a robotic space mission launched by NASA to learn more about the planet Mars.Sophia is a humanoid robot that mimics human

movements and facial expressions and uses artificial intelligence, visual data processing, and facial recognition.

An unmanned aircraft called a drone can be remotely piloted or can fly on its own using software-controlled flight plans in embedded systems in conjunction with onboard sensors and GPS.

4.4 Big Data: Every day, over 2.5 quintillion bytes of data are generated, and the rate is rising due to the Internet of Things' ongoing development (IoT). As a result, big data, data sets with a large volume and high level of complexity are created.

Such data cannot be handled and analyzed using conventional data processing methods because it is not only large but also unstructured, such as our posts, conversations, and instant messages, as well as the pictures.

This data is highly valuable in the businesses, So, there is a strong focus on developing tools and processes to process and analyze big data.

Characteristics of Big DataThere are five different types of characteristics of Big Data –

1. **Volume** – Size presents the biggest challenge for large data. It will be challenging to process a certain dataset if it is large.
2. **Velocity** – Velocity is the term used to describe the speed with which information must be processed after being input into a system. For example, Amazon record every click of the mouse when the shoppers are browsing on its website.
3. **Variety** – All the organized and unstructured data that could be produced by either people or machines is referred to as variety in big data.
4. **Veracity** – Big data can occasionally be inaccurate, distorted, noisy, or contain errors. It can also have problems with the methods used to obtain the data. Veracity relates to how reliable the data is.
5. **Value** – Big data is more than just a large collection of data; it also contains hidden patterns and insightful information that may be highly valuable to businesses.

4.5 Data Analytics: The practice of analysing datasets to make judgments about the information they contain is known as data analytics. You can take raw data and use data analytical tools to find patterns and gain insightful conclusions from it.

"Data analytics is the process of examining data sets in order to draw conclusions about the information they contain, with the aid of specialised systems and software.

4.6 "Internet of Things (**IoT**) The "Internet of Things" is a collection of interconnected devices that can connect to one another and exchange data in the same network or you can say, It is an overall network of interconnected devices as well as the technology that enables communication between them.

4.7 Web of Things (**WoT**) Internet of Things allows us to interact with different devices through the Internet with the help of smartphones or computers, Web of Things (WoT) allows use of web services to connect anything in the physical world, besides human identities on the web. It will pave the way for creating smart homes, smart offices, smart cities and so on.

4.8 Sensors: Sensors are frequently used as monitoring and observing components. The development of IoT is being greatly aided by the evolution of smart electronic sensors. It will result in the development of fresh, intelligent systems with sensors.

A smart sensor is a device that receives input from the physical world and uses internal computer power to carry out predetermined tasks when a certain input is detected. The data is then processed before being transmitted.Smart CitiesA smart city use the information and communication technologies (ICT), for creating, implementing, and promoting sustainable development methods to handle the issues of expanding urbanisation.

4.9 Smart City: handle transportation systems, power plants, water supply networks, waste management, law enforcement, information systems, schools, libraries, hospitals and other community services work in unison to optimise the efficiency of city operations and services through the information and communication technologies.

4.10 Cloud Computing: Cloud computing is a new trend where computer-based services are supplied via the Internet or the cloud and are accessible to the user from any location using any device.

Cloud computing is the distribution of computer services over the Internet ("the cloud"), including servers, storage, databases, networking, software, analytics, and intelligence.Cloud Services.

There are three standard models to categorise different computing services delivered through the cloud.

1. Infrastructure as a Service (IaaS)
2. Platform as a Service (PaaS)
3. Software as a Service (SaaS)

1. Infrastructure as a Service (IaaS) – IaaS is a particular kind of cloud computing service that provides necessary computation, storage, and networking resources on demand for example different types of computer infrastructure, such as servers, virtual machines (VM), storage and backup facilities, network components, operating systems, or any other hardware or software, can be offered by IaaS providers.

2. Platform as a Service (PaaS) – a cloud-based service that enables users to install and run applications without worrying about their setup or underlying infrastructure. In other words, PaaS offers a platform or setting for creating, testing, and distributing software applications.

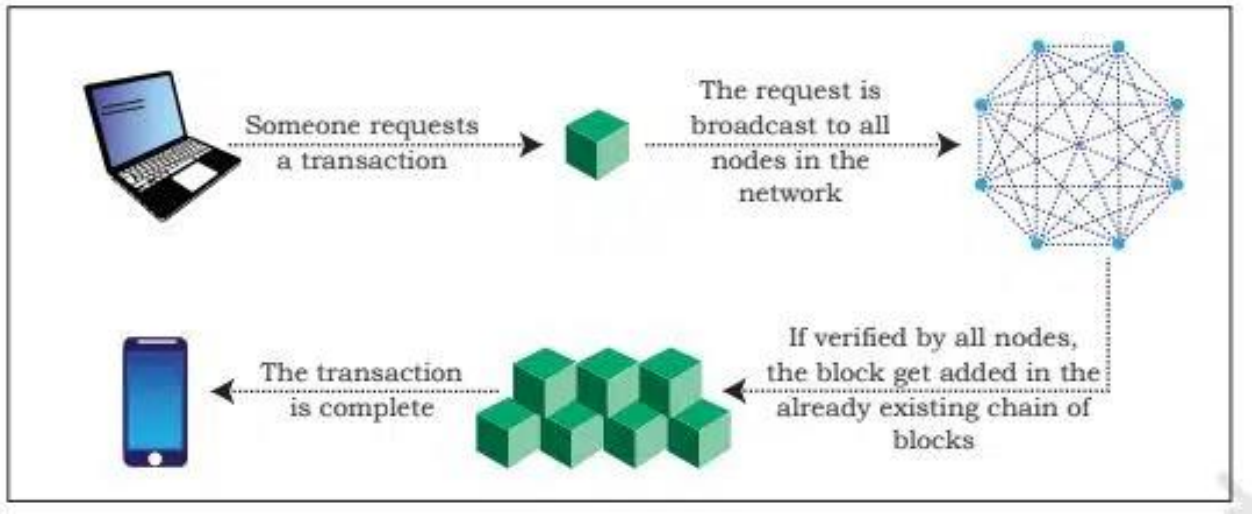
3. Software as a Service (SaaS) – SaaS offers on-demand access to application software; often, this service requires user licencing or subscription. We utilise SaaS from the cloud when using Google Doc, Microsoft Office 365, Drop Box, etc. to modify a document online.

4.11 Grid Computing: Grid computing refers to a network of computers from various administrative domains cooperating to complete a task. Grid computing enables simple completion of complicated tasks that may be intractable for a single computer machine.

Grid can be of two types:

1. **Data grid**: used to manage large and distributed data having required multi-user access
2. **CPU or Processor grid**: where processing is moved from one PC to another as needed or a large task is divided into subtasks and divided to various nodes for parallel processing.

4.12 Blockchains: The blockchain technology is based on the idea of a shared, decentralised database that is replicated on every computer. A block is a safeguarded section of data or a legitimate transaction. Only the block's owner has access to the block's private data, which is hidden behind the header of each block, which is visible to all other nodes. These blocks come together to form the blockchain.



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